

Japan – Austria Joint Workshop

## Development and Applications of a Multiple Risk Communicator with its Future Direction



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- Development of Multiple Risk Communicator (MRC)
- Application of MRC to Personal Information Leak Issue in a Local Government
- Future Direction of MRC
  - Social-MRC as a Social Consensus Formation Support System
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#### Various Risks in Corporate Management

**Original Risk** 

Primary Risk

The risk taken positively in order to obtain profits

Secondary Risk

**Information Security Risk** 

Personal Information Leakage Risk

Compliance Risk, Tax Risk etc.

The risk at which reputation gets worse

## Trend

Among them, <u>Information security risk</u> and <u>privacy risk</u> which contains personal information leakage risk become very serious in Japan.

According to the JNSA survey in 2008, personal information of more than seven million people leaked in Japan.



JNSA: Japan Network Security Association

### Security and Privacy



## Multiple Risks (Risk vs. Risk)

- Public key certificate system is main measure to reduce security risk. However it often causes privacy risk, because the user name, address, etc become open.
- Thus, how to deal with one risk versus another risk, or tradeoff of multiple risks, is a major problem.



### The Image to Solve the Conflict



Many Participants for decision making have many preferences.

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## Background and Requirements to Develop MRC

**<u>Requirement 1</u>** Existence of many risks (security risk, privacy risk and so on) = > **Necessity of measure for avoiding conflict** of risks **<u>Requirement 2</u>** Difficulty to achieve the objective with only one measure => **Necessity of searching for optimal** combination of measures **<u>Requirement 3</u>** Existence of many participants (executive officer, customers, employees and so on) => <u>Necessity of risk</u> communication to obtain consensus from many participants



# Requirements and Main Measures in MRC (1)

**<u>Requirement 1</u>** Existence of many risks (security risk, privacy risk and so on) => Necessity of measure for avoiding conflict of risks

<u>Requirement 2</u> Difficulty to achieve the objective with only one measure=> Necessity of searching for optimal combination of measures

<u>Requirement 3</u> Existence of many participants (executive officer, customers, employees and so on) = > Necessity of risk communication to obtain consensus from many participants



Formulated as Combinatorial Optimization Problem



# Requirements and Main Measures in MRC (2)

Requirement 1 Existence of many risks (security risk, privacy risk and so on) = > Necessity of measure for avoiding conflict of risks

Requirement 2 Difficulty to achieve the objective with only one measure => Necessity of searching for optimal combination of measures Requirement 3 Existence of many participants (executive officer, customers, employees and so on) => Necessity of risk communication to obtain consensus from many participants

<MRC> The display easy to understand the optimal solution for participants, and easy to obtain the consensus

## Overview of MRC



## Development of MRC Program

(1) The MRC program was implemented using Java and PHP in a Windows XP environment.

(2) The total number of coding steps was about 10,000.

(3) Apache 2.24 was used for the Web server, MySQL 5.0 for the Database server, and Xoops 2.0.16 for the communication server.

(4) In addition, Mathematica 5.2 was used to deal with the numerical formula in the PC for the specialist.

Ryoichi Sasaki, et al." Development and applications of a multiple risk communicator "Sixth International Conference on RISK ANALYSIS 2008 (in Greece)

## How to Use MRC (1)



Decide the objective function and constraint functions

#### **Objective function** :

Min (Total risk of information leakage+Total cost of measures)

## **Constraint functions is used to represent the risks for each Stakeholder:**

- (a) Probability of leakage (for the year) for Customers
- (b) Cost of measures for Manager
- (c) Degree of worker's privacy burden for Employees
- (d) Degree of worker's convenience burden

for Employees











## Display Image of MRC for Specialists



## How to Use MRC (2)



## How to Use MRC (3)



#### **Display Image of MRC for Decision Participants**



Constraints and the values

#### Display Image of MRC for Decision Participants



1.Using these displays, participants can understand the status of the proposed optimal solution.

2. In addition, MRC has the function for the participants to search for the background from which such solution was lead.

## How to Use MRC (4)



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Decide the objective function and constraint functions

**Objective function :** 

Min (Total risk of information leakage+Total cost of measures)

**Constraint functions** :

- (a) Probability of leakage (for the year) for Students
- (b) Cost of measures for Manager
- (c) Degree of worker's privacy burden for Teachers
- (d) Degree of worker's convenience burden

for Teachers



Decide the objective function and constraint functions

**Objective function** :

Min (Total risk of information leakage+Total cost of measures)

#### **Constraint functions :**

- (a) Probability of leakage (for the year) for Students
- (b) Cost of measures for Manager
- (c) Degree of worker's privacy burden for Teachers
- (d) Degree of worker's convenience burden

for Teachers

Privacy risk not only for students but for teachers is considered in this formulation.

## Result of Actual Application (1)

(1) In this case, the number of alternative measures was 13.

(2) Every optimal solution was obtained within one minute.

(3) Consensus of the participants for decision-making was obtained after three times meetings.

(4) The number of total times that the optimal solution was shown to participants for decision making was12 times.



## Result of Actual Application (2)

(5) The adopted optimal solution consists of three measures such as encryption of the data in USB memory.



(6) The Setagaya-ku government office is preparing to implement the measures included in the adopted optimal solution for all junior high schools in Setagaya-ku. <sup>35</sup>

## Application Results of MRC



D Personal information leakage problems,

Internal control problems

Illegal copying problems

Best paper award was given to the paper related with MRC from Japan Security Management Society in 2009.
## **Results and Future Direction**

In cases in which the number of people necessary for consensus formation is low, such as forming a consensus within an organization, the MRC offers a possible solution to this problem.

However, the MRC cannot be applied to problems of social consensus formation among several thousand or more stakeholders, and an innovative solution is necessary.



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# Objective to Develop Social -MRC

For applying to problems of social consensus formation among several thousand or more stakeholders, we developed the concept of <u>Social - MRC</u> in 2009.

Problems to be solved with Social - MRC are Information filtering to protect children, introduction of a citizen identification system, installation of surveillance cameras

### **Overview of Social-MRC**



Use scenes

Web-based public hearings, consensus meetings, government program reviews, television discussion programs

### **Overview of Social-MRC**



Use scenes

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### **Overview of Social-MRC**



Use scenes

Web-based public hearings, consensus meetings, government program reviews, television discussion programs

#### Social-MRC system configuration



#### Social-MRC system configuration



### Example of Broadcast with USTREAM

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Ustream: video sharing service for the live broadcast of conferences

### Social-MRC system configuration



## **Application Phases of Social-MRC**



## **Application Phases of Social-MRC**



(1) Arrangements Phase before the Start of Broadcasting

- (1) The sponsor decides in advance the problem to be solved and the opinion leaders.
- (2) The specialist formulates the problem to be solved as a combined optimization problem, inputs the parameter and constraint values into MRC-Studio, and seeks an optimal combination of measures as an initial solution.
- (3) The specialist shows the results to the opinion leaders, and make them add proposed measures, change parameter values, changes constraint values, and uses MRC-Studio to calculate the optimal combination of the proposed measures for each opinion leader .

#### Example of optimization results for each opinion leader



## **Application Phases of Social-MRC**



# (2) Phase of Selecting Preferable Opinion Leader

(1) Each opinion leader expresses his or her preferred combination of proposed measures obtained by using MRC-Studio in an advance deliberation along with basic stance, evaluation indexes that should be emphasized etc.

(2) This process is shown to the ordinary stakeholders through MRC-Plaza using images captured by video cameras and the MRC-Studio output screen. The ordinary stakeholders select their preferred opinions.



### Display of MRC-Plaza Phase of Selecting Preferable Opinion Leader



## **Application Phases of Social-MRC**



# ③ Phase of Forming Consensus among Opinion Leaders (1)

(1) Since the results are made known to the facilitator via MRC-Plaza, subsequent discussion progresses on the basis of optimal solution of the selected opinion leaders.

Optimal Solution Proposed by Selected Opinion Leader



# ③ Phase of Forming Consensus among Opinion Leaders (2)

(2) Each opinion leader points out problems with the combinations of proposed measures in question or makes observations, such as differences in the values of coefficients and constraints.

Optimal Solution Proposed by Selected Opinion Leader



# ③ Phase of Forming Consensus among Opinion Leaders (3)

(3) In response to these opinions, the MRC specialist uses the MRC-Studio to calculate the optimal combination of proposed measures and displays the results on the display screen.





# ③ Phase of Forming Consensus among Opinion Leaders (4)

(4) This process is made known to the ordinary stakeholders using Ustream. The ordinary stakeholders input their own opinions using Twitter.



(5) MRC-Plaza (semi-)automatically analyzes the important opinions, and conveys the results to the facilitator and opinion leaders.

## **Application Phases of Social-MRC**



### (4) Phase of Voting to Provisional Agreement Alternatives



## **Application Phases of Social-MRC**



# (5) Arrangements Phase after Broadcasting

- (1) The results of the consensus formation are linked to specific measures.
- (2) The specialist or facilitator analyzes the Social-MRC application process and organizes the expertise for use in a future application.
- (3) In cases in which a deadline is reached without a consensus having been formed, the sponsor plans the next conference.



# **Small Scale Trial Application**

Prototype program of Social-MRC was applied to small scale trial issue.

(1) Applied Social-MRCMRC-Studio: Conventional MRCMRC-Plaza: Developed Prototype Program



(2) Applied Issue

Information Filtering to Protect Children

In Japan, the law for Information Filtering to Protect Children was established in 2008, and it is to be made a review three years later.

### **Opposition point**



# Players in Trial Application(1)

Two Opinion Leaders :

First Person

Role Player of a Chair of PTA from Regulation agreeable group (Student of Master Course)

Second Person Role Player of Free Journalist from Regulation opposition group (Professor)





# Players in Trial Application(2)

Ordinary Stakeholders (7persons) :

Professors and Students engaged in the research of Security

(Watching Discussion of Opinion Leaders with Ustream, Writing opinions with Twitter, Selecting preferable opinion leaders)







### Staff for Trial Application

Facilitator (1 person) : Student of Master Course (Support of consensus formation)

Director (1person) : Student of Master Course (Operation of MRC-Plaza)

Video Cameraman (1 person) : Student of Bachelor Course (Photography of the meeting)

Specialist of MRC(1 person) : Student of Bachelor Course (Operation of MRC-Studio)



## **Objective function**

Min {Risk for children(Yen)+Total cost for implement measures (Yen)}

Risk for children=

The probability that the damage occurs to a child by harmful information of the Internet X Size of the damage at the time of the occurrence



# Stakeholders and Constraints

(1) (For Children and Parents) The expected number of children to be damaged

(2) The convenience burden degree(For Parents ) Trouble of the judgment whether or not they hang filtering to the mobile telephone of the child

(For WEB site operator) Trouble to take the young people cannot watch harmful information measures



# Result of Small Trial Application (1)

It was not results against our expectation.

- (a) The ordinary stakeholders were able to watch the discussion of opinion Leaders and the output of MRC-Studio.
- (b) They were able to send their opinions to facilitator with Twitter and to select the answer of questions.
- (c) It was possible to obtain the consensus among two opinion leaders and many stakeholders.



However,

# Result of Small Trial Application (2)



Ryoichi Sasaki, et al.," Proposal for a Social-MRC Social Consensus Formation Support System Concerning IT Risk Countermeasures" IMS2010 (to be held in Korea in Nov. 2010)

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## Conclusion (1)



- (1) We developed Multiple Risk Communicator MRC, and applied it to personal information leakage problems, illegal copying problems etc.
- (2) Judging from these application results, we can say that MRC is useful for obtaining consensus in cases in which the number of people necessary for consensus formation is low, such as forming a consensus within an organization.
- (3) However, it was impossible to apply to the problem of which number of stakeholders is more than several thousands such as social consensus formation.

## Conclusion(2)



- (4) We proposed the Social MRC for supporting the social consensus formation.
- (5) The primitive prototype program of Social MRC was developed and applied the information filtering issue to protect children.
- (6) We will perform the experiments under more than several thousands stakeholders after improving the Social MRC program.

## Thank you for your attention

## Any questions ?

