



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

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# Human Cloud and Crowdsourcing in Future Internet

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## ▶ **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?



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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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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

Page 1 of 4 [next >>](#)

### 1. The Professional

#### Story Tools



#### 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](#)





## Crowdsourcing National Challenges With the New Challenge.gov

By [Alexander Howard](#) / August 31, 2010 3:04 PM / [1 Comments](#)

283

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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



Download the  
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### **Brothers in art**

The Dutch Web and Social Media company with 10 years of experience  
[brothersinart.com](http://brothersinart.com)

### **Web 2.0 op kantoor**

Bloggen, documenten delen en online gesprekken in je eigen Kenniscafé  
[winkwaves.com/products](http://winkwaves.com/products)

### **LivingSocial Amsterdam**

Amsterdam: Amazing Daily Deals For Restaurants, Spas, Events And More!

# Human Cloud and Crowdsourcing in Future Internet

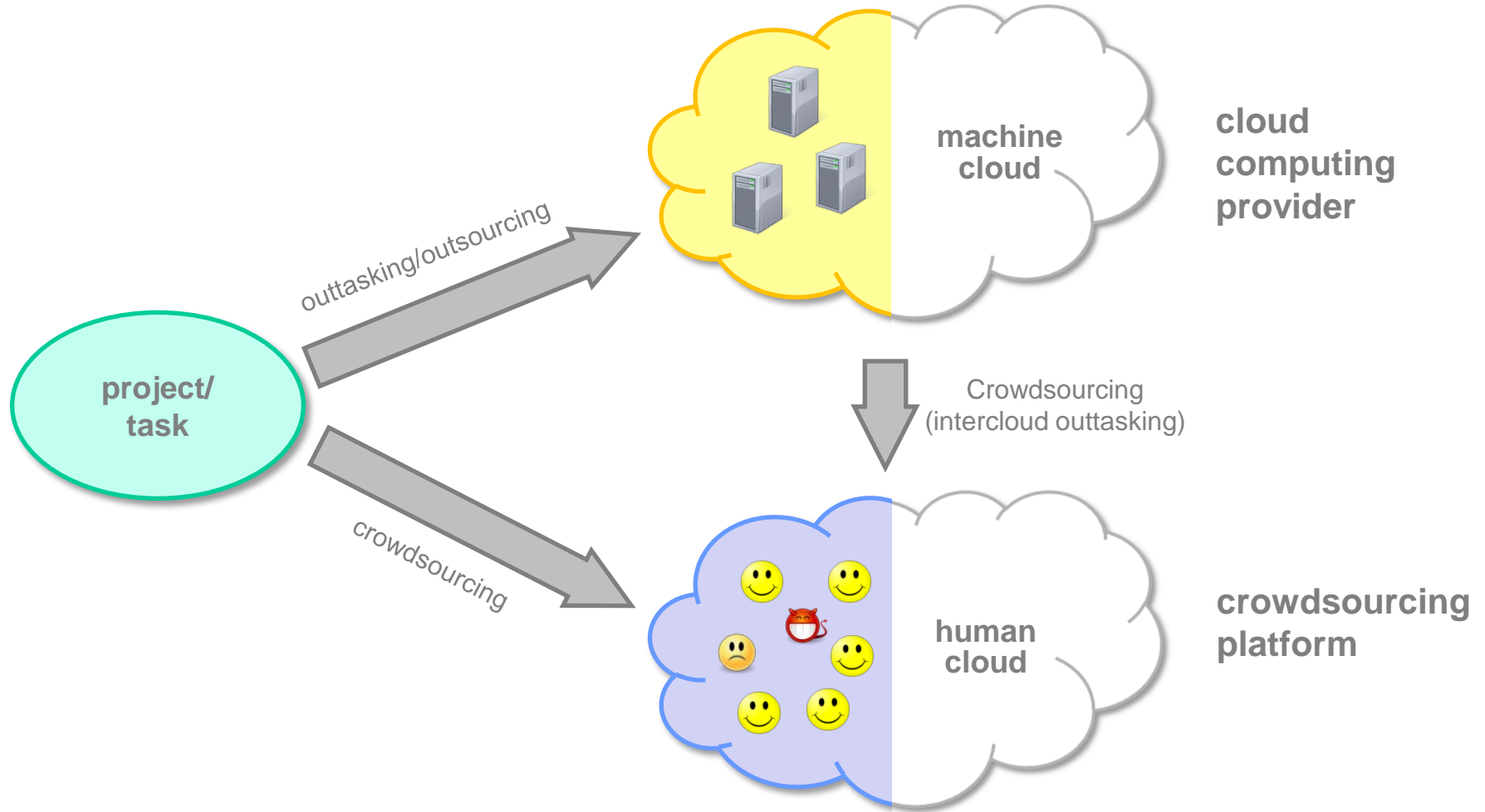
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## ▶ Machine-Cloud and Human Cloud

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



# Human cloud vs machine cloud



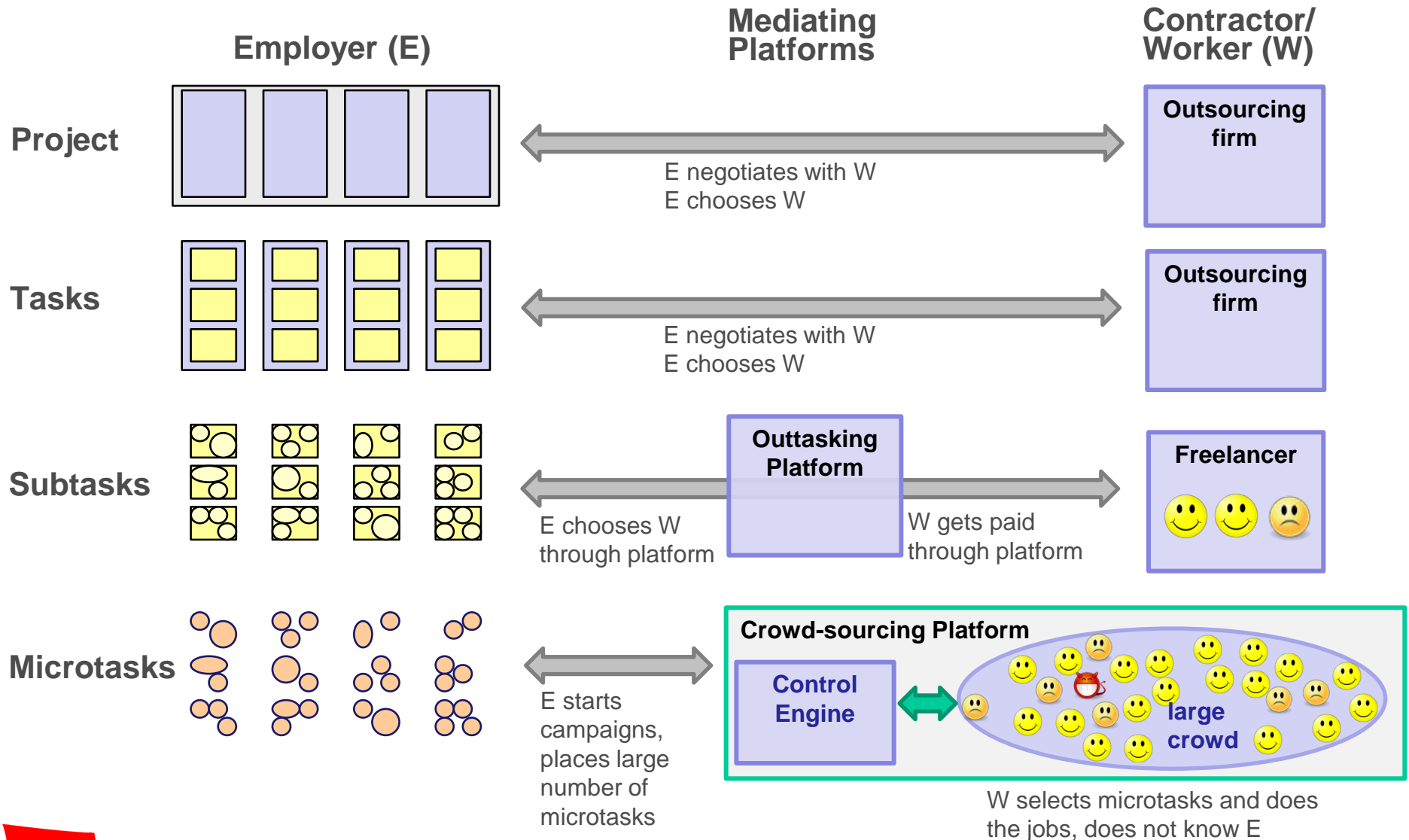
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# Crowdsourcing & Evolution of work organization in Internet

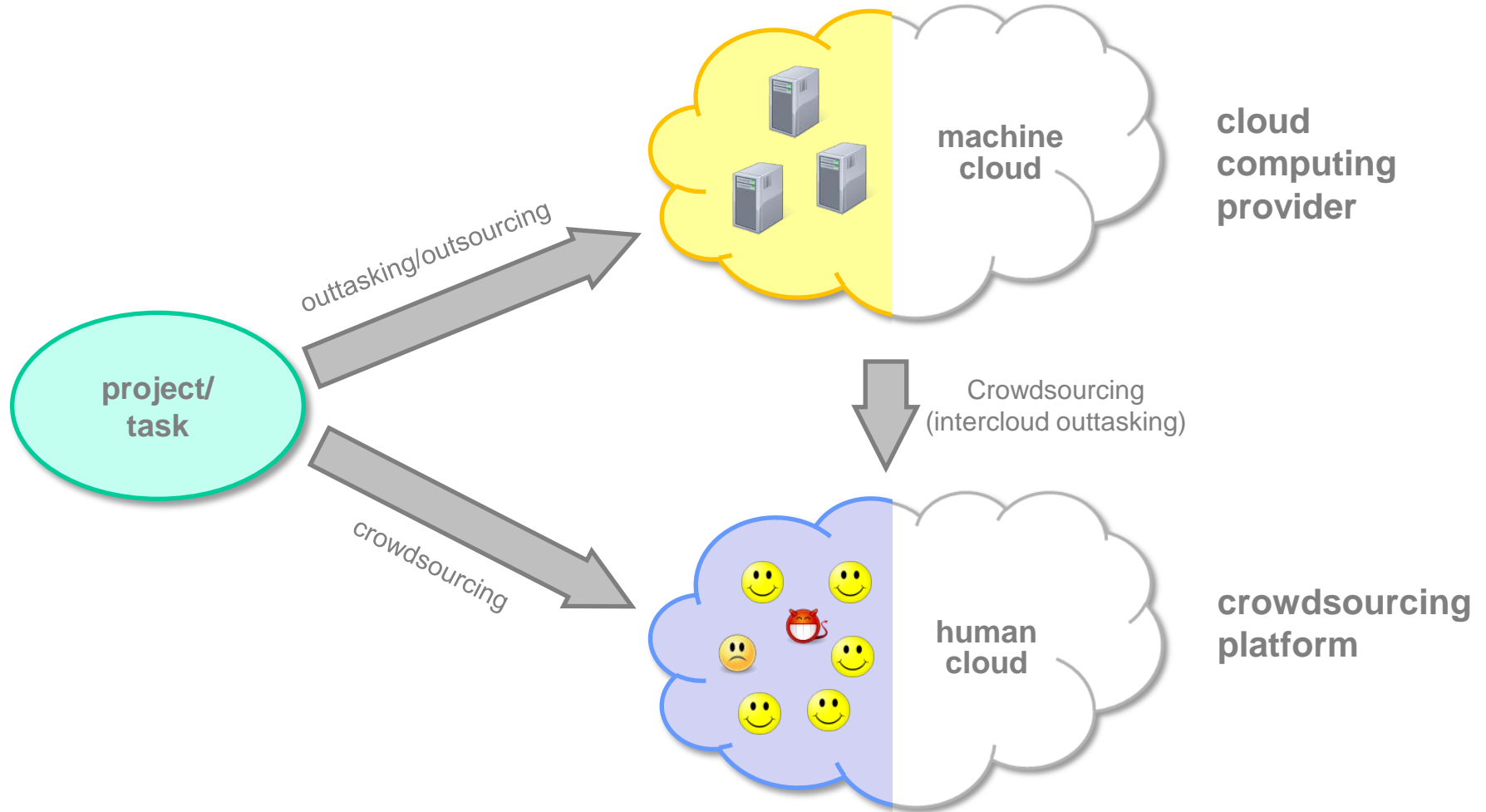




# Evolution of Work Organization



# Human cloud vs machine cloud



# Human Cloud and Crowdsourcing in Future Internet

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## ▶ **Machine-Cloud and Human Cloud**

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

## ▶ **Crowdsourcing Platforms**

- Prerequisites and enabling technologies
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# Definition

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***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/>)



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# What enables crowdsourcing?



# Enabling technologies for Crowdsourcing

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- ▶ 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



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# Major crowdsourcing platforms?



# Classic outsourcing and outtasking platforms

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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

http://odesk.com/my\_assignments

oDesk Changing How the World Works. Hello, mcraig What's New Profile & Settings Sign Out

Overview Find Providers & Jobs Messages Community Help

Openings Candidacies Assignment Search Providers keywords Go

Assignments - Review Jobs you or your team members are assigned to

Active (20) Ended

Assignments for: Acme > Acme Marketing Manager: Provider: All

ID	Status	Provider/Assignment	Hired by	Staffed by	Terms	Actions
1755367	Active since 11/16/08	Tracy Coleridge (tcoleridge) Design custom icons for applications	Mitch Craig	Mitch Craig	• \$33/hour • 8 hours/wk	Select...
1653342	Active since 10/29/08	Stan Dart (standart) Experienced Sales Rep / Account Manager	Sarah Molina	Mitch Craig	• \$20/hour • 40 hours/wk	Select... Select... Dispute Give Bonus Increase Rate Change Weekly Limit End Assignment
1499130	Active since 10/14/08	John Migdal (jmigdal2) Designer	Mitch Craig	Mitch Craig	• \$18/hour • 12 hours/wk	Select...
1689935	Active since 10/14/08	Karim Shar (karims) Expert web designer / PHP		Craig	• \$30/hour • 12 hours/wk	Select...
1587910	Active since 10/13/08	Beth Doe (bethmdoe) Link builder		Craig	• \$9/hour • 40 hours/wk	Select...
1433698	Active	Lella Knight (lknight)	Mitch Craig	Jain Kimberly	• \$14/hour	Select...



- Products +
- Seekers +
- Solvers +
- Challenges +
- FAQ
- My InnoCentive
- Send A Solver
- Blog
- News and Events +
- About Us +

## My InnoCentive

- My Challenges
- My Interests
- My Account
- My Public Profile

Challenges are recommended for you based on your [expertise and interests](#), please take a moment to configure those in order to receive relevant recommendations.

### Your Recommended Challenges

- OPEN (0)
- RECOMMENDED

NUMBER	CHALLENGE DESCRIPTION	DEADLINE	TYPE	REWARD	FUNCTIONS
<a href="#">9127673</a>	<a href="#">Lightning as an Alternative Energy Source</a>	Apr 19, 2010	Ideation	\$30,000	
<a href="#">9150435</a>	<a href="#">Seeking a Stable Micro-structured System in High Ionic Strength Aqueous Pesticide Solution</a>	Apr 29, 2010	RTP	\$30,000	
<a href="#">9189351</a>	<a href="#">Collection and Curation of Protein Expression Data</a>	May 10, 2010	RTP	\$25,000	
<a href="#">9002305</a>	<a href="#">Synthetic DNA Management Software</a>	Mar 02, 2010	RTP	\$45,000	
<a href="#">9046179</a>	<a href="#">Biodegradable, Bioderived Elastomers for Medical Applications</a>	Mar 17, 2010	RTP	\$30,000	
<a href="#">9153999</a>	<a href="#">Mn2+ Chelation</a>	Mar 29, 2010	Theoretical-licensing	\$20,000	
<a href="#">9032888</a>	<a href="#">Algorithms Optimized for Efficiency and Speed for Exploring and Testing Large Model Spaces</a>	Mar 25, 2010	RTP	\$20,000	
<a href="#">9093841</a>	<a href="#">Sunlight/UV-light dose indicator</a>	Apr 11, 2010	RTP	\$40,000	
<a href="#">8993143</a>	<a href="#">Delayed Burst Release</a>	Mar 04, 2010	Theoretical-IP Transfer	\$20,000	
<a href="#">9051616</a>	<a href="#">NASA Challenge: Mechanism for a Compact Aerobic and Resistive Exercise Device</a>	Feb 28, 2010	Theoretical-IP Transfer	\$20,000	

# Major crowdsourcing platforms

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## 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

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# MTurk

All HITs | [HITs Available To You](#) | [HITs Assigned To You](#)  
Search for  containing  that pay at least \$  for which you are qualified

## All HITs

1-10 of 733 Results

Sort by:

[Show all details](#) | [Hide all details](#)

[1](#) [2](#) [3](#) [4](#) [5](#) > [Next](#) >> [Last](#)

[Adult/inappropriate video identification](#)

[View a HIT in this group](#)

Requester: [David Mozealous](#)

HIT Expiration Date: Sep 13, 2010 (19 minutes 16 seconds) Reward: \$0.01

Time Allotted: 20 minutes

HITs Available: 1

[Is this the Right Category for this Business?](#)

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Requester: [Dolores Labs](#)

HIT Expiration Date: Sep 20, 2010 (6 days 23 hours) Reward: \$0.06

Time Allotted: 60 minutes

HITs Available: 11

[Find information about Businesses Online](#)

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Requester: [Dolores Labs](#)

HIT Expiration Date: Sep 20, 2010 (6 days 23 hours) Reward: \$0.07

Time Allotted: 60 minutes

HITs Available: 1258

[respond to article in 2 minutes](#)

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Requester: [Dawn williams](#)

HIT Expiration Date: Sep 13, 2010 (58 minutes 8 seconds) Reward: \$0.01

Time Allotted: 5 minutes

HITs Available: 1



# Major crowdsourcing platforms

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## Crowdsourcing

... hype at the moment ...

- ▶ Amazon Mechanical Turk (Mturk)
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- ▶ ... rapidly growing number of platforms



# microWorkers

microWorkers  
work & earn or offer a micro job



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Available jobs	Tasks I finished	My campaigns	My account	Deposit \$	Withdraw \$
[Redacted]		Worker [last 30 days]	Rated Satisfied: 0 of 0		<a href="#">Log out</a>
Balance: <b>\$0.00</b> +1.00 bonus ?		Success rate: <b>100%</b> <a href="#">More...</a>			

**Available jobs**

**87 jobs running & available to you**

You should only accept jobs you are capable of finishing.

- running & available
- temporary unavailable
- remove from the list

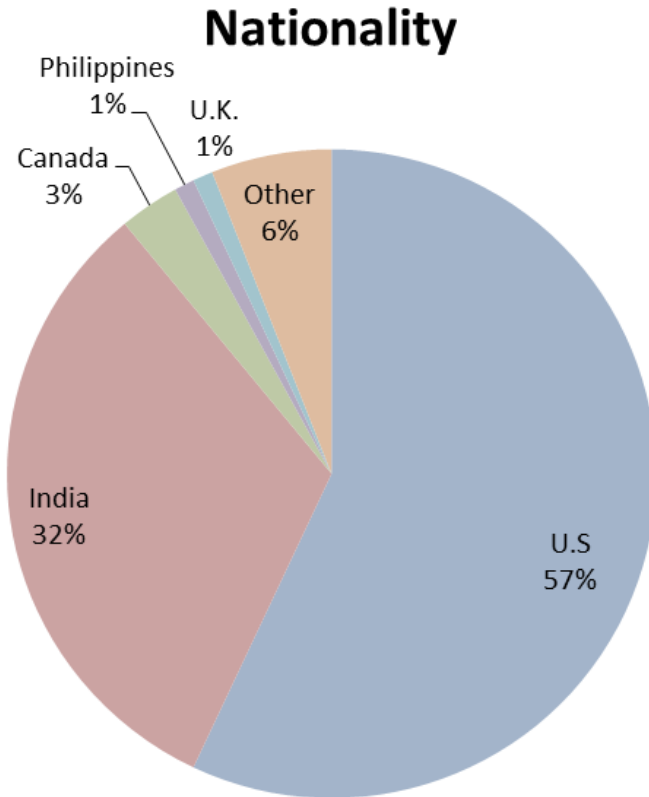
[most paying](#) [latest](#) [rating](#) **NEW!**

**NEW!** Success rate column

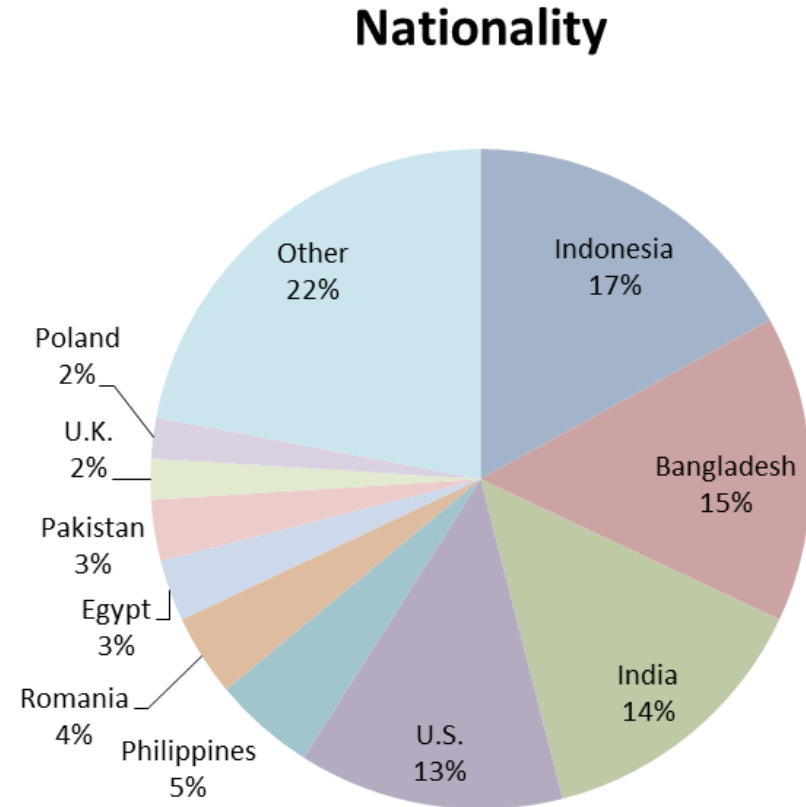
Job name	Payment	Success %	Time	Status	Done
Inxautoinsurance: Comment 4x + Click 2x	\$0.13	0	6 min	<input type="checkbox"/>	6/30 <a href="#">↓</a>
Add Votes: Mixx + Yahoo Buzz + Stumble Upon	\$0.20	0	3 min	<input type="checkbox"/>	28/200 <a href="#">↓</a>
Post to your Twitter Account with 1000+ followers	\$0.30	0	3 min	<input type="checkbox"/>	3/30 <a href="#">↓</a>
Inboxdollars: Sign up	\$0.10	55	3 min	<input type="checkbox"/>	75/90 <a href="#">↓</a>
Blogs: Review + Link to funny video site	\$0.40	0	6 min	<input type="checkbox"/>	1/30 <a href="#">↓</a>
Websites: Sign up + Display a text link in your site	\$0.25	0	3 min	<input type="checkbox"/>	16/90 <a href="#">↓</a>
Thehomerefinance: Comment 4x + Click 2x	\$0.13	80	6 min	<input type="checkbox"/>	25/40 <a href="#">↓</a>
The sideworld: Comment 1x + Click 2x	\$0.11	0	3 min	<input type="checkbox"/>	61/90 <a href="#">↓</a>
Neobux: Sign up	\$0.24	0	3 min	<input type="checkbox"/>	7/90 <a href="#">↓</a>
Copy + Paste Article	\$0.15	0	1 min	<input type="checkbox"/>	12/40 <a href="#">↓</a>
Sign Up + Comment + Follow	\$0.20	5	6 min	<input type="checkbox"/>	39/65 <a href="#">↓</a>
Find Forum + Sign up + Comment + Link in Signature	\$0.25	50	5 min	<input type="checkbox"/>	1/30 <a href="#">↓</a>
Forum: Post 2x	\$0.25	86	5 min	<input type="checkbox"/>	6/30 <a href="#">↓</a>
Weight Loss Forums: Post 1x	\$0.20	0	6 min	<input type="checkbox"/>	9/38 <a href="#">↓</a>
Wigix: Sign up	\$0.10	0	3 min	<input type="checkbox"/>	44/122 <a href="#">↓</a>
Business URL + Email address	\$0.15	0	1 min	<input type="checkbox"/>	40/100 <a href="#">↓</a>



# Nationality of workers in MechanicalTurk and microWorkers



**MTurk**

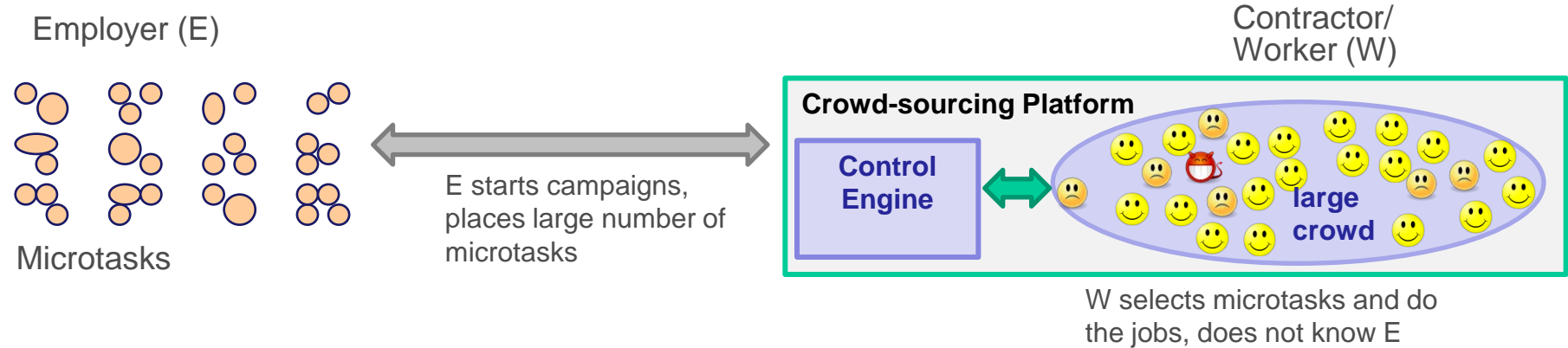


**microWorkers**





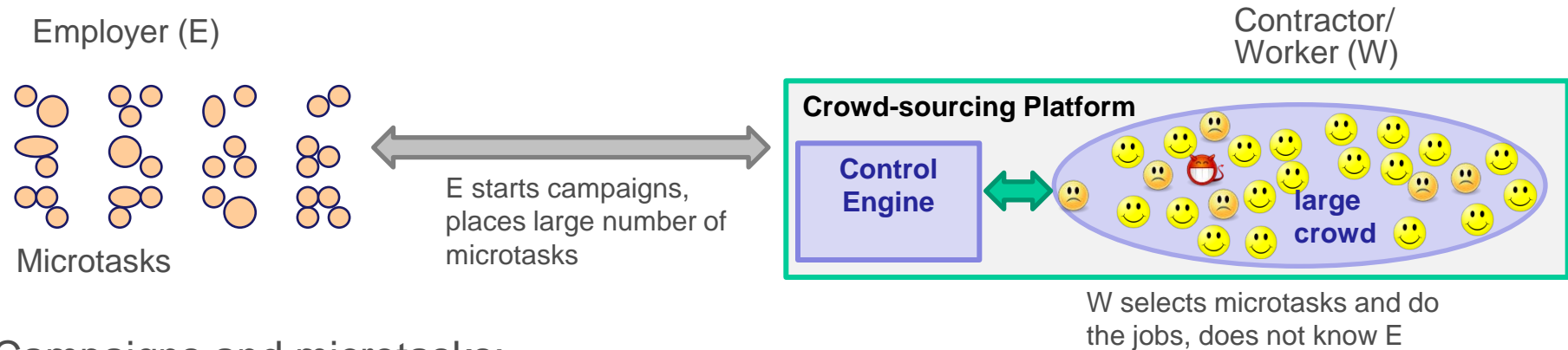
# Evolution of work organization



## ► 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



## ► 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 Issues**

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



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# Modeling what ?



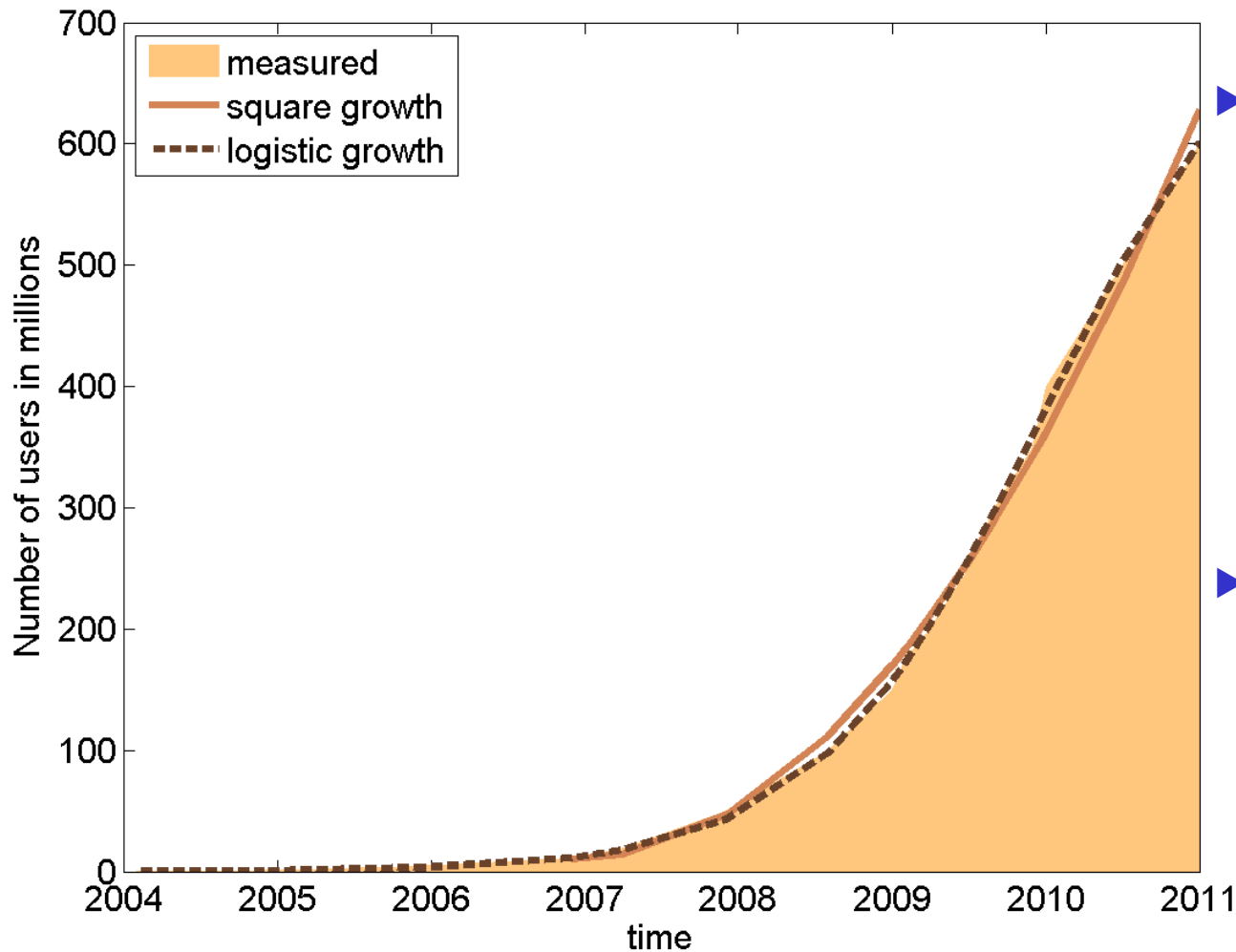
# Modeling issues

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- ▶ 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:

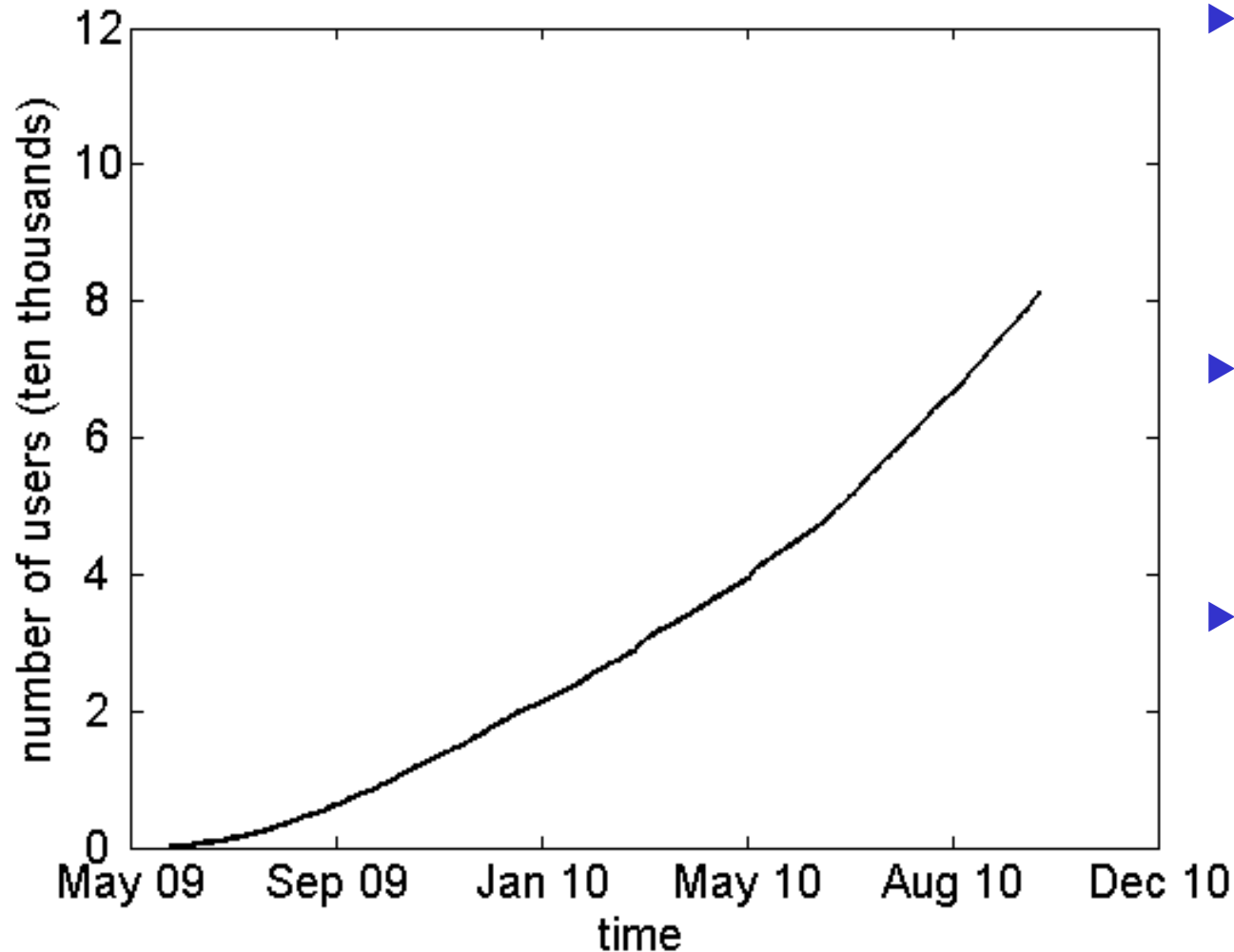
- Most visited web page form business PCs in 2009 ( about 7%)
- Together with YouTube consuming 14.5% of the business bandwidth (WindowsUpdate 3.3%)

▶ 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:

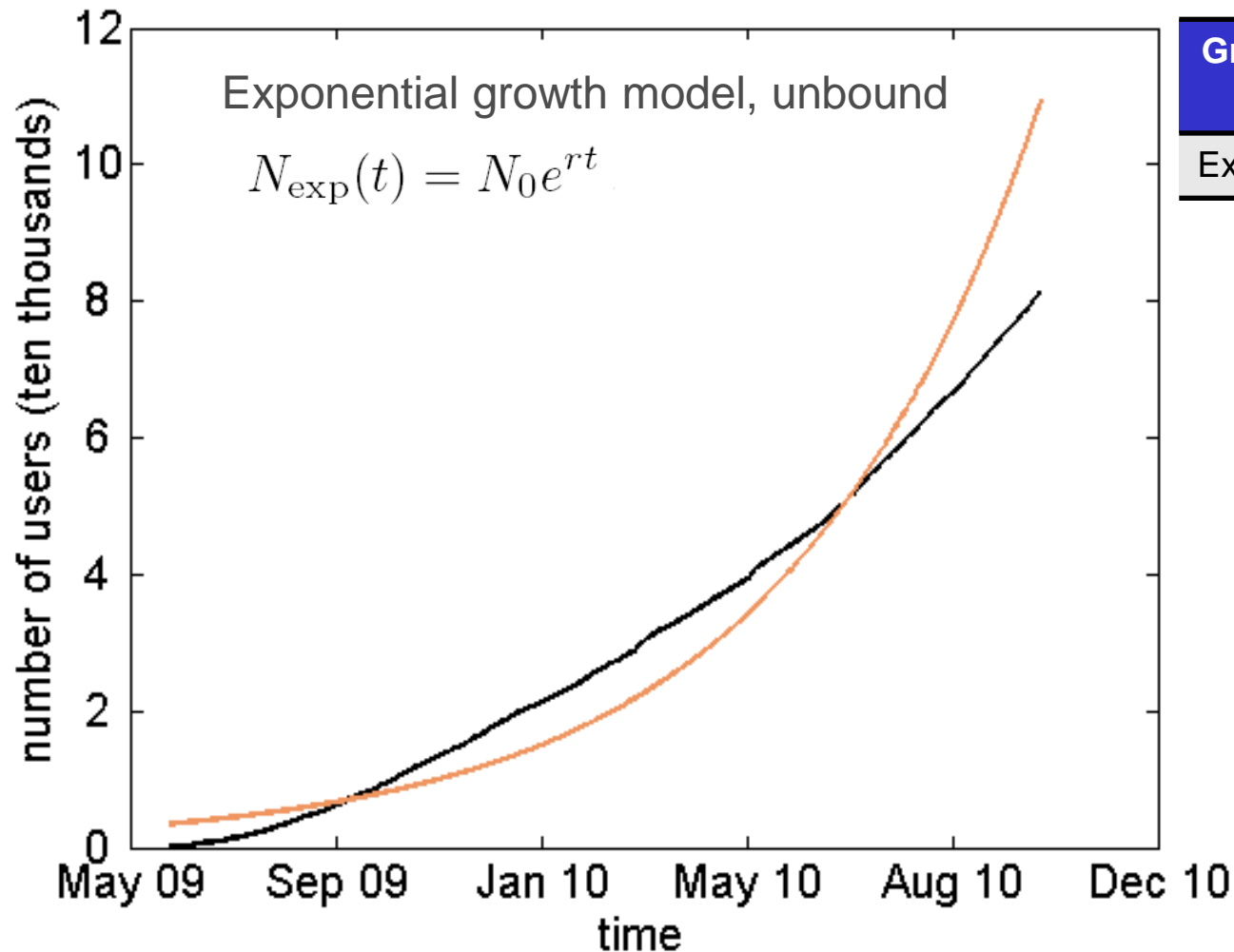
- Unbound population
- Bound population

▶ Parameter determination:

- Minimization of least-square error



# Application of growth models

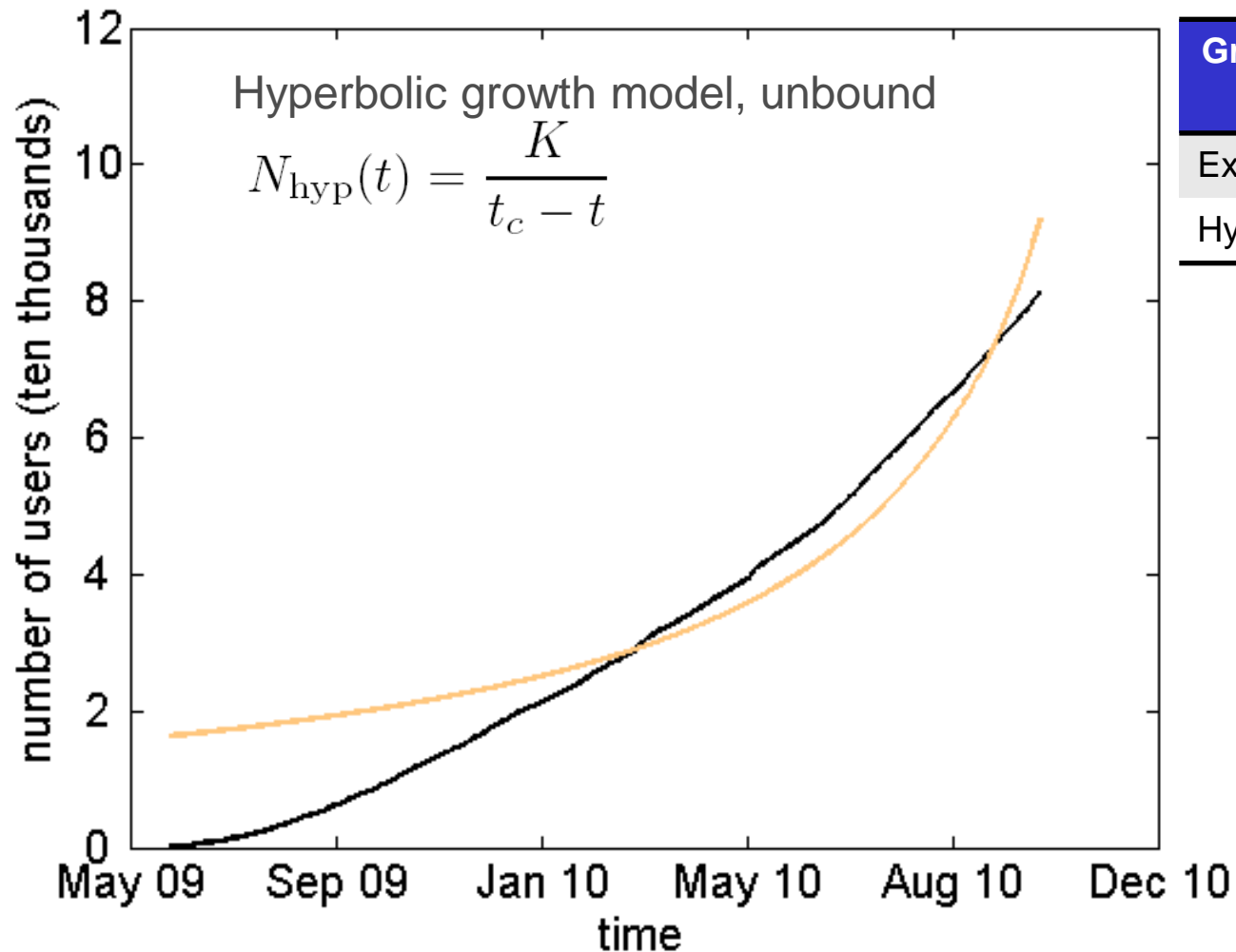


Growth model	Coefficient of determination
Exponential	0.9572



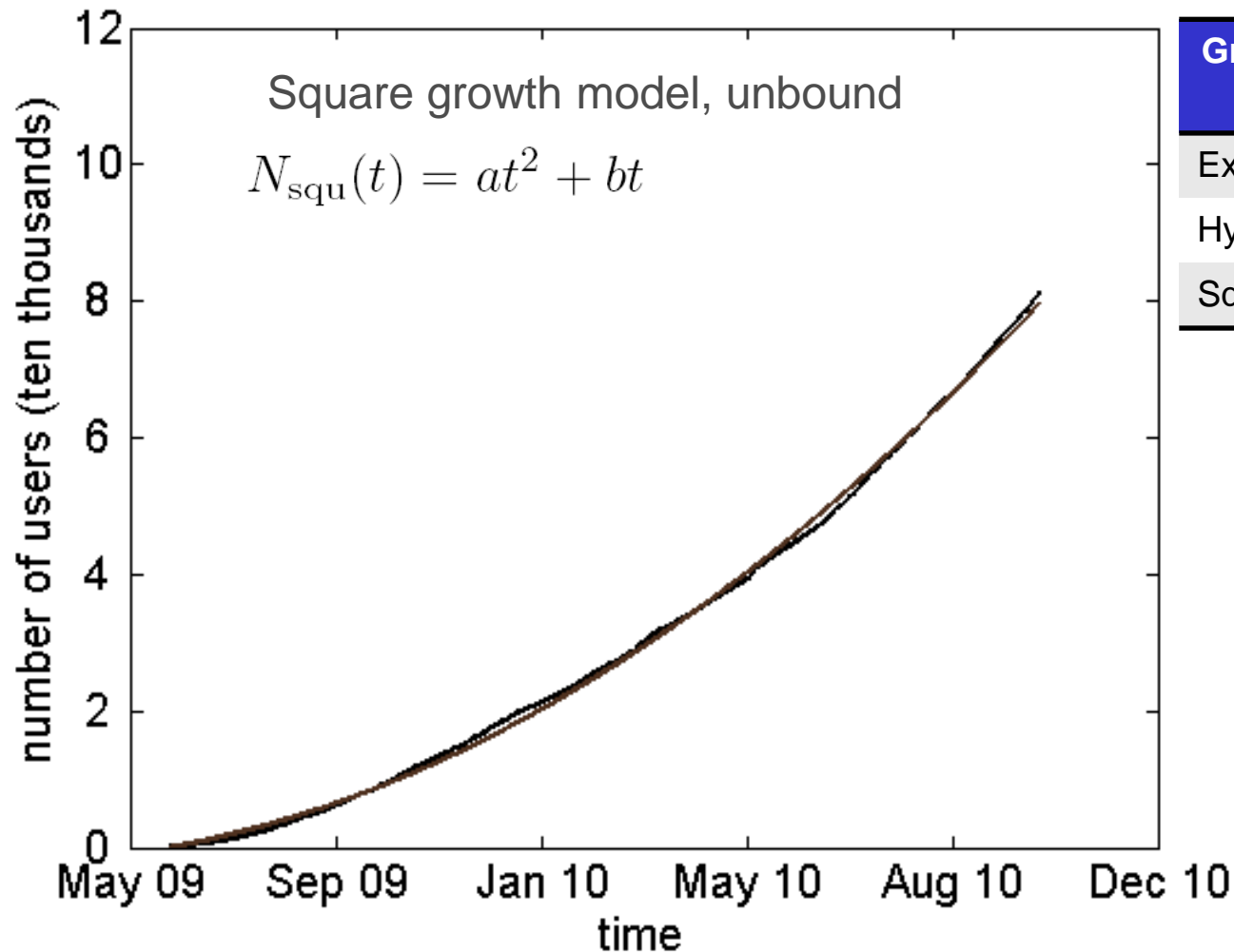


# Application of growth models



Growth model	Coefficient of determination
Exponential	0.9572
Hyperbolic	0.9302

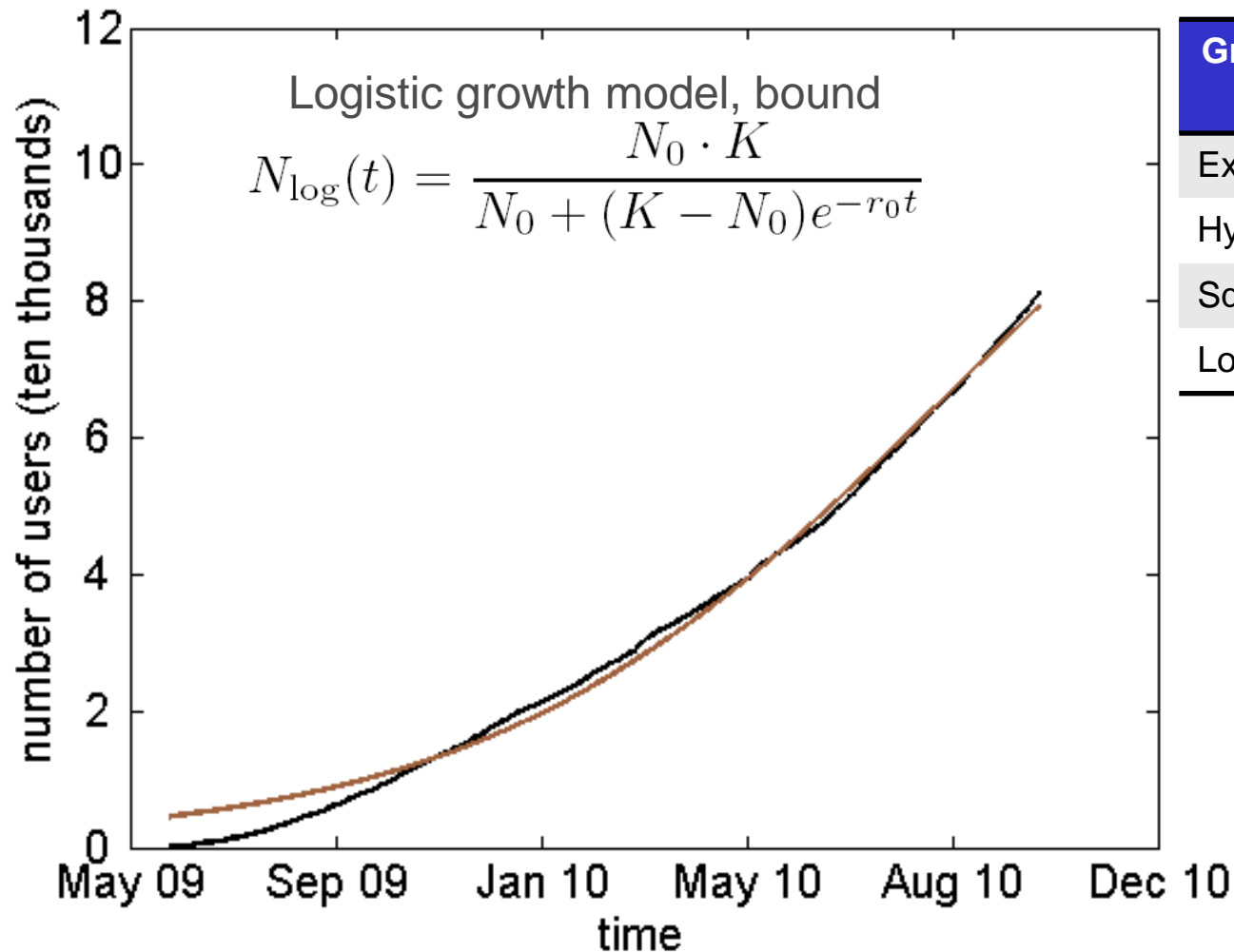
# Application of growth models



Growth model	Coefficient of determination
Exponential	0.9572
Hyperbolic	0.9302
Square	0.9988



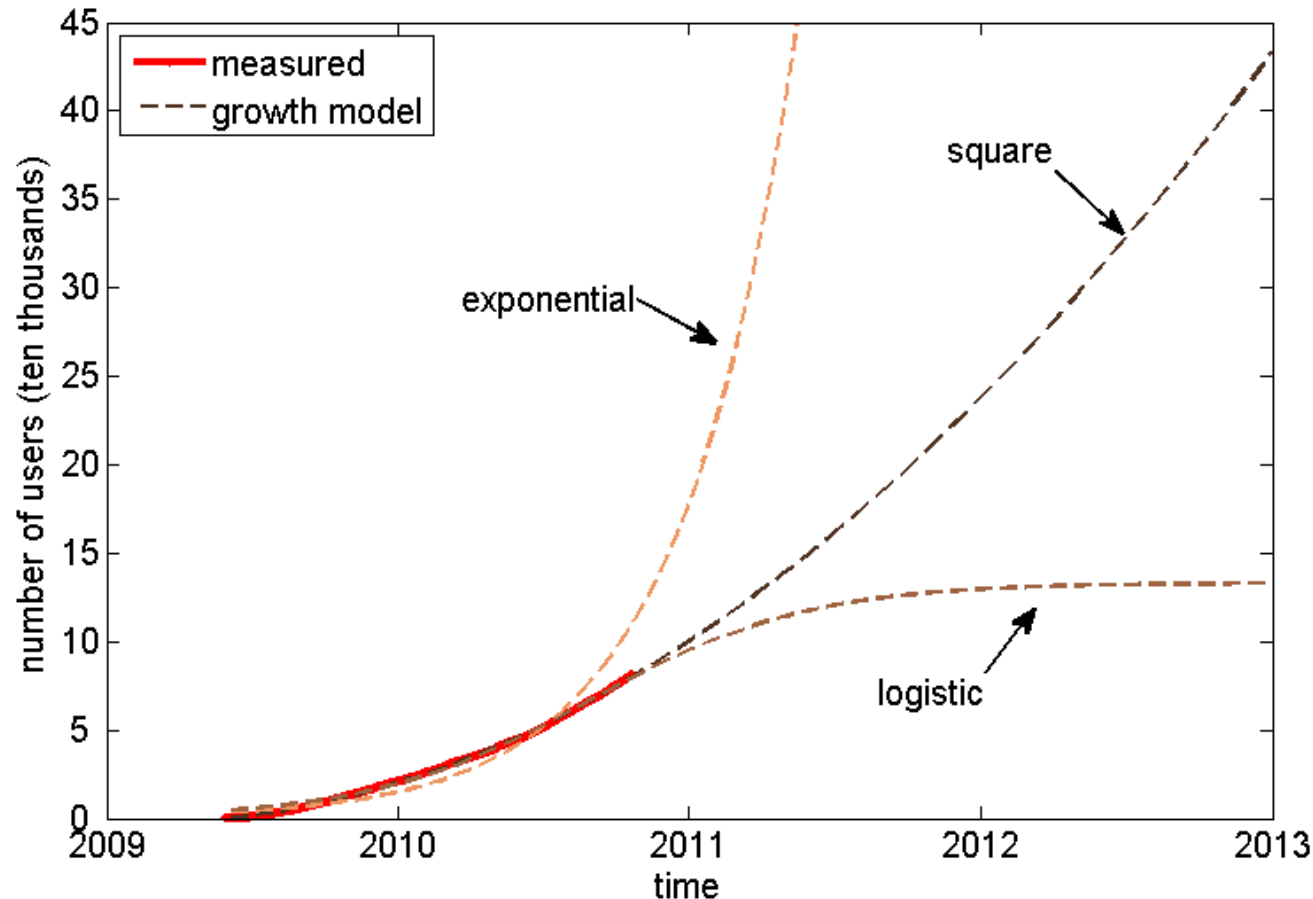
# Application of growth models



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

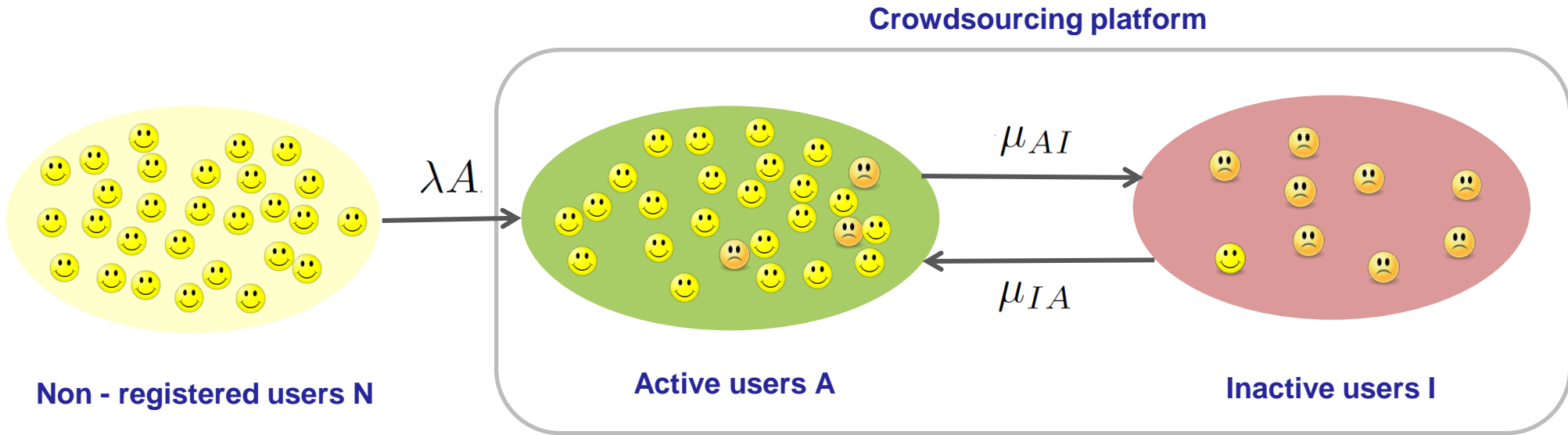
► Logistic growth model:

- End of growth: 2012
- Number of users: About 130000

**But: Are all users really active?**



# Crowdsourcing dynamics



► User interaction models:

- *Local User Decision (LUD)*

- User only influenced by personal opinion
  - Platform has to advertise continuously

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

- *Globally Influenced Dynamics (GID)*

- Users are influence by global opinion
  - Attractive platforms grow faster
  - Unattractive platforms starve

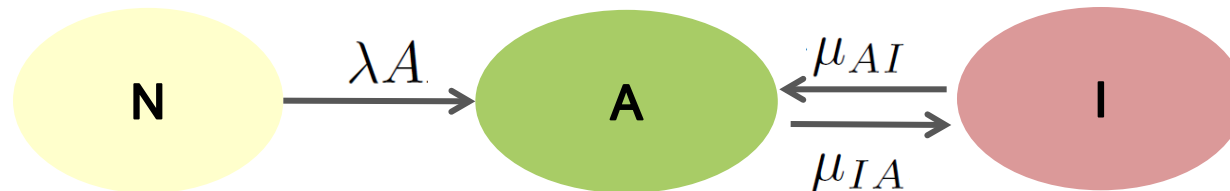
$$\mu_{AI} = \gamma I \quad \mu_{IA} = \delta A$$



# 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:

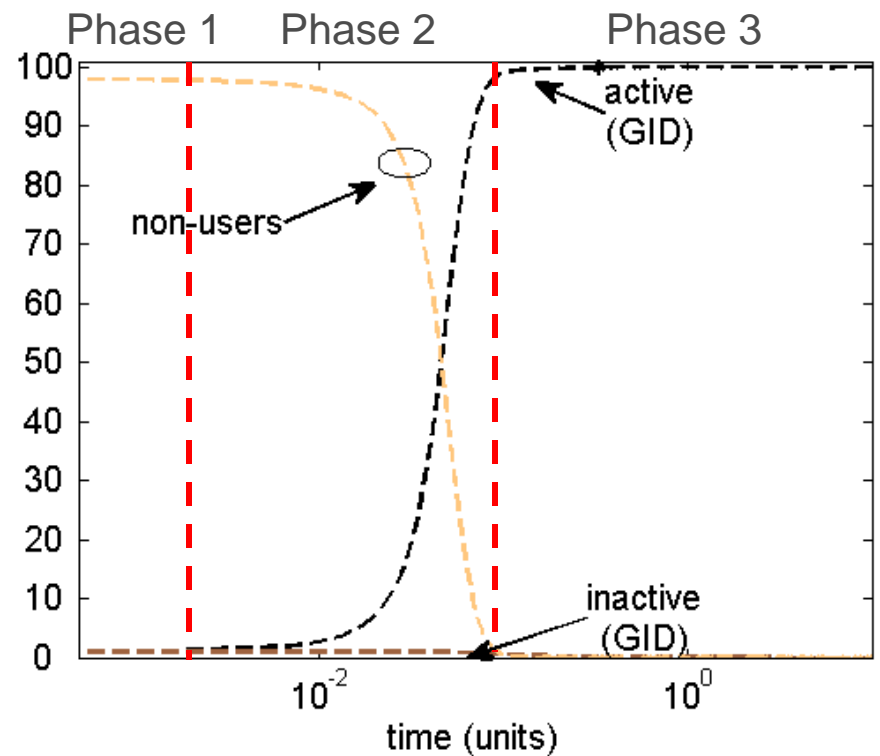
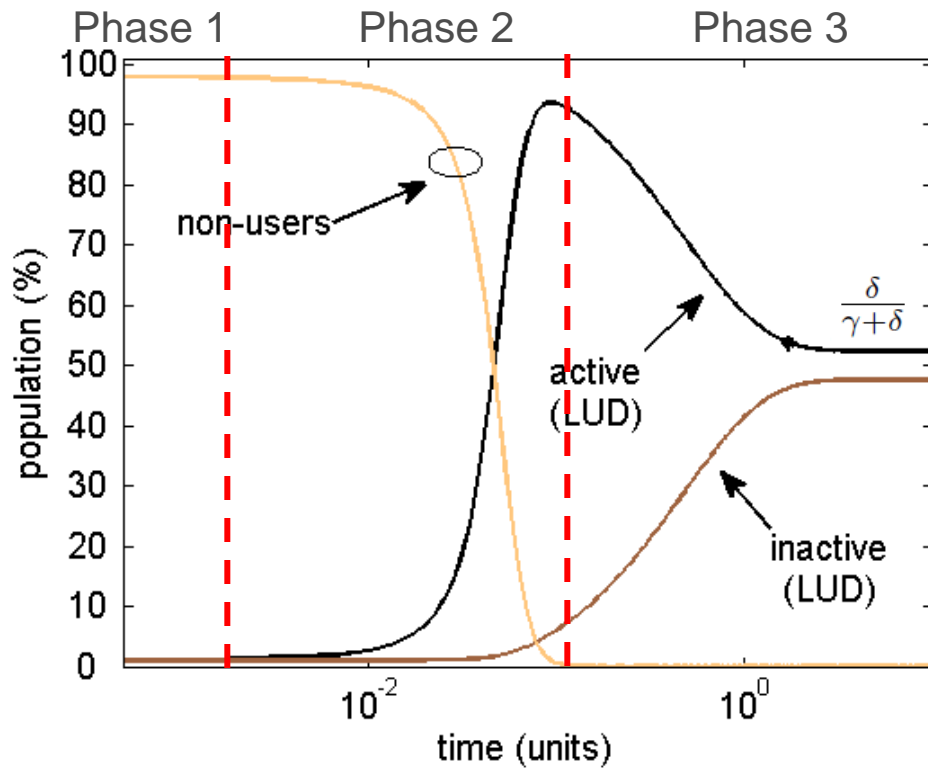
$$\begin{aligned} \frac{dN}{dt} &= -\lambda AN \\ \frac{dA}{dt} &= -\mu_{AI}A + \mu_{IA}I + \lambda AN \\ \frac{dI}{dt} &= -\mu_{IA}I + \mu_{AI}A \end{aligned}$$

## ▶ 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 ?

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- ▶ 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



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Thank you !

