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# The Impact of Mobile Computing on ICT Enhanced Interdisciplinary and Multidisciplinary Applications

## ICT - Mobile

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19 November 2013

# Introduction



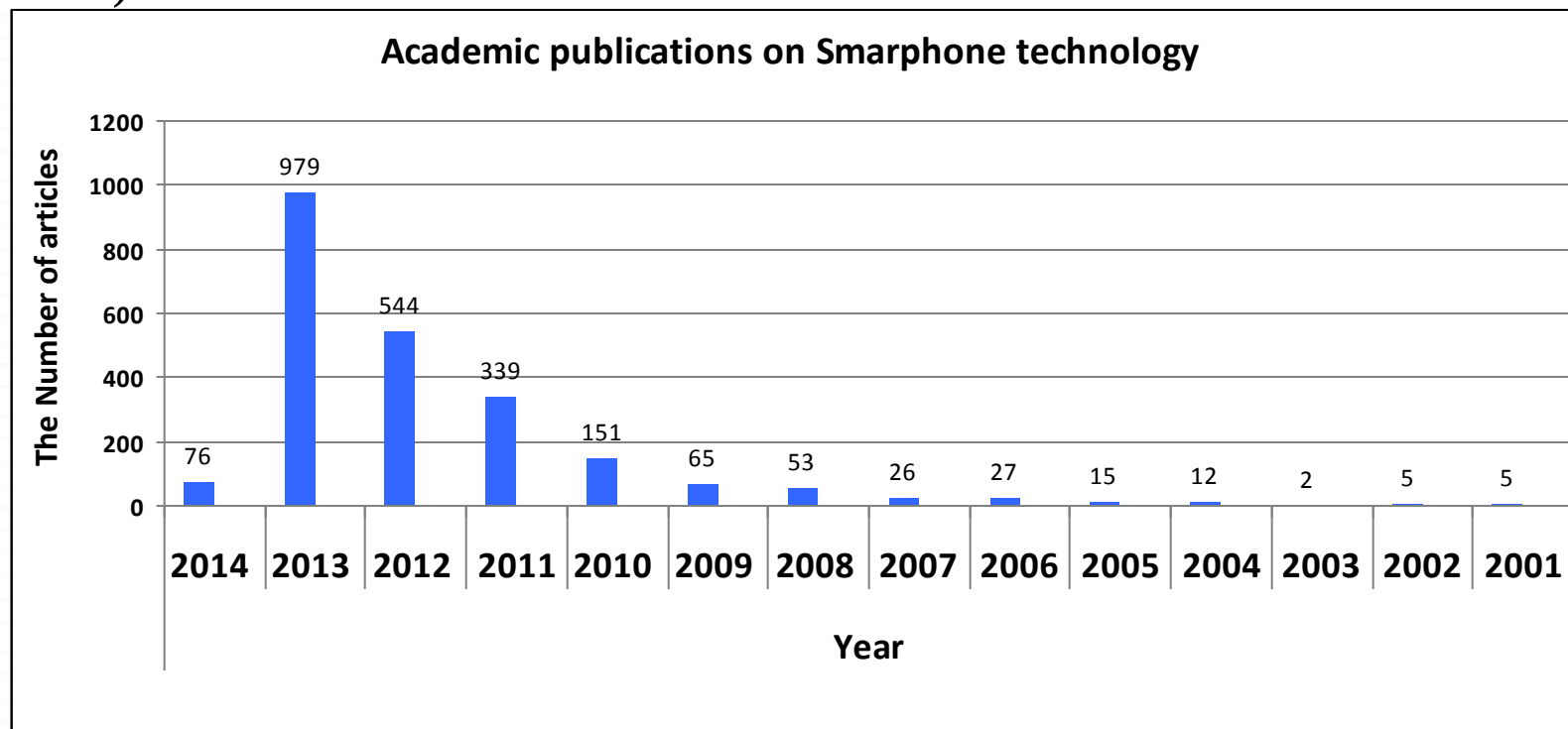
## ✦ **Mobile computing boosts the markets dramatically**

- ✦ According to the Apple company, more than 40,000 apps can be downloaded from Apple Store. The company announced that the price has been set up for \$25 billion in the application store from 2008 to 2012 [1].
- ✦ Hardware devices from PDA, tablets to iPod/iPad/iPhones, and other makers of Smartphone;
- ✦ Software applications from WAP/WML to J2ME, iPhone SDK/XCode, Google Android, Window phones, etc.
- ✦ Services from single device based to iCloud environment [2]. The files with large contents, such as photo streams, can be stored wirelessly free.

# Introduction



- ✦ Academic publications on Smartphone technology have been increased significantly since 2001. (sciencedirect.com, accessed on 3 November 2013).



# Mobile Computing vs. ICT



- ✦ Smartphone technology brings scientists together from a number of areas, e.g.
  - ✦ Information science,
  - ✦ Computer science,
  - ✦ Software engineering,
  - ✦ Physics,
  - ✦ Electronics,
  - ✦ Communication,
  - ✦ Etc.
- ✦ into the domain of mobile computing that is traditionally dominated by the electronic engineering with strong physics and communication background.

# Mobile Computing vs. ICT



- ✦ There after, with rapid growth of Smartphone technology, a number of topics are introduced and integrated into the mobile computing, e.g.
- ✦ Artificial Intelligence,
  - ✦ Business workflow,
  - ✦ Agent technology,
  - ✦ Advanced graphic animation,
  - ✦ Multimedia interactions,
  - ✦ Games,
  - ✦ Ubiquitous accessibility,
  - ✦ Complex distributed systems, cloud computing,
  - ✦ etc.

# Mobile Computing vs. ICT



- ✦ The impact is not just revealed by the technology itself but also involved by a huge number of users from all over the world.
- ✦ A typical example, game apps that are developed in the following major operating systems:
  - ✦ Microsoft Windows phone,
  - ✦ Google based Android phone,
  - ✦ iOS based iPhone, iPad/iPod touch, etc.
- ✦ Especially, the serious games have been used in a large number of educational markets for the purposes of learning and training [3], i.e. learning for fun, inspiration with a touch on the screen.

# Mobile Computing vs. ICT



- ✦ The platform of Smartphone technology is so easy to be adopted by the developers, especially for those who have a background in computing science and software engineering, e.g.
  - ✦ Use a language, Objective C with Xcode,
  - ✦ Apply XML looking lineout,
  - ✦ Integrate with advanced adobe development packages,
  - ✦ Deploy advanced graphic features,
  - ✦ Embed Database programming,
  - ✦ Enable network connections,
  - ✦ Equip location navigations,
  - ✦ Reduce the time of learning, in comparison with traditional development platform, e.g. Java, C++, and a set of Microsoft development environment, etc.
- ✦ Thus, there is a great potential to integrate almost all the ICT required facilities for the users, e.g. WIFI network connections, Internet, Data management services for the local and remote access and retrieval, and security measures.

# Mobile Computing vs. ICT



## ✦ Considering:

### ✦ Context awareness:

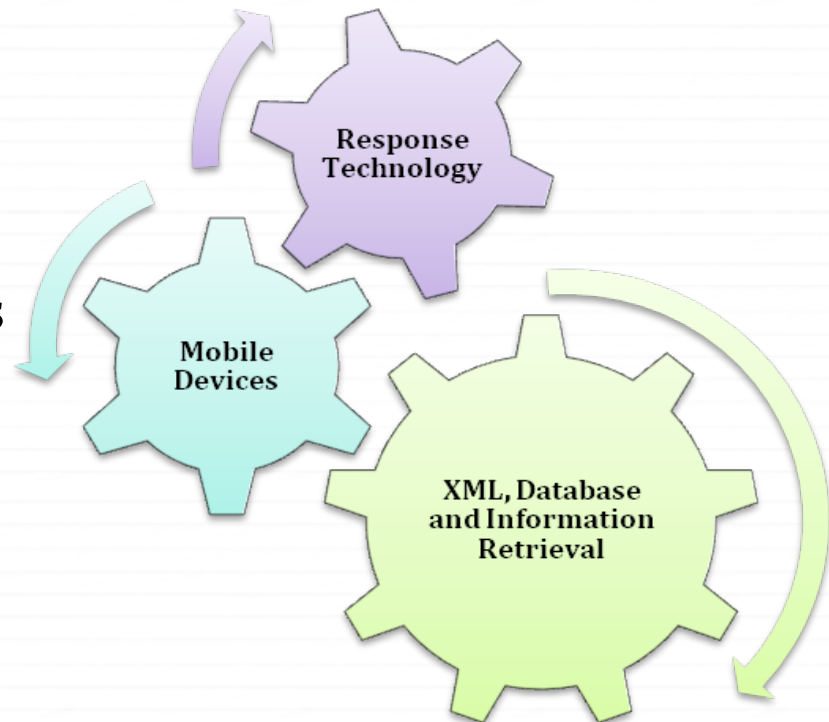
- ✦ when you are using Smartphone

### ✦ Environment awareness:

- ✦ when you are using less natural materials

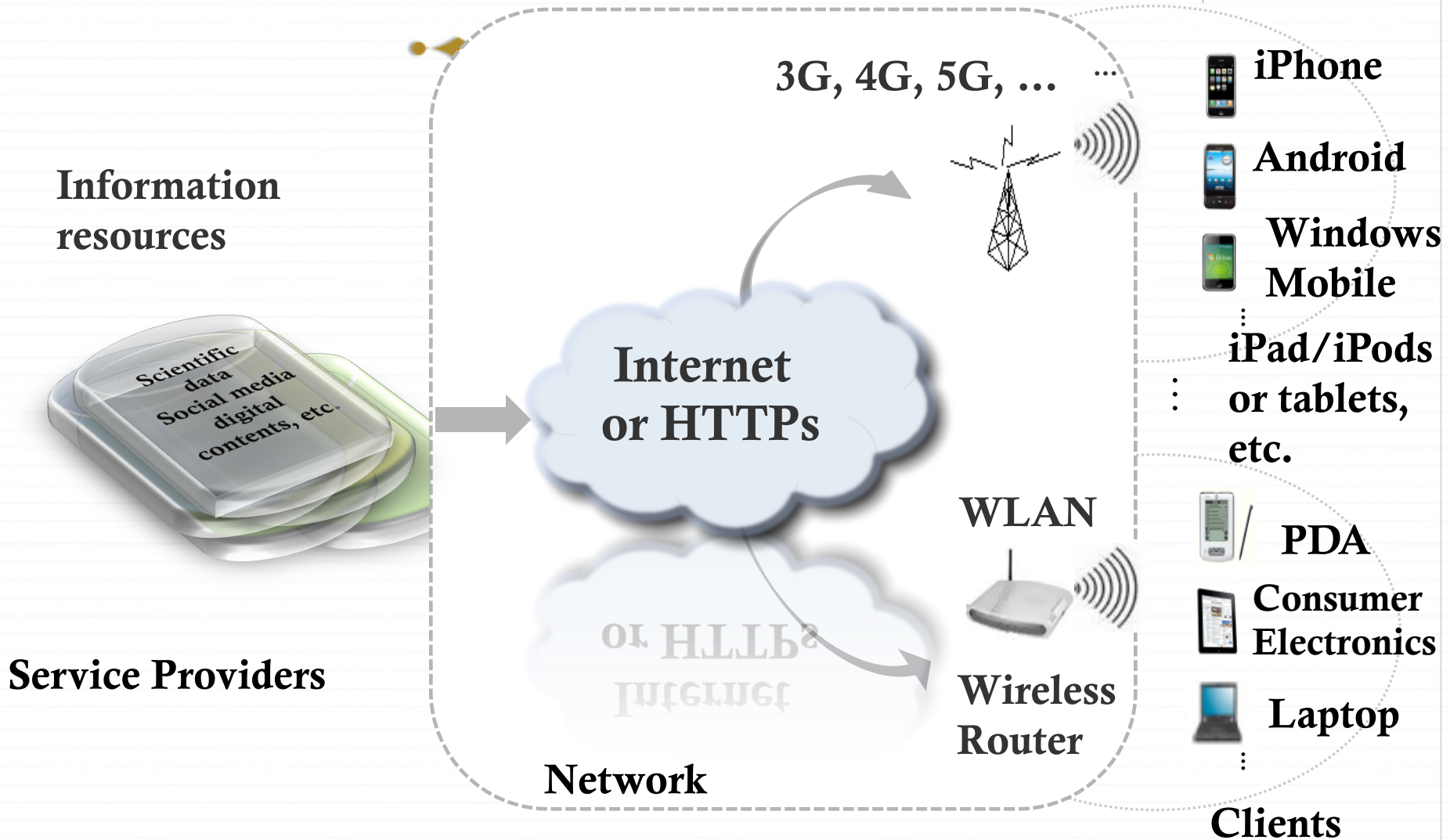
### ✦ Security:

- ✦ be aware the data integrity, confidentiality and authentication, especially for an online banking.

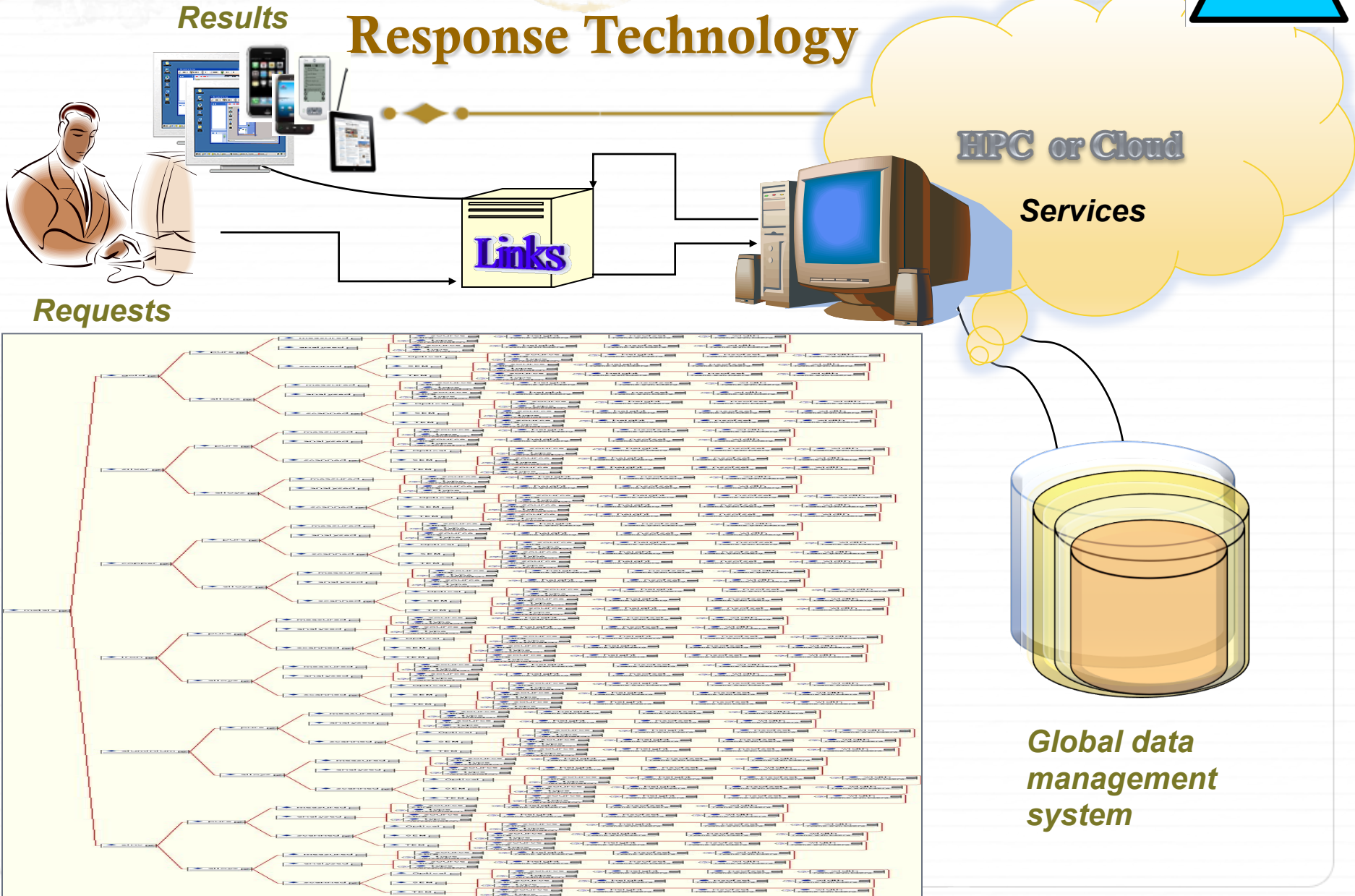




# Mobile Computing vs. ICT



# XML, Database and Information Retrieval Mobile Devices Response Technology



# XML, Database and Information Retrieval

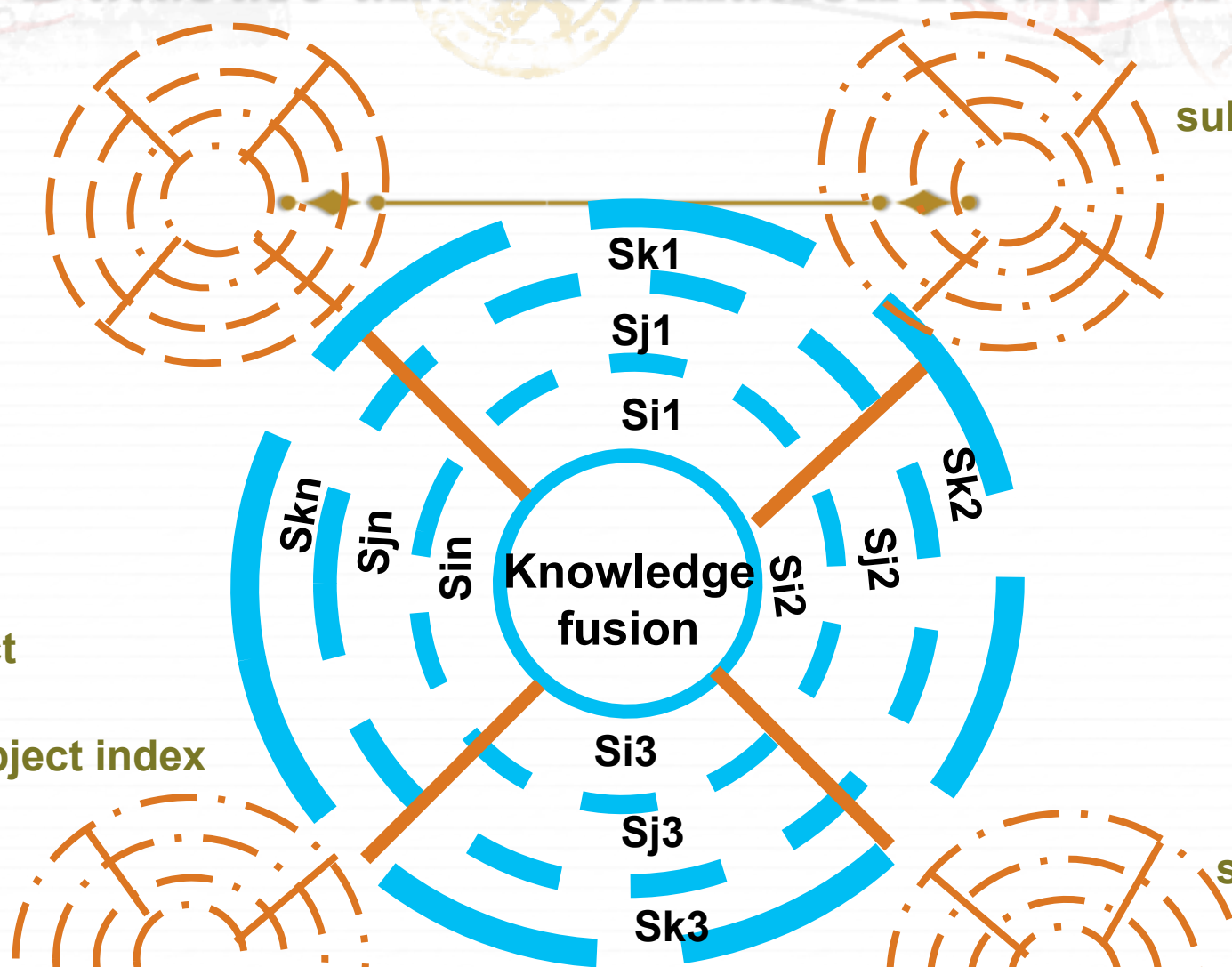


Subtopics

subtopics

S – subject

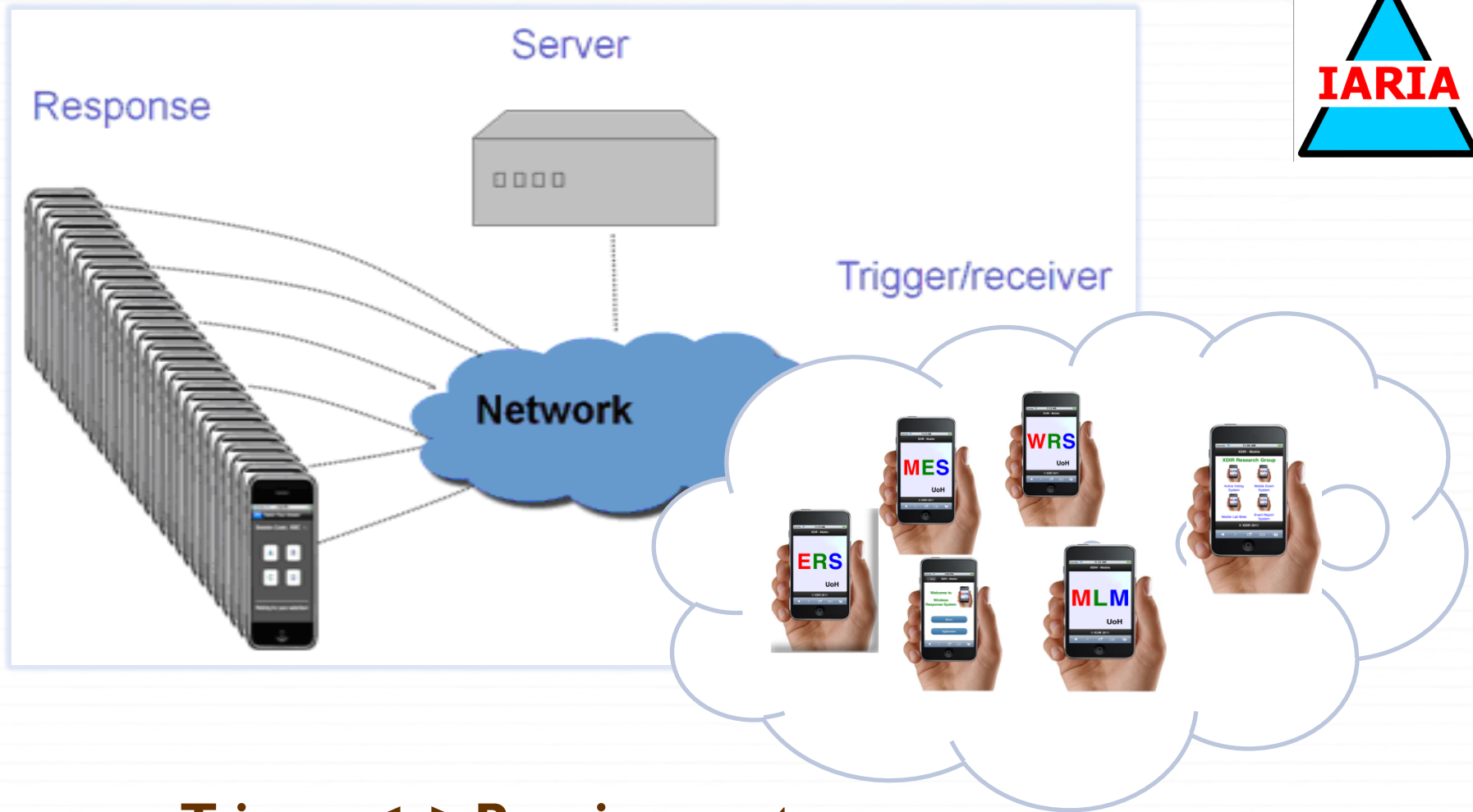
i, j, k – subject index



subtopics

$$D = \sum_{j=1}^m \left[ T_j \supset \sum_{i=1}^n \left( S_i \supset \sum_{k=1}^l P_k \right) \right] \quad [3]$$

# Response Technology in the Framework



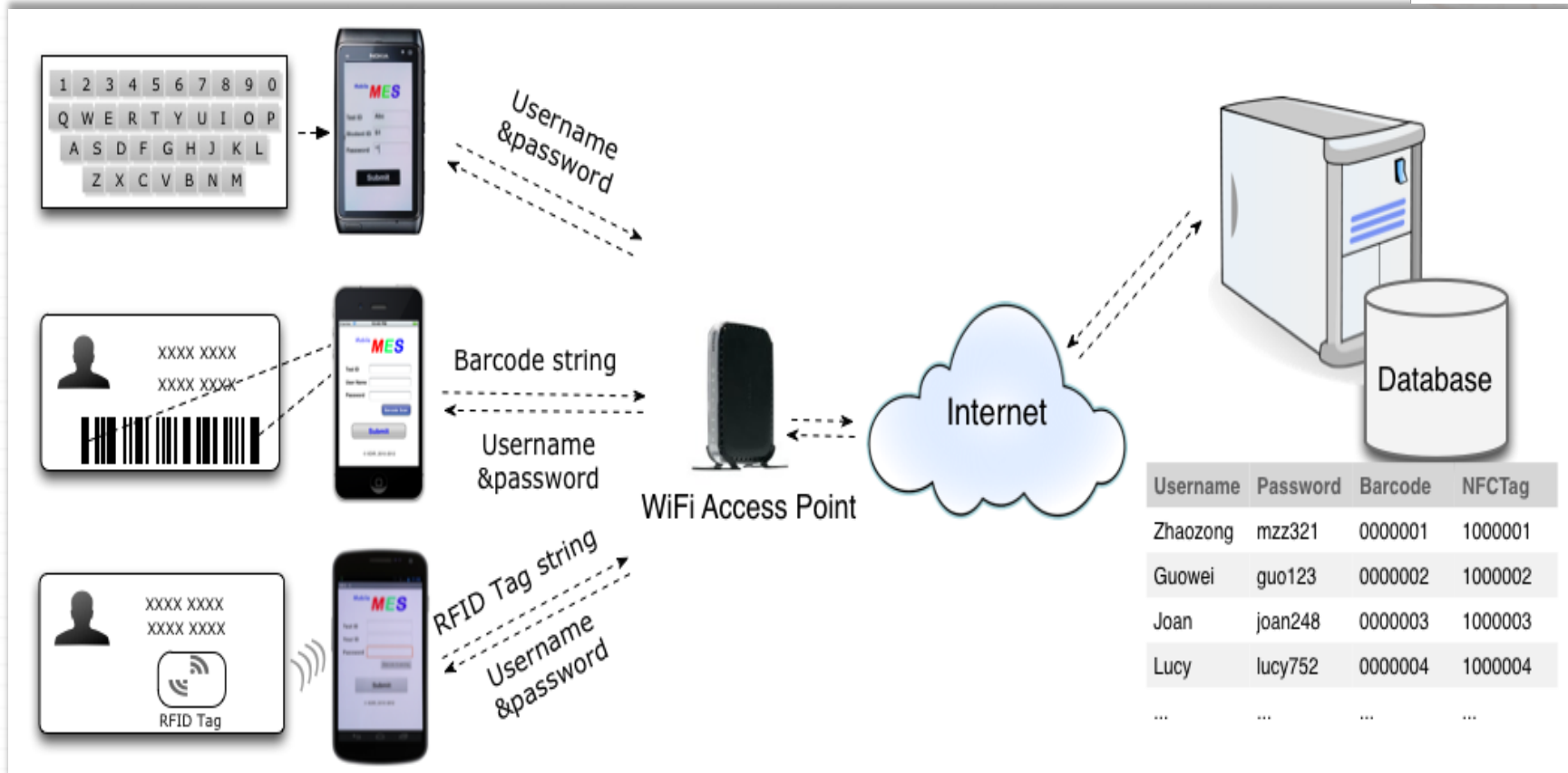
**Trigger  $\leftrightarrow$  Receiver systems**



# Response Technology in the Framework

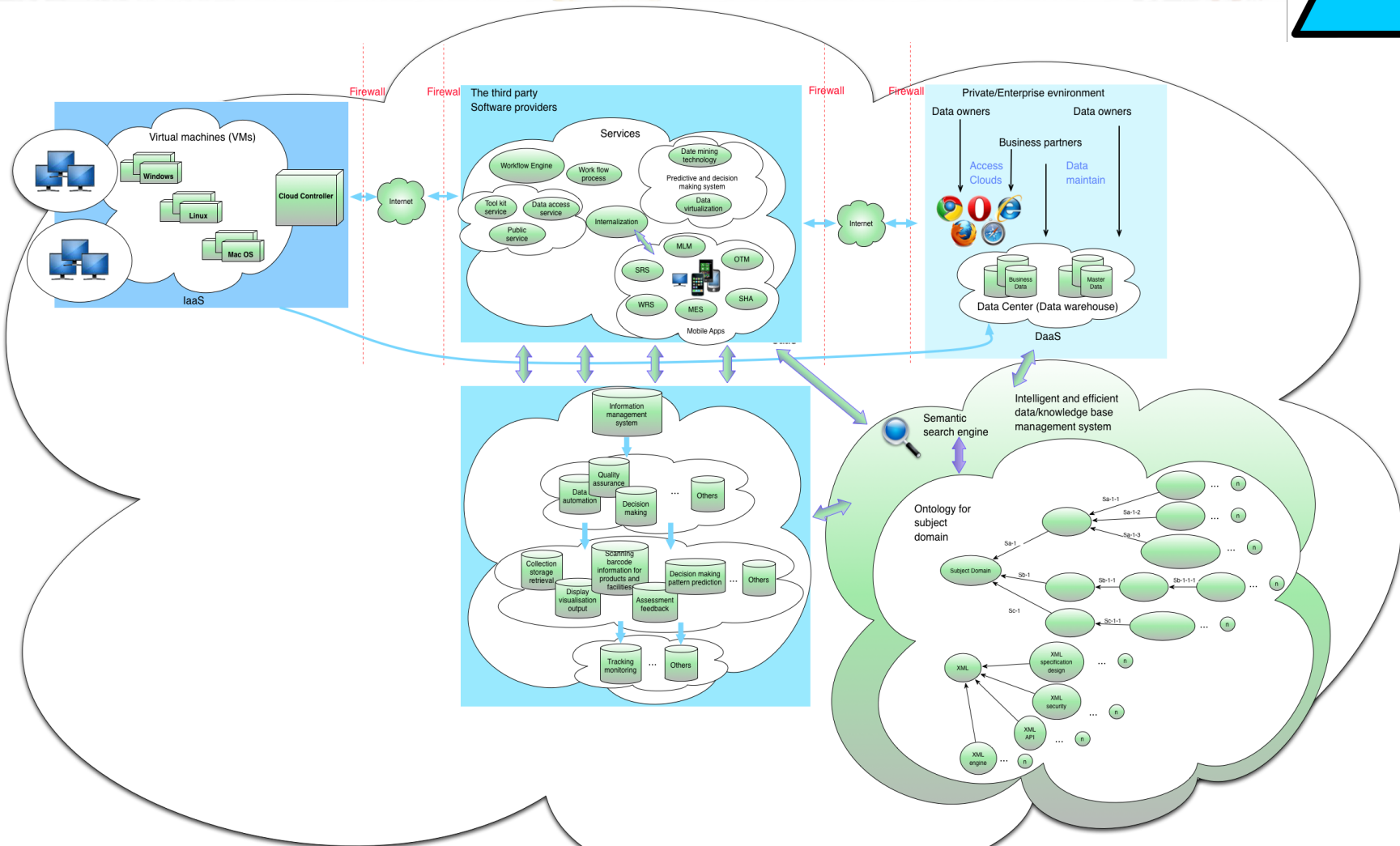
- ✦ Response technology is one of the key components in ICT enhanced mobile applications. It links data/information to the communications between human and computers through the mobile devices. It collaborates the network and services with users. It performs instructions from users to the machine/devices and sends the feedback from machines to the users, e.g. between:
  - ✦ Customers and Business,
  - ✦ Patients and Doctor,
  - ✦ Employees and Employer,
  - ✦ Clients and Solicitor,
  - ✦ Learners and trainer,
  - ✦ Residence and police,
  - ✦ Passengers and airport
  - ✦ Etc. for any other communication channels.
- ✦ It follows that the “response” produces the data, as the foundation of information that could be analysed to discover the new knowledge to the subjects or events involved.

# Response Technology in the Framework



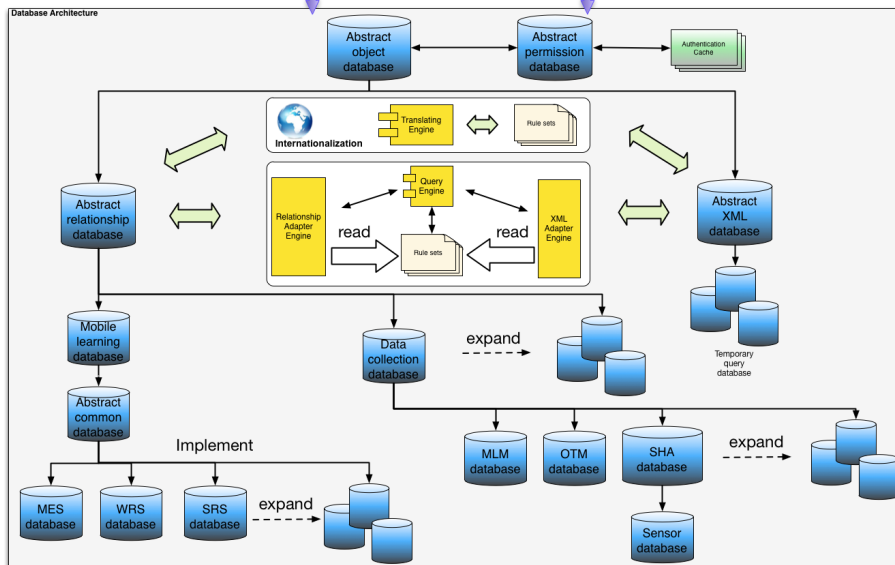
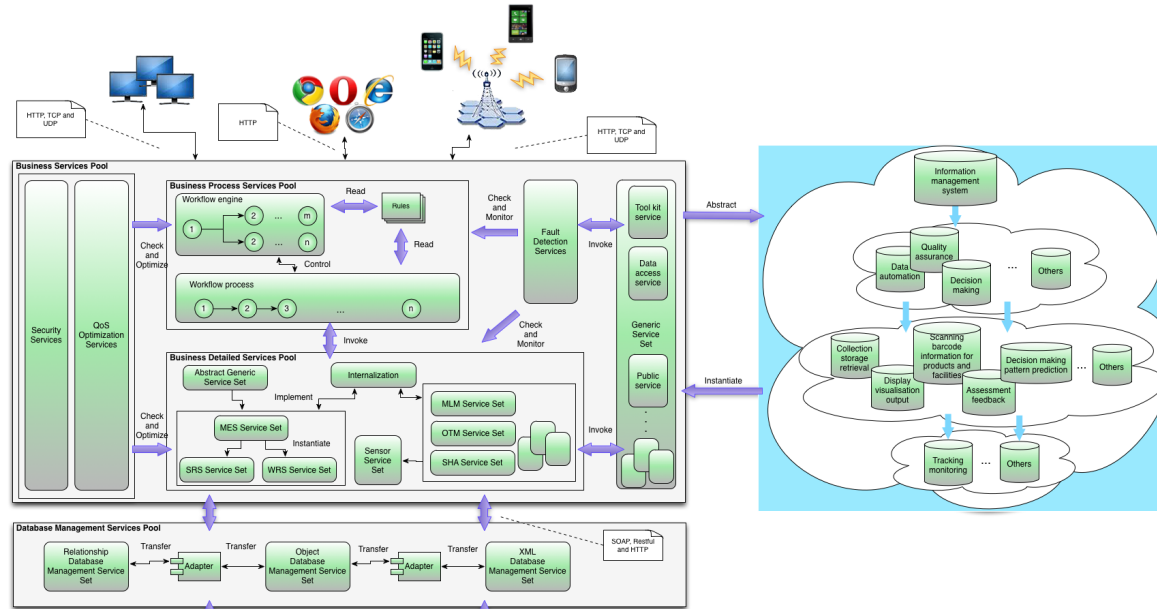
**It has a simple security measure, e.g authentication for accessing the systems**

# Response Systems embedded in the cloud environment



(Drawn by Wei Guo)

# Global Architecture for the response systems



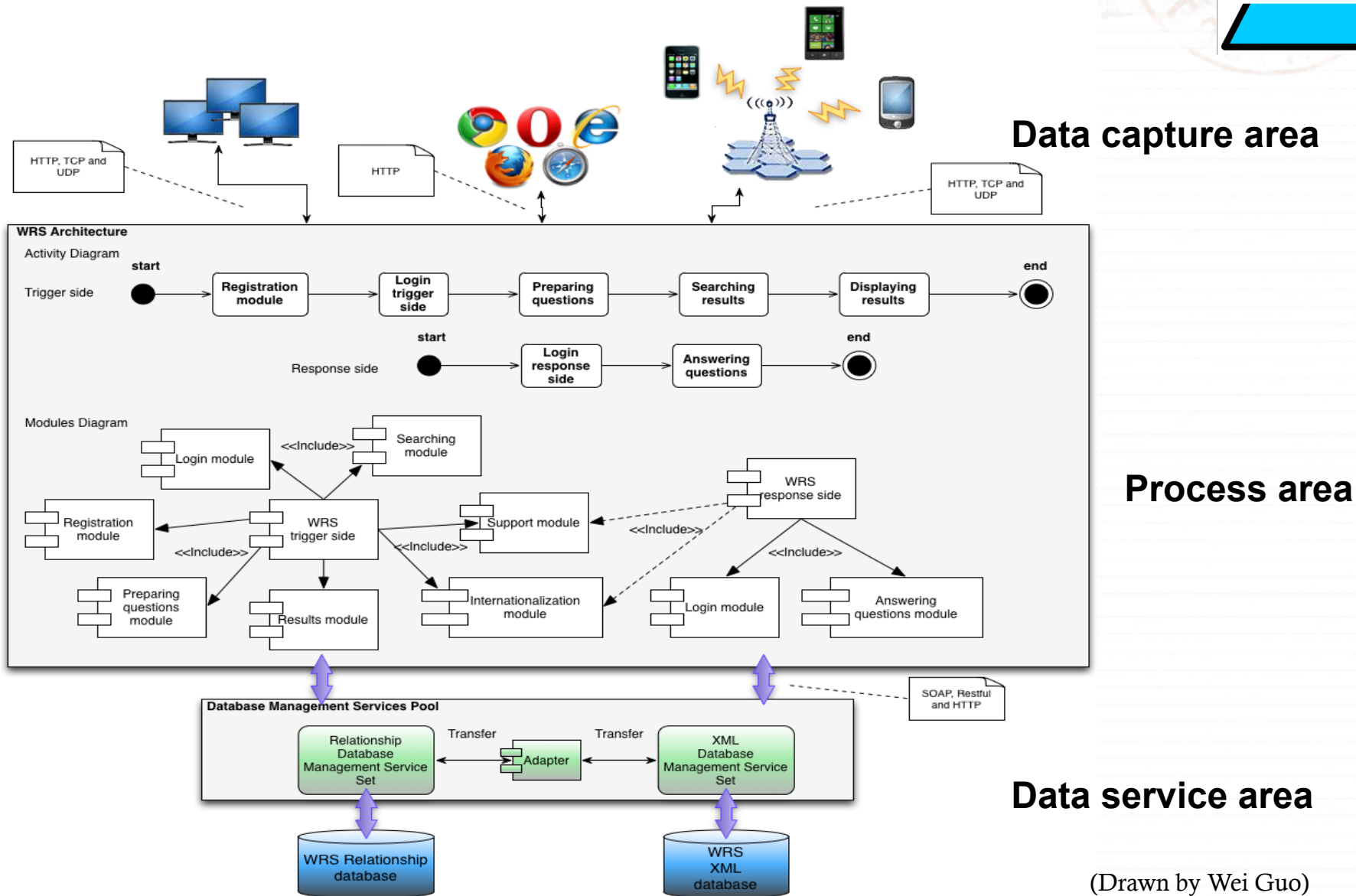
## Three major components:

- ✦ Business services
- ✦ Database architecture
- ✦ Information management

(Drawn by Wei Guo)



# The workflow for the response system



(Drawn by Wei Guo)



# Response Technology in the Framework

Sender



Results for further research and analysis



Responder



The first generation of mobile response system that has been used in some universities and industrial training courses.

# Response Technology in the Framework

WRS File Edit Window © xdir. 2010-2012 V.2-1 Area: **Math1**

Current Results History Assessment Exit Logout Support

**Are you happy today ?**

**1. Question types**

Text: Yes, No, Do not know  
True, False, Do not know

Alphabetic choice from 1-20:

Upload questions from your system:

**2. User input contents**

Text  
Image

**3. Process control**

Time: 0s 30s 1min 2min 3min 4min

00:00

Sound:  Single  Multiple

Start Stop



## Current mobile response system

# Response Technology in the Framework



## ✦ Example in learning physics

The screenshot shows a web browser window with a navigation bar at the top containing 'Discipline: physics', 'Current', 'Results', 'Logout', 'Exit', 'Support', and 'Settings'. The main content area displays the question: 'Firing the rocket engines increases the momentum of the rocket. Explain why.' Below the question, there are three control panels: 1. Question Type (with buttons for 'Yes, No, Don't Know', 'True, False, Don't Know', and 'Asking student questions'), 2. User input contents (with an 'Attach an image' button), and 3. Process control (with a timer set to 00:40, a 'Sound' section with 'Single' selected, and 'Restart' and 'Stop' buttons). At the bottom left, there are options for 'Alphabetic choice from 3\_20' and 'Upload questions from your system'.

The screenshot shows a mobile device screen with the title 'Response'. It displays the question text: 'Firing the rocket engines increases the momentum of the rocket. Explain why.' Below the text is an image of a rocket. A text input field contains the answer: 'Because the speed of the rocket increases fast.' At the bottom of the screen is a 'Submit' button. A green message at the top of the response area says: 'Your vote has been submitted successfully. You still can change your mind, and the system will count your last vote.'

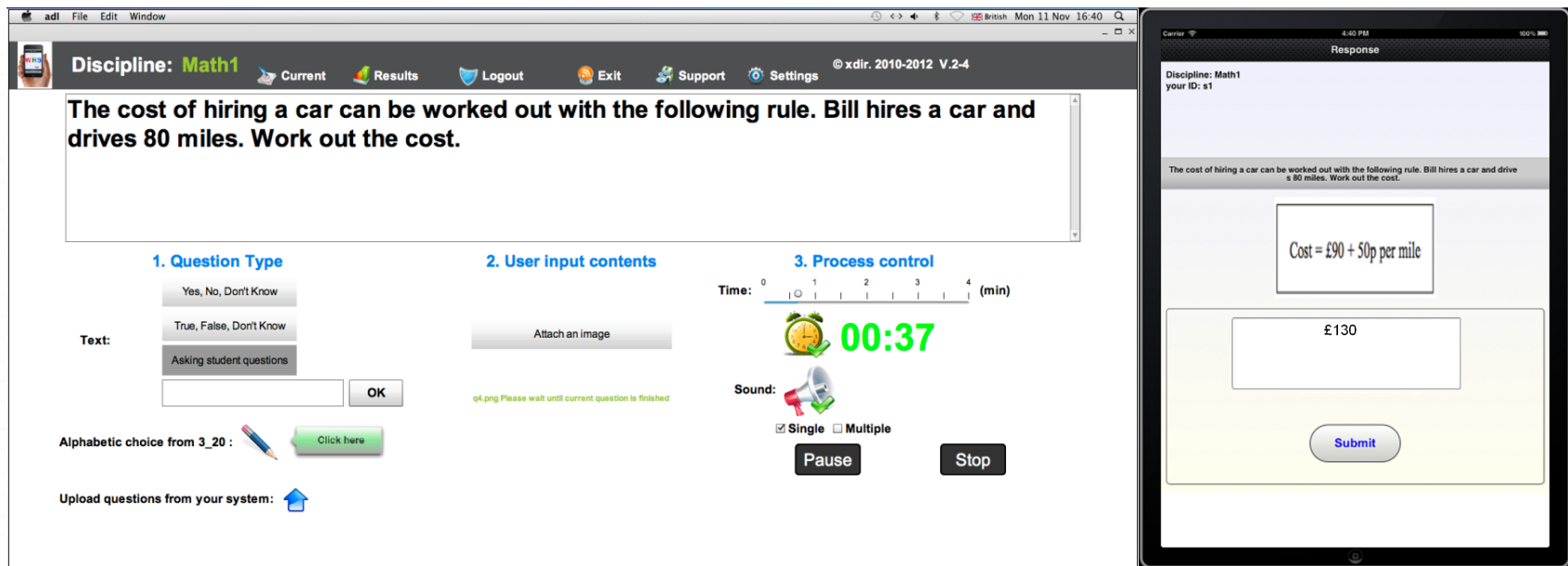
Reference to UK GCSE past paper (<http://www.wjec.co.uk/>)

(tested by Z. Meng)

# Response Technology in the Framework



## ✦ Example in learning mathematics



The screenshot shows a web browser window displaying a mathematics question. The question text is: "The cost of hiring a car can be worked out with the following rule. Bill hires a car and drives 80 miles. Work out the cost." Below the question, there are three main sections: "1. Question Type" with options like "Yes, No, Don't Know" and "Text"; "2. User input contents" with an "Attach an image" button; and "3. Process control" with a timer showing 00:37, a "Sound" button, and "Single" and "Multiple" checkboxes. There are also "Pause" and "Stop" buttons. To the right, a mobile device screen shows the same question and a response area with the text "Cost = £90 + 50p per mile" and a text input field containing "£130". A "Submit" button is visible at the bottom of the response area.

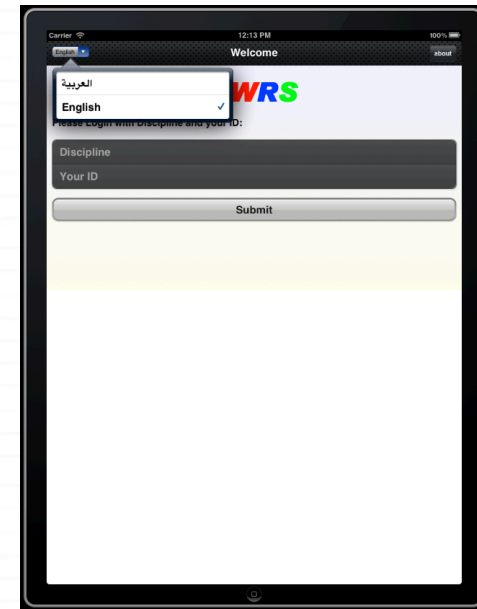
Reference to UK GCSE past paper (<http://www.wjec.co.uk/>)

(Tested by Z. Meng)

# Response Technology in the Framework



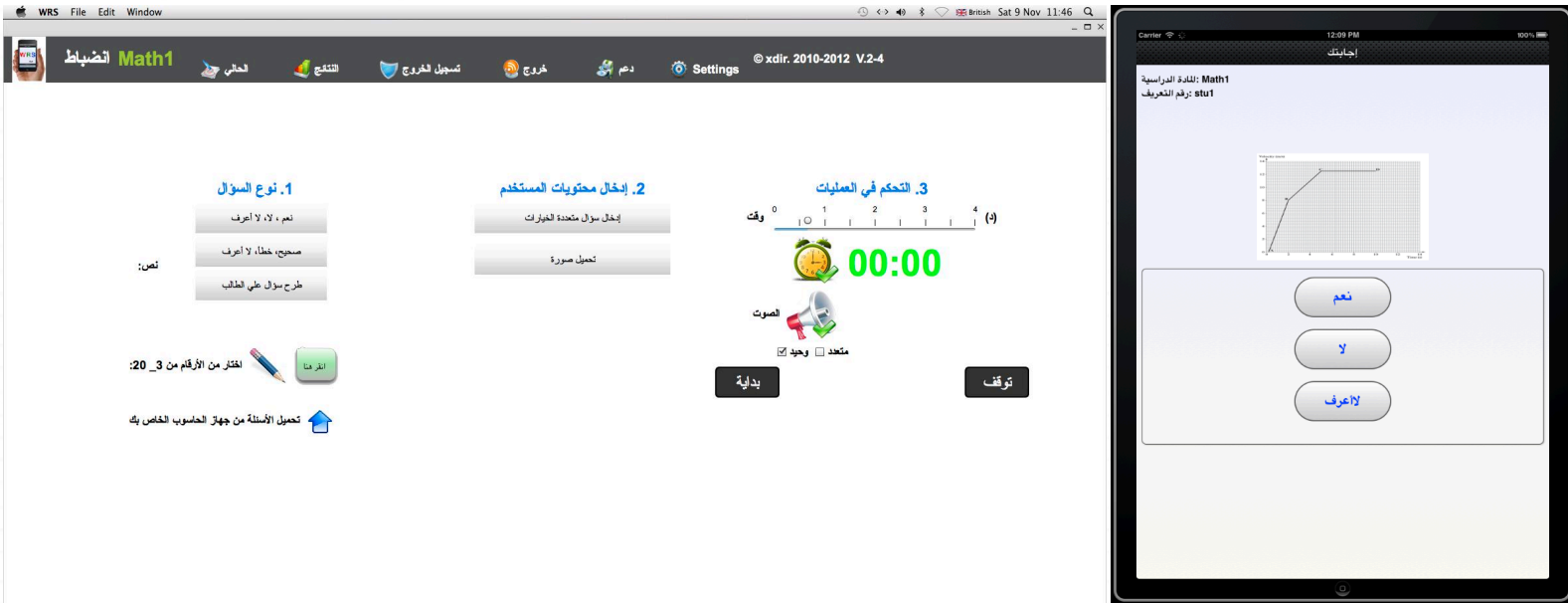
## ✦ Internationalization



Currently Arabic language has been implemented, Italian, Romania, Malaysian and other languages are on the way.

(Tested by Z. Meng)

# Response Technology in the Framework



The system is implemented for the native Arabic speakers.

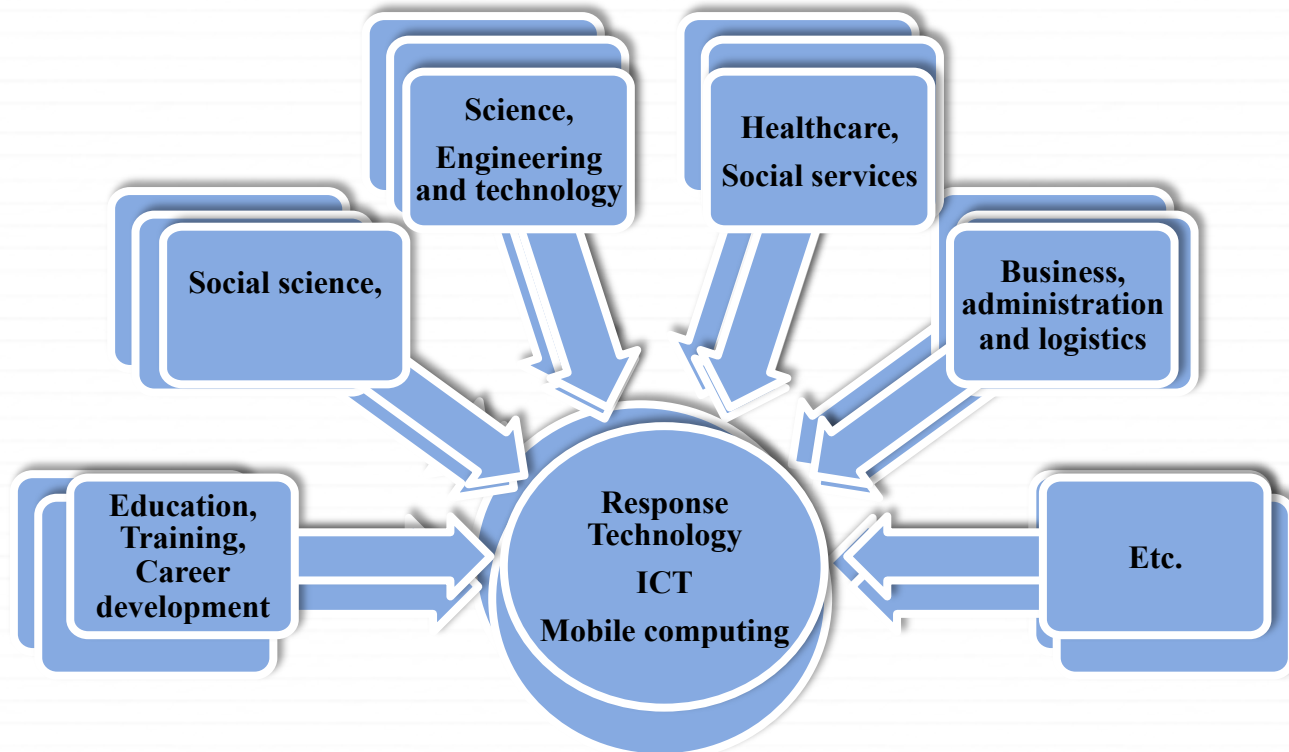
Reference to UK GCSE past paper (<http://www.wjec.co.uk/>)

(Tested by Z. Meng)

# The impact on the real world



“the possibilities for using mobiles to engage learners are endless”. ([Emma Drury, Guardian Professional](#), Monday 10 September 2012 16.00 BST)

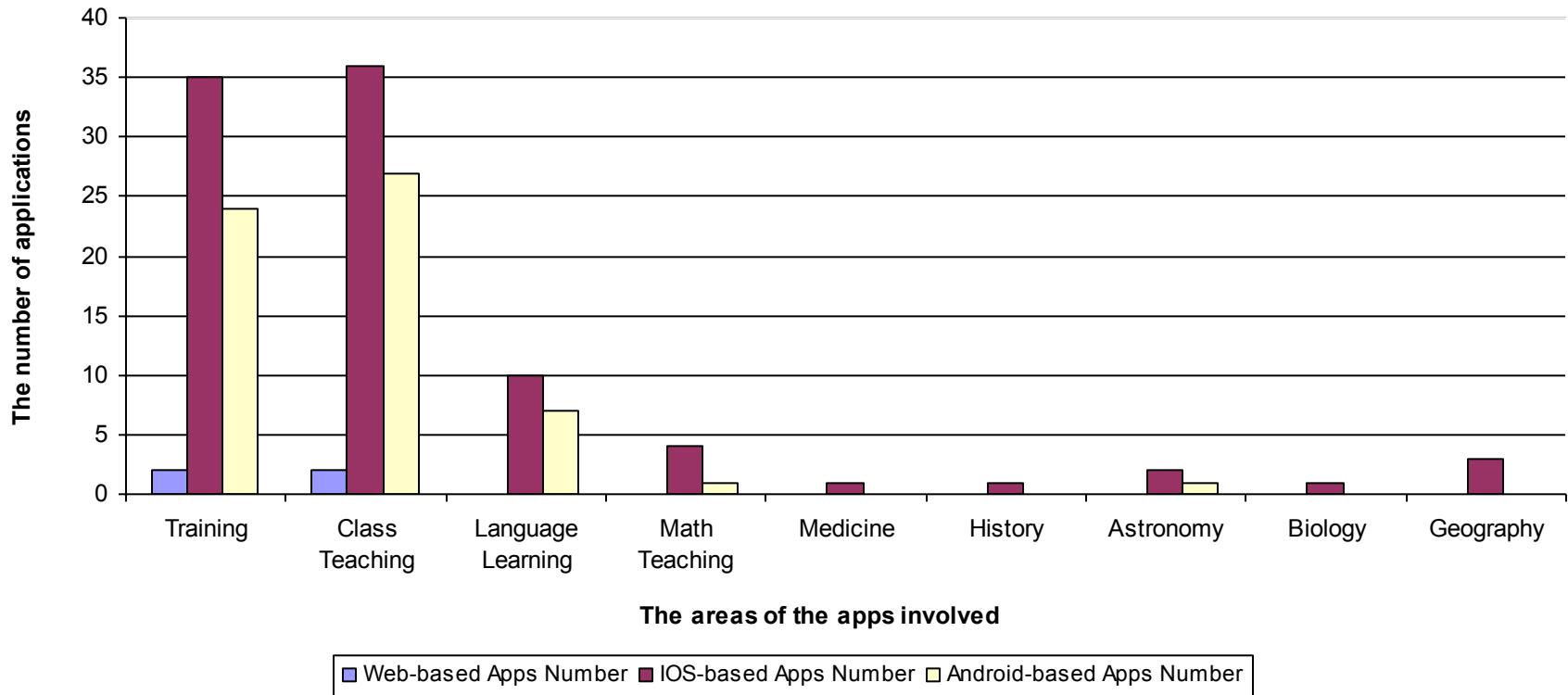




# The impact on the real world



Examples of Mobile related applications



Activate



Qwizdom Q7



TuringPoint XR

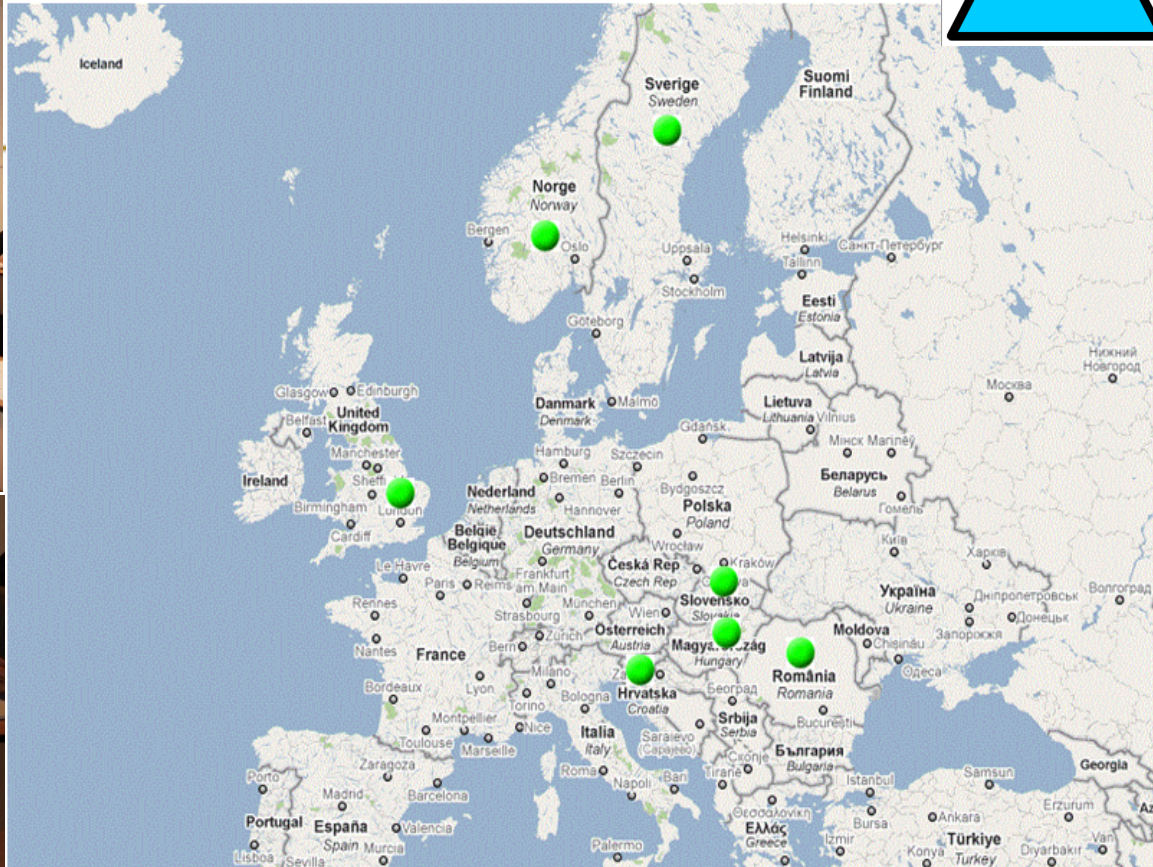


ResponseWare



SRS

# The impact on the real world



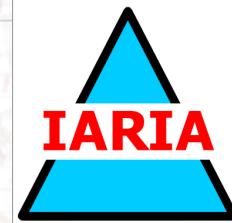
Engineers were using the response system.



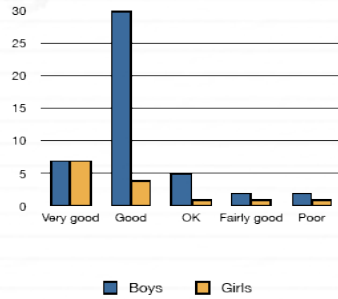
(Provided by EU Edumecca project consortium)

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# The impact on the real world

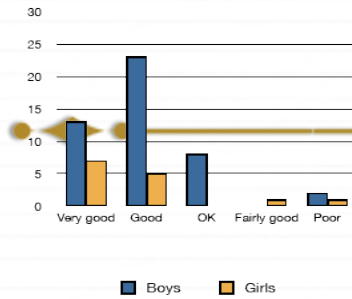


My first impression of the SRS is



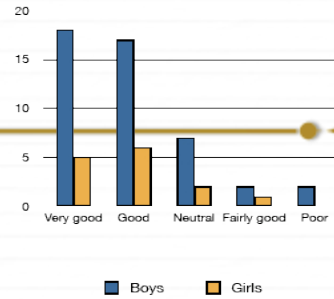
Average: 3,02  
Standard deviation: 0,93  
Average boys: 3,87  
Standard deviation boys: 0,81  
Average girls: 4,07  
Standard deviation girls: 1,22

I think the manner in which the lectures using SRS have worked is



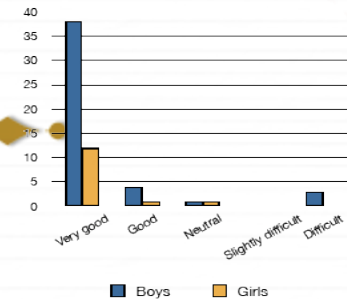
Average: 4,05  
Standard deviation: 0,91  
Average boys: 4,07  
Standard deviation boys: 0,80  
Average girls: 4,00  
Standard deviation girls: 1,20

How satisfied are you with the information given about the SRS in the beginning?



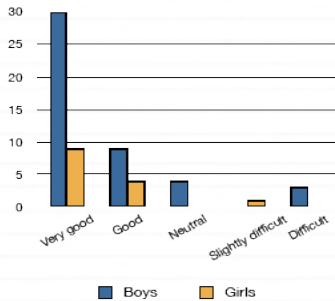
Average: 4,03  
Standard deviation: 0,97  
Average boys: 4,04  
Standard deviation boys: 1,01  
Average girls: 4,00  
Standard deviation girls: 0,85

How easy was it to cast a vote with the iPod Touch?



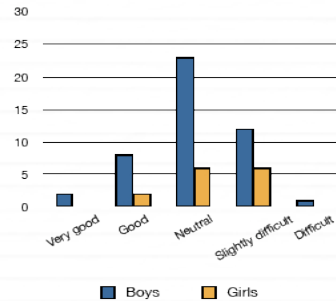
Average: 4,71  
Standard deviation: 0,82  
Average boys: 4,69  
Standard deviation boys: 0,89  
Average girls: 4,79  
Standard deviation girls: 0,56

How easy to read is the confirmation on the iPod Touch that you have voted?



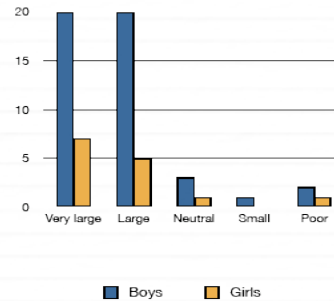
Average: 4,46  
Standard deviation: 0,94  
Average boys: 4,44  
Standard deviation boys: 0,98  
Average girls: 4,50  
Standard deviation girls: 0,82

What was the level of difficulty of the quiz questions?



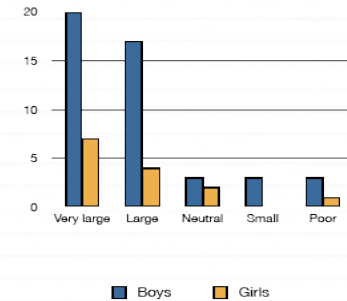
Average: 2,93  
Standard deviation: 0,78  
Average boys: 2,98  
Standard deviation boys: 0,77  
Average girls: 2,79  
Standard deviation girls: 0,77

To what extent does the SRS engage and activate the students?



Average: 4,24  
Standard deviation: 0,91  
Average boys: 4,27  
Standard deviation boys: 0,85  
Average girls: 4,14  
Standard deviation girls: 1,06

How would you assess the value of the group discussions before voting?



Average: 4,12  
Standard deviation: 1,09  
Average boys: 4,13  
Standard deviation boys: 1,09  
Average girls: 4,07  
Standard deviation girls: 1,10

The feedback from young users (Provided by EU Edumecca project consortium) [4]

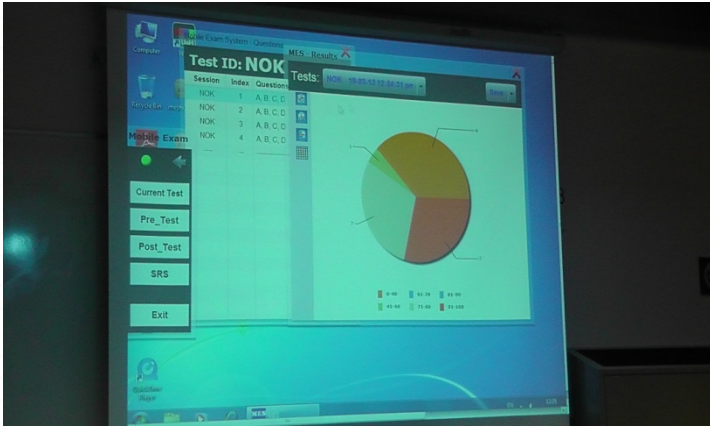
# The impact on the real world



a



b



c



d

Classroom in the University of Huddersfield  
(provided by XDIR research group)

The Third International Conference on Advanced Communications and Computation,  
INFOCOMP 2013, November 17 - 22, 2013 - Lisbon, Portugal.

# More projects on the response technology

- ✦ **Mobile Exam System – MES**
  - ✦ with EU lifelong learning project
- ✦ **Wireless Response System**
  - ✦ SRS 2G with Social science
- ✦ **Mobile Lab Mate - MLM**
  - ✦ with Bioscience
- ✦ **Mobile Occupational Therapy – MOT**
  - ✦ with Healthcare
- ✦ Etc.

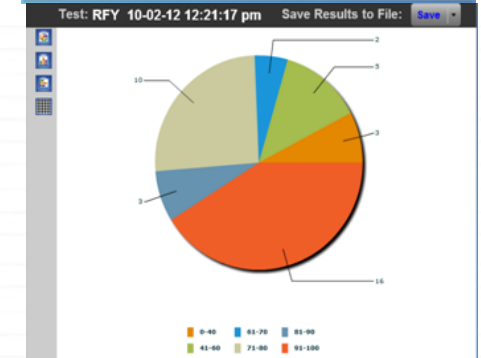
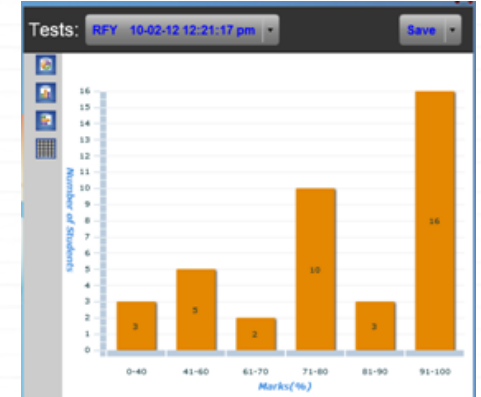


# More on the response technology



## Mobile Exam System

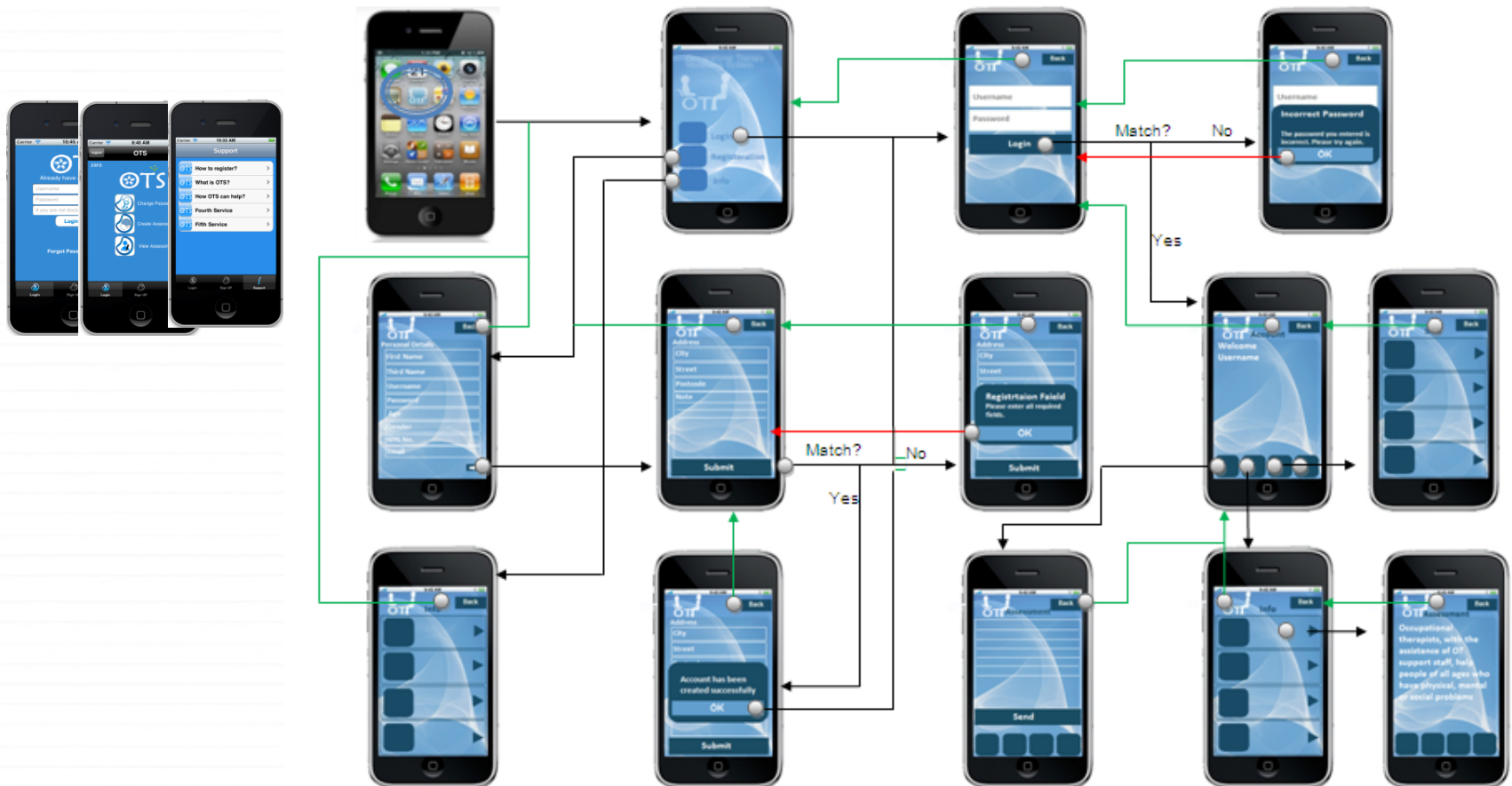
A mobile assessment tool – It is dedicated to the use that makes life easier for instructors in a wide range of subject areas



This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

# More on response technology

## Mobile Occupational Therapy System



**This system is designed to enable a conversation between the professional therapist and his/her patient at anywhere and anytime.**

# Challenges



- ✦ User oriented approach
  - ✦ Simple
  - ✦ Easy to use
  - ✦ Fast
- ✦ Login - > > press ->> go

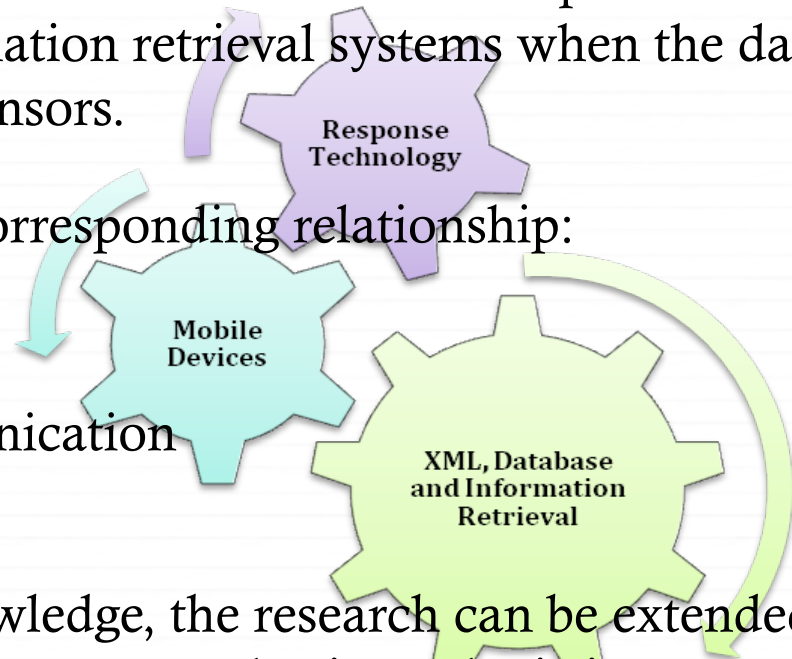




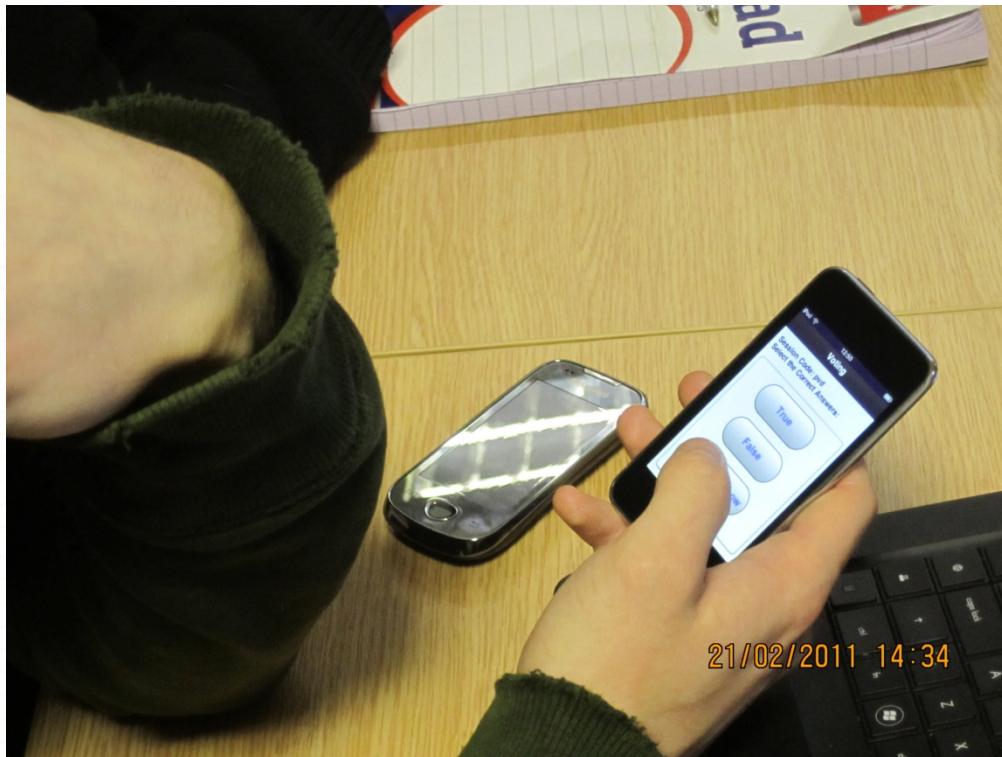
# Conclusion



- ✦ Modern mobile computing cannot be isolated from complex network distributed systems, and information retrieval systems when the data are captured from devices or sensors.
- ✦ THUS, there is an integrated corresponding relationship:
  - ✦ Information retrieval,
  - ✦ Mobile devices for communication
  - ✦ Response technology
- ✦ With the support of above knowledge, the research can be extended into a wide range of application areas e.g. business, logistics, engineering, healthcare, social science, e.g. psychology, behaviour science, etc. and other research interests, e.g. information/knowledge mining, complex distributed systems/cloud computing, Internet of things, etc.



# Thanks.



# References



- ✦ [1] Apple, <http://www.apple.com/education/ipad/teaching-with-ipad/>, accessed 8, November 2013
- ✦ [2] Alevan, V., Myers, E., Easterday, M. and Ogan, A. (2010) 'Toward a Framework for the Analysis and Design of Educational Games', *Digital Game and Intelligent Toy Enhanced Learning (DIGITEL)*, 2010 Third IEEE International Conference on. , pp. 69-76.
- ✦ [2] Apple, <http://www.apple.com/uk/pr/library/2011/10/04Apple-to-Launch-iCloud-on-October-12.html>, accessed 6 November 2013
- ✦ [3] Lu, Zhongyu (2009), XML in Science and Technology, *An Introduction to Contemporary Computing with XML in Science and Technology, Natural Language Engineering & Machine Learning and Self Adaptive Systems Pervasive Computing*. Elliott & Fitzpatrick, Inc., Athens, USA. ISBN 978-0-9798786-3-3
- ✦ [4] Lu, J., Pein, R. P., Hansen, G., Nielsen, K. L., & Stav, J. B. (2010). User centred mobile aided learning system: student response system (SRS). In: *Proceedings of 2010 IEEE 10th International Conference on Computer and Information Technology (CIT 2010)*, June 29 – July 1, Bradford UK

# Meet the team



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The Third International Conference on Advanced Communications and Computation, INFOCOMP 2013, November 17 - 22, 2013 - Lisbon, Portugal.