



## - Early Warning Systems -

### Example of Tsunami Alarm System by SMS

Prof. Dr. Eduard Heindl

International Workshop on Tsunami Modelling  
Ispra, 5-6 October 2006

**A3M**

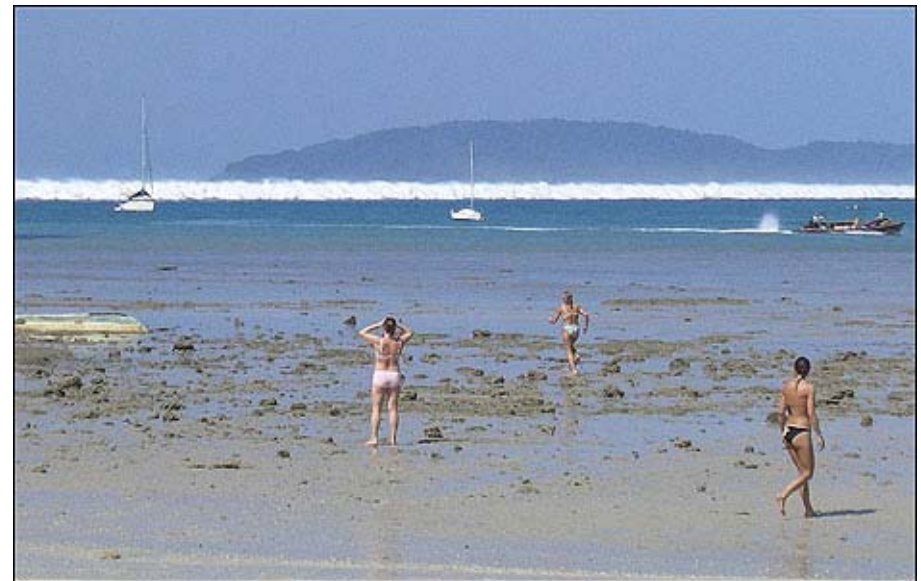
**3 M FUTURE**

**Heindl  
internet**



## Why Warning?

- Chance for rescue at the seaside
- Regular reminders about a forgotten risk
- Pre-warning in connection with other events signals that immediate escape is necessary
- e.g. with
  - slight increase in sea level
  - recession of the sea
  - spray at the horizon





## Technology AND Psychology



If a tsunami struck again next year, the technology would be ready, but the people might not be.

"I have no doubt that the technical element of the warning system will work very well," said Professor Bill McGuire, of the Benfield Hazard Research Centre, London, UK.

"But there has to be an effective and efficient communications cascade from the warning centre to the fisherman on the beach and his family and the bar owners."

BBC News - 25 March 2005

<http://news.bbc.co.uk/2/hi/science/nature/4373333.stm>



## Warning is Difficult

- Short time between seismic event and tsunami disaster
- Global scale of risk, over 200.000 km coastline
- Very different quality of infrastructure
- Very infrequent events in one region
- People forget what a tsunami is
- Many different languages at one beach, tourists!
- False alarm may decay awareness
- Meaningful alarm message necessary
- Dealarm required





## Speed

Why can you warn of Tsunamis,  
but not of earth quakes?

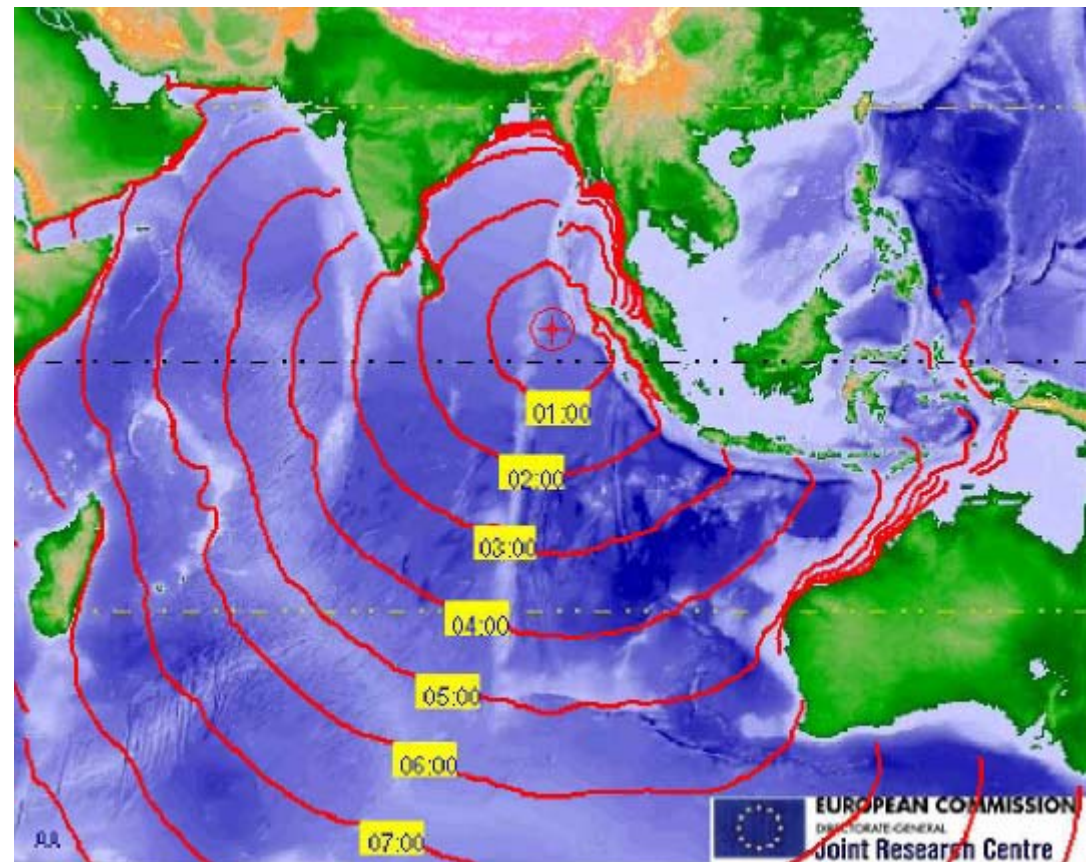
Speed comparison

- Light: 300.000 km/s
- Earthquake waves: 13.000 km/h
- Tsunami (Ocean): 800 km/h

Within ten minutes travels

- Light 5000 around the earth
- An earthquake 2200 km far
- A Tsunami 130 km far

Enough time to warn the people





## Well known attempts

- Sirene
- Loudspeaker
- Board
- Sign
- Radio
  - Longwave
  - Shortwave
- Television
- Signal rockets
- Police cars + speaker
- Misc...

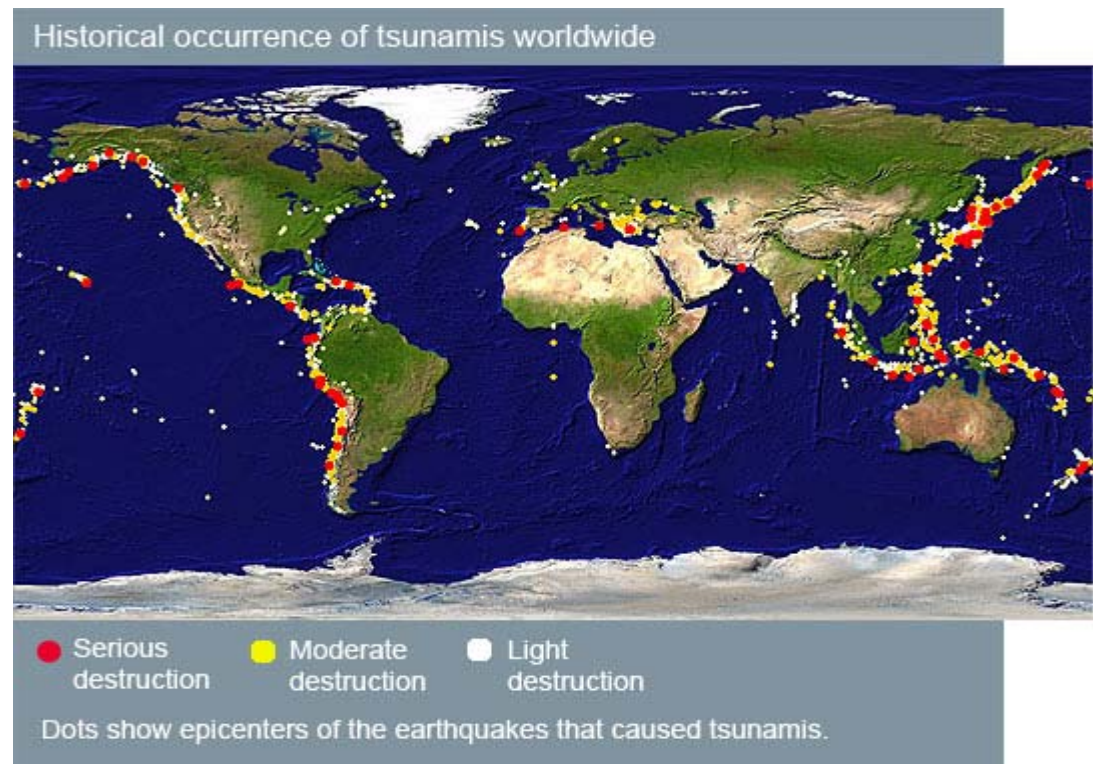


## Global Scale

A tsunami could arrive just anywhere in the world. Some regions may have more frequent events, only a few are quite safe.

**Remember Lissabon 1755!**

Alarm systems should be available in any endangered area!







## Infrastructure

Different countries have  
different quality of  
infrastructure

Unused infrastructure  
decays!





## Language

Beach areas are quite often  
populated with tourists

Rare radio and sign messages  
are not understood



## Meaningful Message

**Sirenenprobe: 15 Sekunden.  
Erfolgt jeden Samstag.**

**Feuerwehr-Einsatz: 3 x 12 Sekunden.  
Einsatz der Feuerwehr, bei Brand oder technischen Einsätzen!  
Kann im Bedarfsfalle wiederholt werden.**

**Warnung: 3 Minuten gleichbleibender Dauerton.  
Achtung, bedeutet herannahende Gefahr!  
Radio oder Fernseher einschalten, Verhaltensmaßnahmen beachten.**

**Alarm: 1 Minute regelmäßiger auf- und absteigender Heulton!  
Bedeutet akute Gefahr!  
Schützende Räumlichkeiten aufsuchen, Radio oder Fernsehen  
einschalten  
und Verhaltensmaßnahmen befolgen.**

**Alarm: Unterbrochener, regelmäßig auf- und absteigender Ton!  
Strahlenalarm Kernkraftwerk!  
Keller/Schutzraum aufsuchen und Verhaltensmaßnahmen befolgen.**

**Alarm: Ein tiefer unterbrochener Ton!  
Wasseralarm in besonderen Gebieten z.B. Nahzonen von Talsperren!  
Radio oder Fernseher einschalten, Verhaltensmaßnahmen beachten  
und gegebenenfalls gefährdetes Gebiet unmittelbar verlassen.**

**Entwarnung: 1 Minute gleichbleibender Dauerton.  
Bedeutet das Ende der Gefahr!  
Weitere Hinweise über Radio und Fernsehen beachten.**



Did you know:

a low, broken sound is  
the alert for a flood



## The Matrix

	Time	Global	Language	Attention	De-Alarm	Longterm reliable
Sirene	✓	✗	✓	✓	✗	✗
Loudspeaker	✓	✗	✗	✓	✓	✗
Sign	✗	✗	✓	✗	✗	✗
Radio, TV	✓	✓	✗	✗	✓	✓
Signal rockets	✗	✗	✗	✓	✗	✗
Police car	✗	✗	✗	✓	✓	✓
SMS	✓	✓	✓	✓	✓	✓



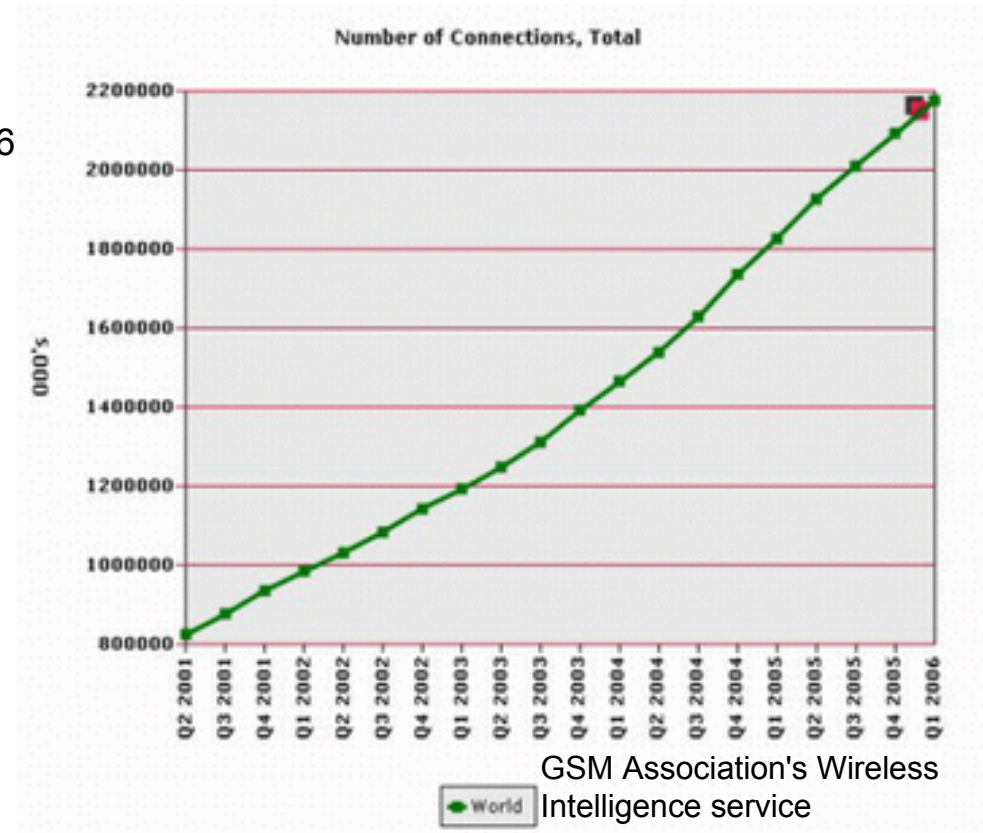
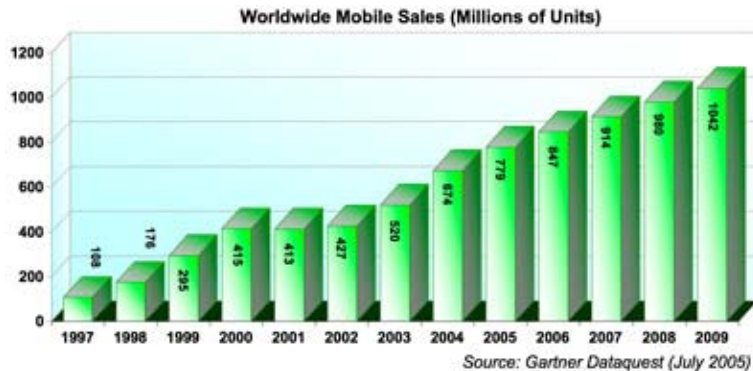
## Growth of mobile user

Today: 2,400,000,000 subscribers Q2-2006

2010 : half of the world population

„fastest growing segment of telecommunications“

Ronald Beaubruna and Samuel Pierre, Telematics and Informatics, Volume 18, Issues 2-3





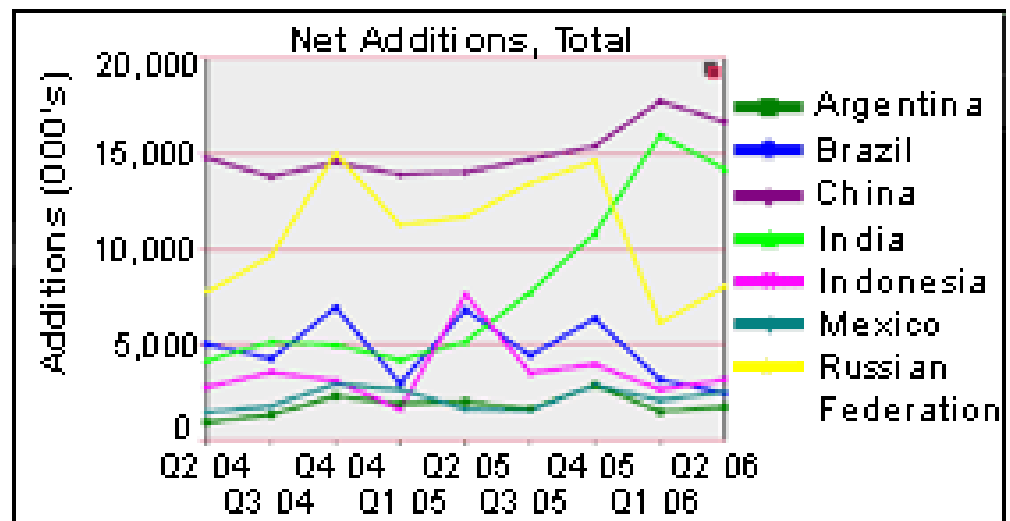


## Growth in all countries

The industrialized world is saturated with mobile phones

The growth happens in the new markets

Source: Wireless Intelligence



GSM Association's Wireless Intelligence service



## The Product

The Tsunami Alarm System sends life-saving alarms timeously to your mobile phone, anywhere and for everybody.

It protects the lives and health of its users and of their family and children.





## Easy to use

Tsunami Alarm System will be activated by registering a mobile phone number at the web site [www.tsunami-alarm-system.com](http://www.tsunami-alarm-system.com)

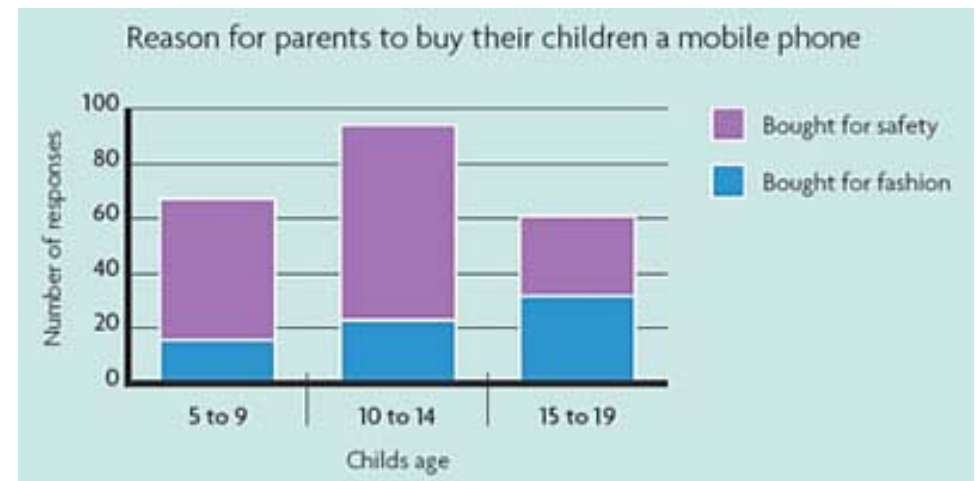
After registration it is immediately ready for action.

Nothing has to be downloaded or installed.



## Reason for mobile phone use

- The mobile phone is always on
- SMS message can be meaningful
- Low bandwidth demand
- Parents buy mobile phones for children safety
- Mobile phones evolve to safety equipment
- Tsunami alarm system is a first step



© Ganesh Technologies 2005





## Architecture of the System

Separation of the Tsunami web site from the alarm system  
Security from disturbances and hacker attacks





## Causes of Tsunamis

- **Earth quakes** are the main cause
- **Landslides and submarine landslides** mostly together with earthquakes
- Volcano eruptions often predictable (Caldera collapse)
- Meteorites (<100m) do not cause big Tsunamis\*
- Nuclear explosions on sea do not cause Tsunamis\*

\*H. Jay Melosh, University of Calif., Worried About Asteroid-Ocean Impacts? Don't Sweat the Small Stuff, 2003



## Well known issues with SMS warning

- Content of the message
- Language of the message
- Global roaming
- Bulk messages
- Location based service
- Mobile in quiet mode



## Research and Solution: Content and Language

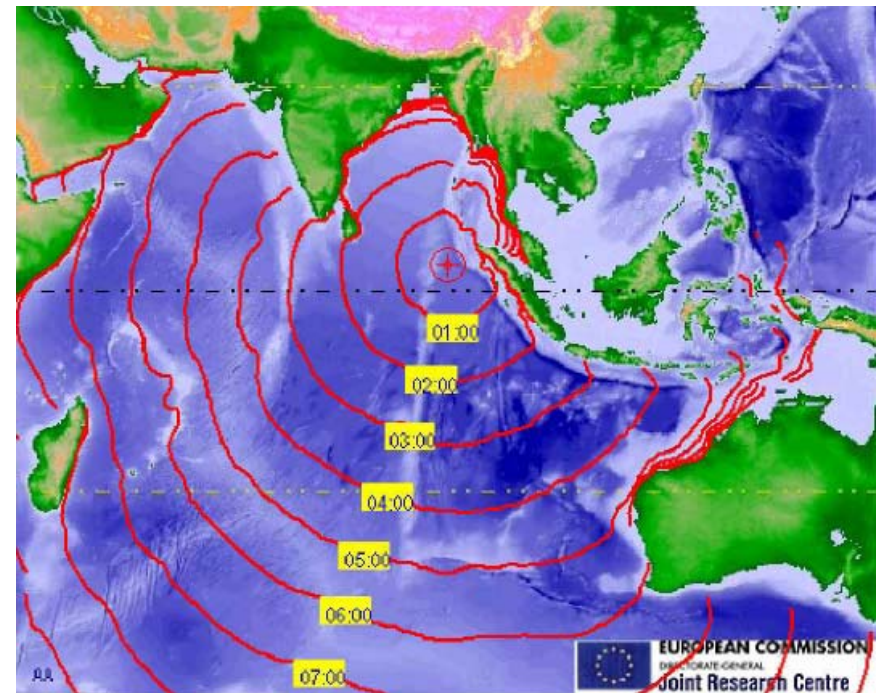
- Text should be tested with different users
- Alert level should be communicated
- Dewarning within calculated time
- Data of user for language decision





## Research and Solution: Global roaming

- User give feedback to welcome SMS
- Multiple SMS gateway servers
- Other protocols (UMTS)
- Bulk message using special protocol slots
- Deliver message only to affected area
- Deliver just in time where necessary





## Research and Solution: Location based service

- Distribution in affected areas
- Location of mobile by E911 or GPS
- Message content with local information
- Smart mobile software



## Research and Solution: Mobile in quiet mode

- Java within mobile can overrun quiet mode
- SMS with different sound than a call
- Alarm message with sound info



## Private Tsunami Warning?

- Private warning is well known in other areas, eg agriculture
- Direct market contact introduces new ideas
- Product quality evolves much faster in private sector, eg telephone
- Users are better aware about the warning message
- Less panic

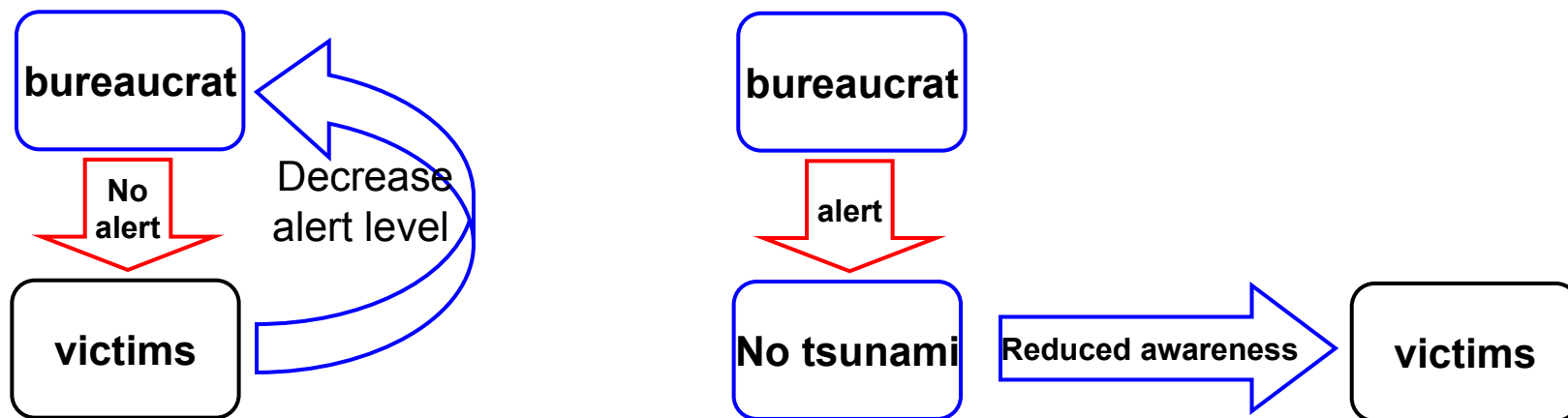




## Public warning systems

Public warning systems

Struggle between false positive alarm and no warning

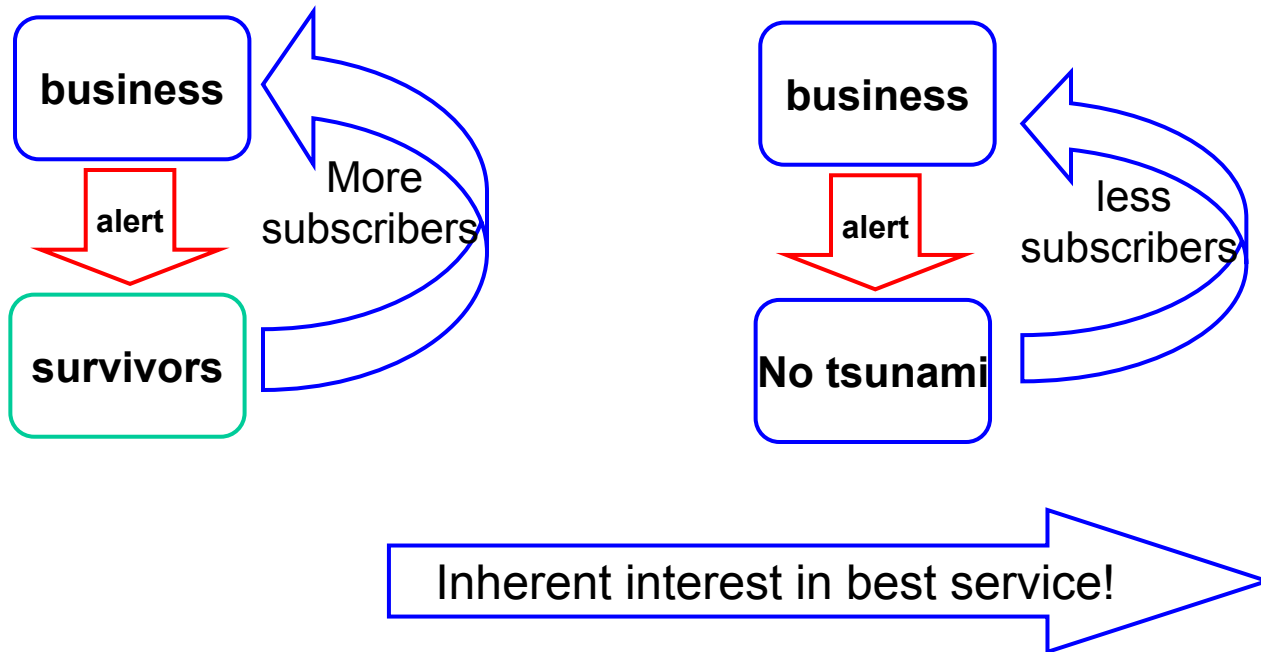




## Private warning systems

Private warning systems

Increase quality for commercial revenue





Thank you for your interest!

Questions?