People Clouds: Human Intelligence as a Service

Prof. Dr. Gerhard Satzger
**Service Science & Innovation (SSI) Community of Practice**
March 15, 2011

KARLSRUHE SERVICE RESEARCH INSTITUTE (KSRI)

The Karlsruhe Service Research Institute is an "IBM on Campus" project – devoted to IT-based services

Karlsruhe Institute of Technology (KIT)

Created 2009 as a merger of a National Research Center and the University of Karlsruhe

- one of Europes's largest research facilities
- nationally recognized as "University of Excellence"
- 8000 employees, 20,000 students
- about $1B annual budget

Karlsruhe Service Research Institute (KSRI)

A part of KIT – founded 2008 as a public-private partnership with IBM Germany

- Driving SSME wrt education, research, innovation
- Focus on interdisciplinary research on IT-based services
- 5 research groups, one of which "IBM on campus"

One of five research groups is staffed by IBMers (across IBM units) and "on campus"

Service Innovation & Management	Knowledge Management	Information & Market Engineering	Software Design & Architecture	Optimization & Healthcare Services	Guest Professorship
Prof. Dr. Gerhard Satzger	Prof. Dr. Rudi Studer	Prof. Dr. Christof Weinhardt	Prof. Dr. Ralf Reussner	Prof. Dr. Stefan Nickel	NN (rotating)
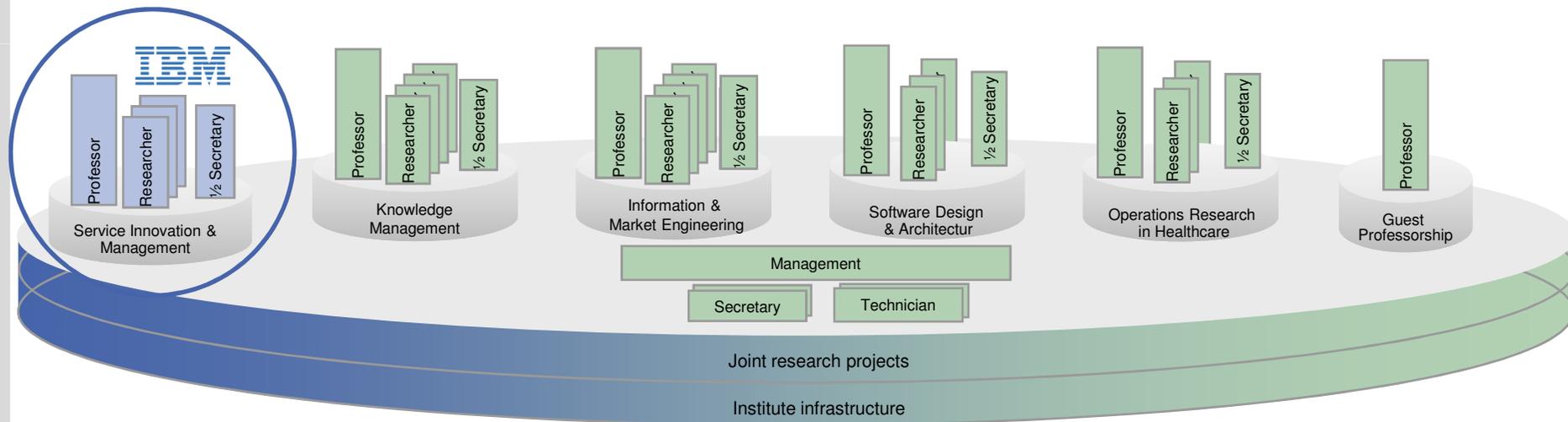
People Clouds: Human Intelligence as a Service

Our vision: Clouds beyond IT

Our objective: Human-based eServices (= "People Services ")
on their way to commercialization

Our contribution: Efficient quality management to make people
clouds applicable for critical tasks

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Our vision: The cloud beyond IT ...

Quickly changing markets & varying demands

Need for scalable provisioning and "de-provisioning" of resources

IT resources: **IT Clouds**
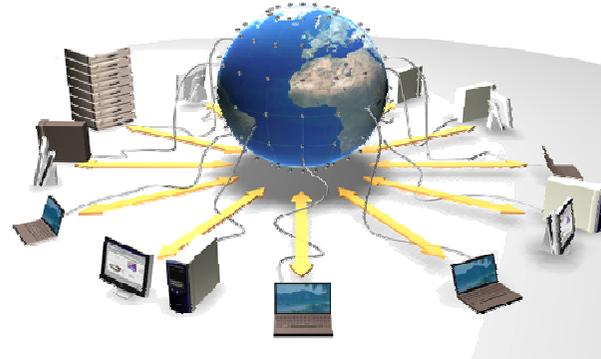
Human resources: **People Clouds**

Business processes

People Service Platform

Guarantees QoS

Service workers

Leverage human intelligence or action

Perform work and earn money
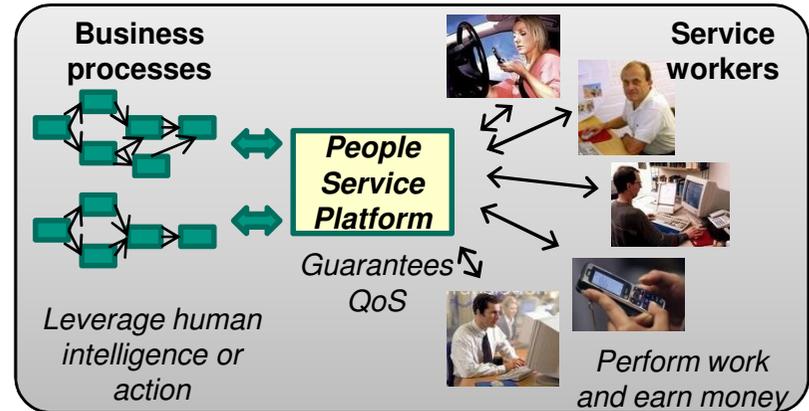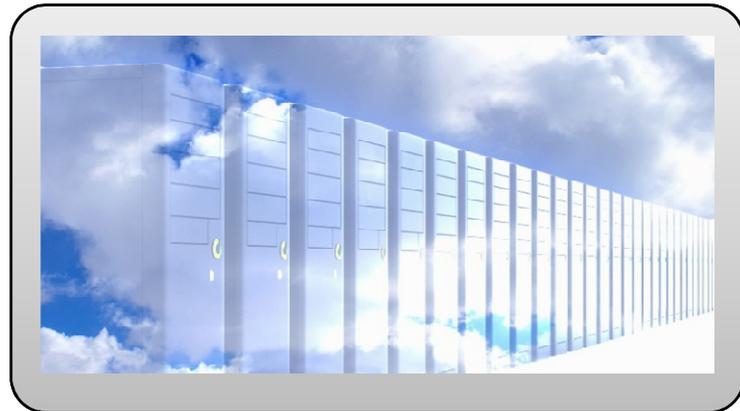
Amazon Mechanical Turk already serves as a people services platform

Make Money
by working on HITs

Find an interesting task → Work → Earn money
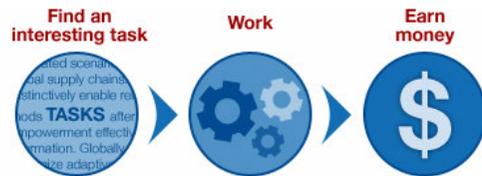
Get Results
from Mechanical Turk Workers

Fund your account → Load your tasks → Get results

Statistics about Amazon Mechanical Turk (Nov 2009)

Geography	56% US, 36% India, 8% other
Gender	male: US 37%, India 66%
	female: US 63%, India 34%
Age (average)	US: 35.4 years, India: 26.4 years
Employment	US: 35% unempl., India: 25% unempl.
Wage (average)	US: $2.30/hour, India $1.58/hour
Hours spent	0-5 hrs: 51%, 5-15 hrs: 32%, >15 hrs: 18%
Income class (US-$ p.y.)	

Income class chart:

US: 10%, 9%, 15%, 13%, 12%, 10%, 8%, 23%
India: 64%, 21%, 7%, 5%, 3%, 1%, 0%, 0%

Legend:
- < $10k
- $10-$20k
- $20-$30k
- $30-$40k
- $40-$50k
- $50-$60k
- $60-$70k
- > $70k
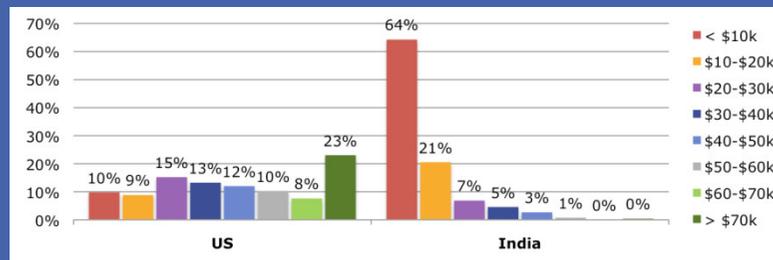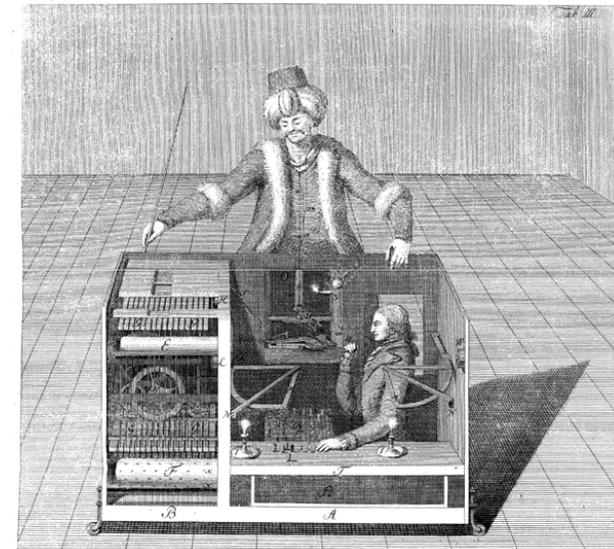
"The Turk" - a chess-playing automation of the 18th century

(Ross 2010)

Commercial use of people services exists, but is limited to "microtasks"

Choose the best category for this product.

Requester: retaildata   Reward: $0.10 per HIT   HITs Available: 13797   Duration: 60 minutes

Qualifications Required: Trusted_Worker_Qualification v1 is not less than 1, Location is US

What is the appropriate category for this product?

Please review the offer and decide whether or not it would belong in Ceiling Fans or in Home Lighting Accessories. If the offer does not belong in either category, then

Hunter - 27169 Textured Black Finish Light Kits

Hunter Fan 20181 Studio Large Fan (52" and Larger) Ceiling Fan - White

Click here for more information.
○ Home Lighting Accessories

Click here for more information.
○ Home Lighting Accessories

○ Ceiling Fans

○ Ceiling Fans

○ None of the Above

○ None of the Above

(8 more products to categorize in this HIT)

innosabi

5119

171

9574

snapmylife

CastingWords
Audio, Video, and General Transcription

14615

ci CHANNEL INTELLIGENCE™

■ Create/ provide content   ■ Revise content
■ Data Research   ■ Special skill application
■ User sentiment detection   ■ Other
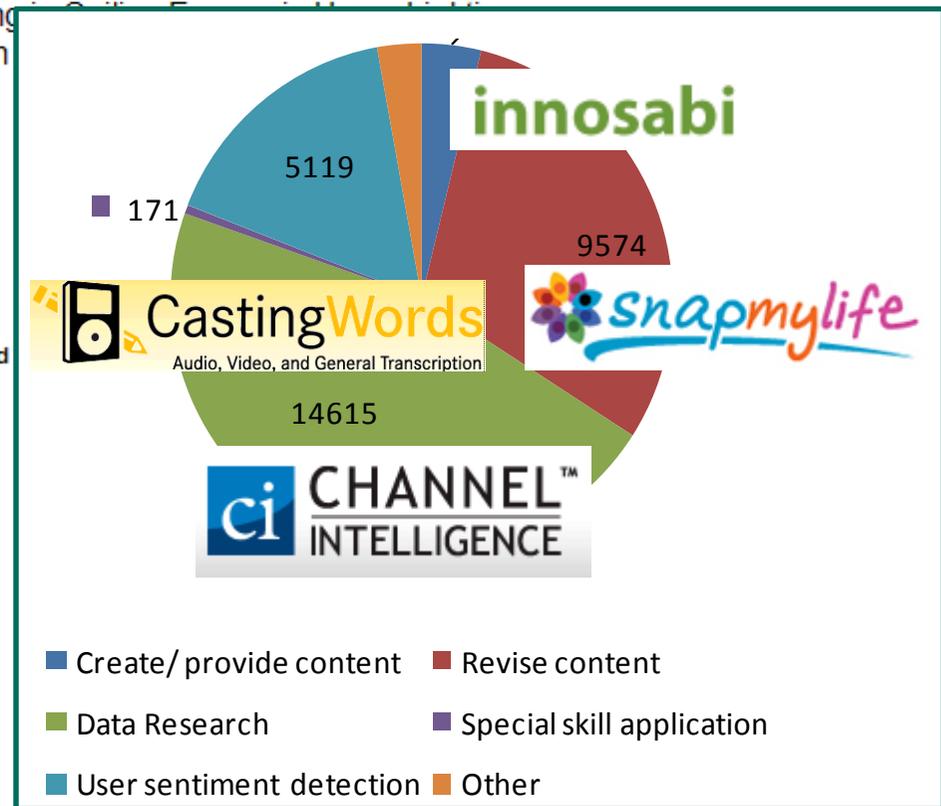
An example from our research illustrates the scalability of people services

Worker participation
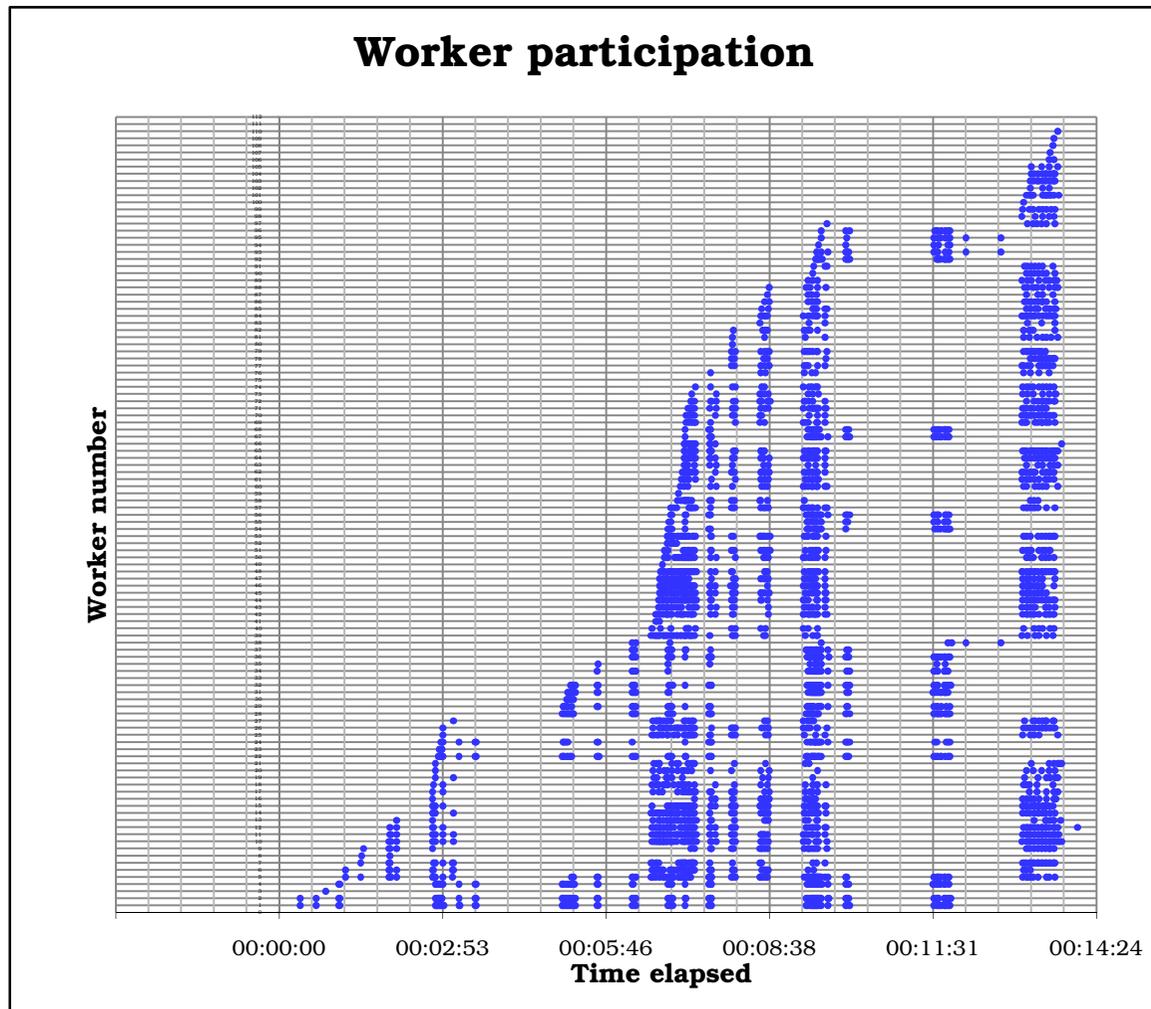
- **Simple OCR scenario on Amazon's Mechanical Turk platform: recognition of a single hand written word**
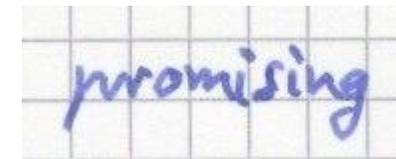
- **3528 tasks**

- **112 workers**

- **First result submitted after 22 seconds**

- **14,088 tasks/hour or ~126 tasks/worker*hour**

(Kern, Thies & Satzger 2010)

More complex tasks may be sourced – efficient quality management is one prerequisite

People Services

Task type	Example	Platforms	Characteristics					
			Number of tasks	Task size	Complexity	Compensation	Interactivity	Quality needs
Micro task	Find an e-mail address or company website	amazon mechanical turk — Artificial Artificial Intelligence						
Macro task	Write a product review	livework beta						
Simple project	Design a branded website	Elance						
Complex project	Program a software module	oDesk / [TopCoder]						

Based on: Frei (2009), Paid Crowdsourcing. Smartsheet.com, September 15.

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Our quality management approach adds statistical methods to guarantee quality levels

People service platform

Requester

Define quality requirements
$AOQL$, ϕ_{min}, ε_{max}

Quality needs

Execute task sequence via Web service

human task

Task

Task description + Task data

Embed results

Final result

Improve task design and instructions.

Escalated task

Quality management component

Continuous sampling (CSP-1)

Individual tracking of worker error rates

Weighted majority vote (WMV)

Dynamic sample inspection

Basic platform

Task queue

Task

Raw result queue

Raw result

Workers

Worker pool

(Kern, Thies & Satzger 2010)

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The approach clearly outperforms „naive" majority vote implementations …

(Kern, Thies & Satzger 2010)

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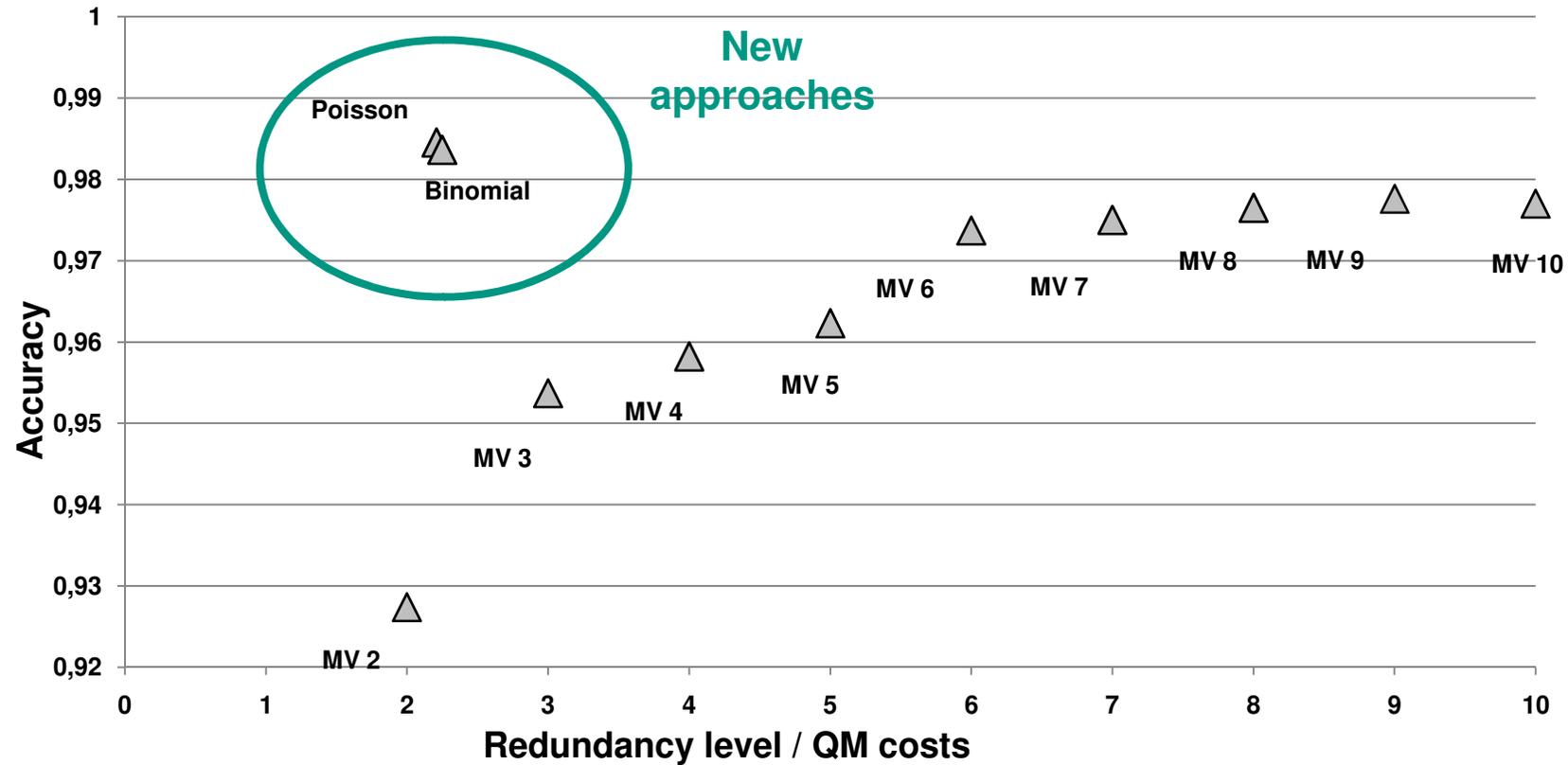
… and has successfully been implemented in a medical diagnosis coding scenario

Private health insurance

Patient

Scannen & Erkennen

Fach-abteilung

Operative Daten

ISH Insurance Service Hub

Doctor's practice

Doctor's practice

Praxis-software

Praxis-software

Clearing house

Data pool

Services

Authorized access

Standardized diagnosis

IBM

People Service Platform

Call Center

Call center agents
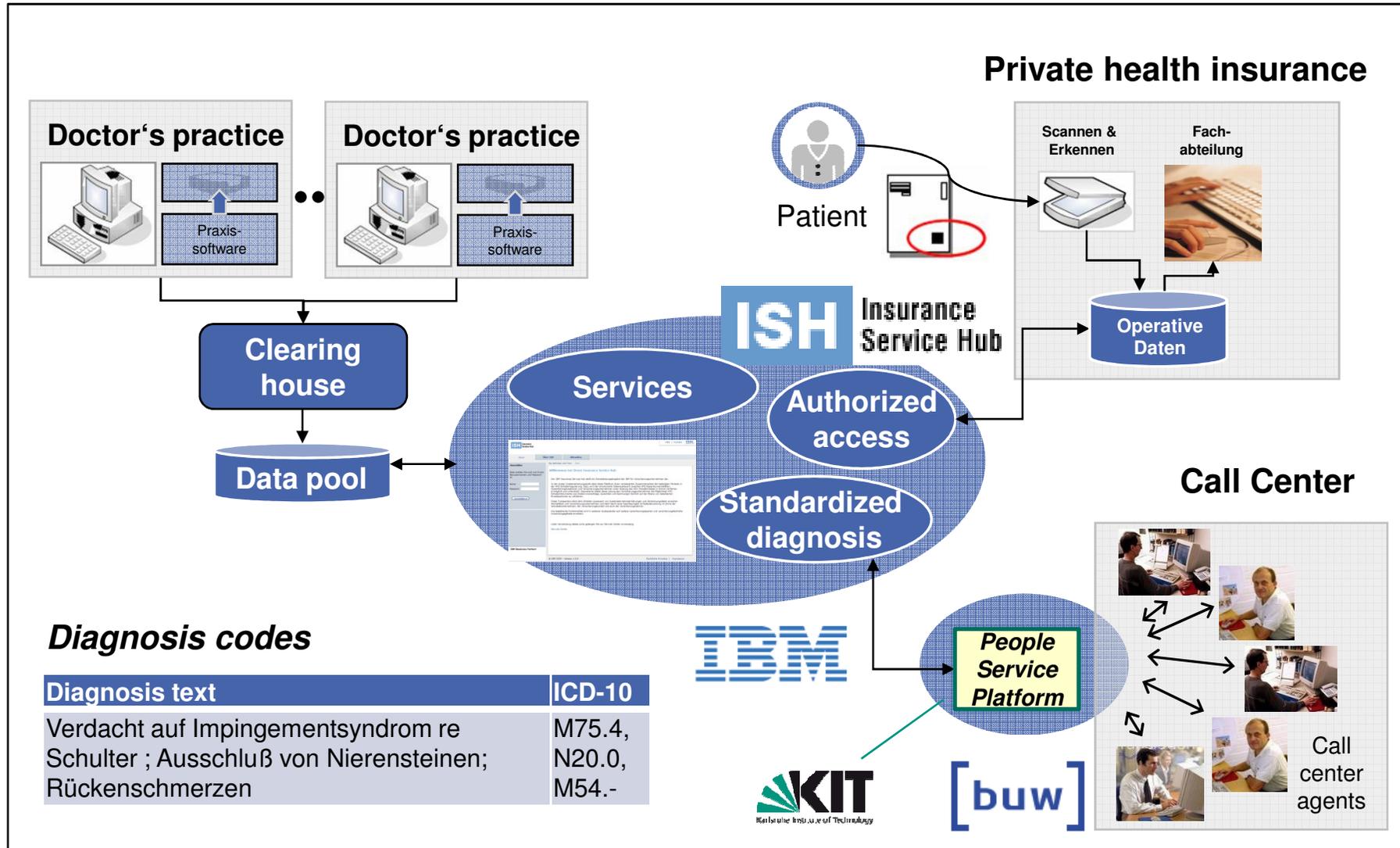
Diagnosis codes

Diagnosis text	ICD-10
Verdacht auf Impingementsyndrom re Schulter ; Ausschluß von Nierensteinen; Rückenschmerzen	M75.4, N20.0, M54.-

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[buw]

The scenario was prototypically implemented based on IBM WebSphere Process Server

Insurance Service Hub (ISH)

Send diagnosis text → Receive ICD-10 codes

WebSphere Process Server with Business Space

IBM

People Service Plattform

Prepare diagnosis text → Required number of workers / quality management → Return ICD-10 codes

Call Center / People Cloud [buw]

Coding of diagnosis texts

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The ICD-10 scenario provides business potential for all involved parties

Partner	Business potential
Insurance provider	• Complete and correct coding of medical diagnosis • Fraud detection • Flexible insurance contracts • Concentrate on core business
Call Center [buw]	• Better utilization • New business models • Higher employe satisfaction
Technology & consulting IBM	• New technology and services • Extension of ISH
Customer / national economy	• Reduce costs • „Smarter Work" / „Smarter Planet"

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Our next steps

Simultaneously manage quality, cost and duration performance.

Drive innovation with people services.

Identify the optimal QM approach depending on the task type.

Quality management for people services

Evaluate use of *private* people services by leveraging resources within large organizations.

Leverage *wisdom of the crowd* in order to increase the quality of individual results.

Investigate the effect of feedback on result quality.

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Some Literature

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For KSRI publications pls. see:
http://www.ksri.kit.edu/Default.aspx?PageId=437&lang=en

Thanks for your attention – pls. contact me for more…

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.. and get a visual impression:

http://www.youtube.com/watch?v=NU_RbkqC0HQ

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