



Mt. Hakusan (2,702m) : Courtesy of [Mato](#)

# SAP HANA for earthquake disaster mitigation

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July 11, 2017

Customer



# SAP Japan -Transforming society with IoT

## SAP-TV

VIDEO – see link below!

Source: <https://www.youtube.com/watch?v=DuRpKojmY40&t=1m04s>

Please raise your hand –  
if you have **NEVER** experienced  
any **EARTHQUAKE?**

Have (or will) you ever been to ...



Alaska

California



Chile



Italy



Turkey



Nepal



India



China



Taiwan



Indonesia



Japan



Philippines



New Zealand

# Smatra, Indonesia 2004 (280,000 died)



Tangshan, China 1976 (**242,769** died)



Tokyo, Japan 1923 (**142,800** died)



Sichuan, China 2008 (87,587 died)





However,

earthquake itself does not kill people.

**Collapsed buildings**, fire or Tsunami do.



**Building & Social Resilience** are  
huge **social issue / business opportunities**.

**SAP myShindo** (my personal seismometer) project  
as a part of **1BL** (One Billion Lives) CSR initiative by SAP APJ

**1BL**  
**ONE BILLION LIVES**

An SAP Asia-Pacific, Japan Initiative

“Help One Billion Lives  
around the world by 2020”



# myShindo project

1. myShindo app installed on iPhone/iPad/iPod-Touch record the shake at minor earthquake



House / Office / Plant

2. the data will be stored to the myShindo server on SAP HANA on SAP Cloud Platform



3. The seismic intensity of each building/house will be shown on map



4. Various stakeholders can use the detailed shake data (with cooperation with us)



Researchers/Experts



Government / Utilities



First responders



Insurance/Morgage



Construction/Real Estates



Event organizers



School/Narsery

**about HAKUSAN**  
**the earthquake experts**



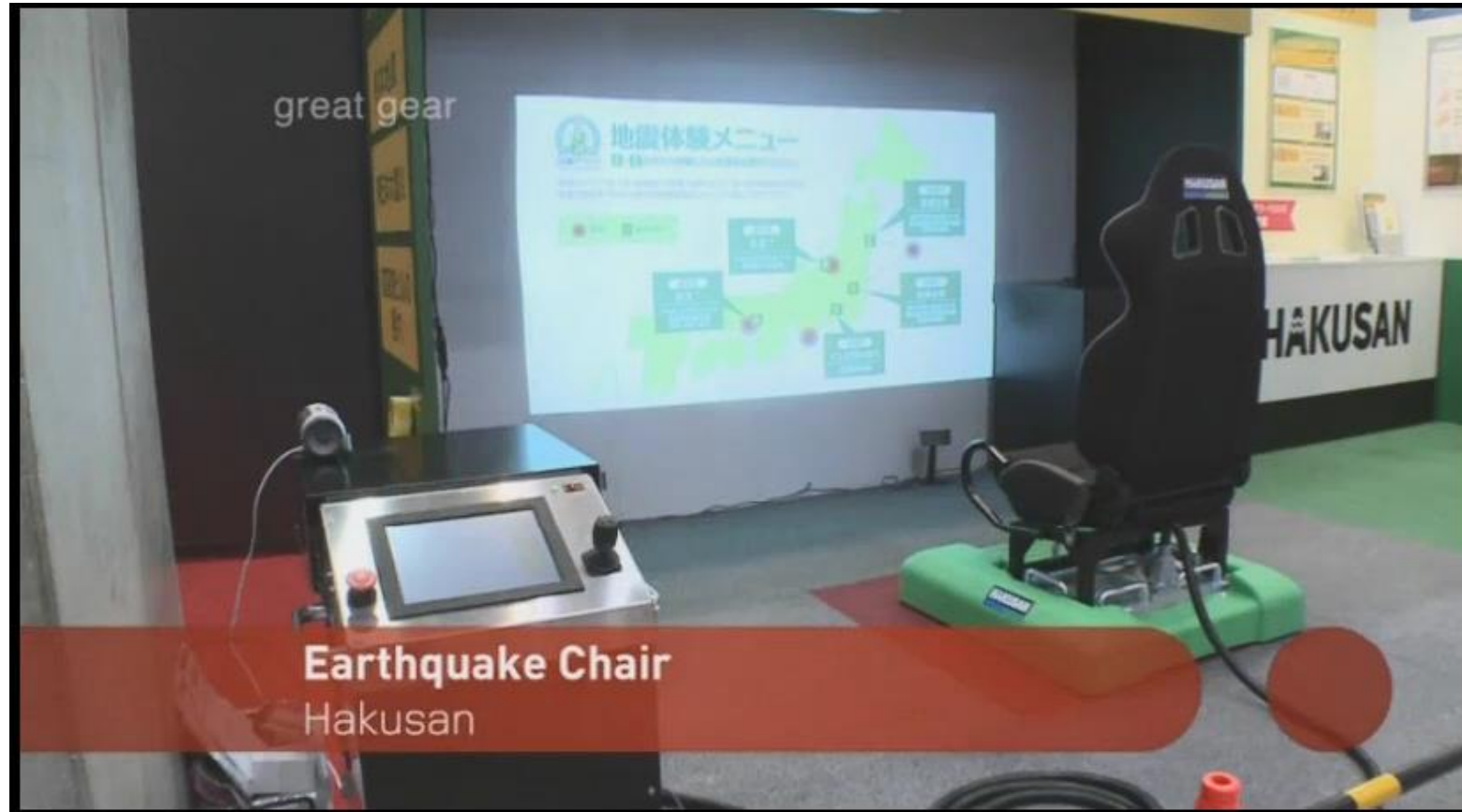
# Hakusan Corporation – Overview

- Small manufacturer in Tokyo, Japan, with 80 people
  - Established in 1958, incorporated in 1986
  - Owner & CEO: Minoru YOSHIDA
- Develop & Manufacture:
  - Seismic observation network systems and earthquake disaster prevention systems
  - Precision slitters & peripherals
- Vision:
  - Creating innovative, unique products which nobody has ever come up with
- Mission:
  - Promoting disaster prevention and social resilience



# Earthquake Chair

- Let you experience the real earthquake with synchronized screen
- To promote awareness to disaster prevention





- MSc in glaciology from Nagoya University in 1977
- Run own consulting/software company
- 10+ research expeditions to Nepal, Greenland and Antarctica, including two Japanese Antarctic Research Expeditions (16 months each on Antarctica)
- In 2007 drilled to more than 3,000 meters deep and extracted the ice core spanning 720,000 years
- Visiting professor to several universities
- Joined Hakusan in 2009 and led the software development of the networked seismic monitoring systems

# Earthquake Monitoring System in Japan the third generation network

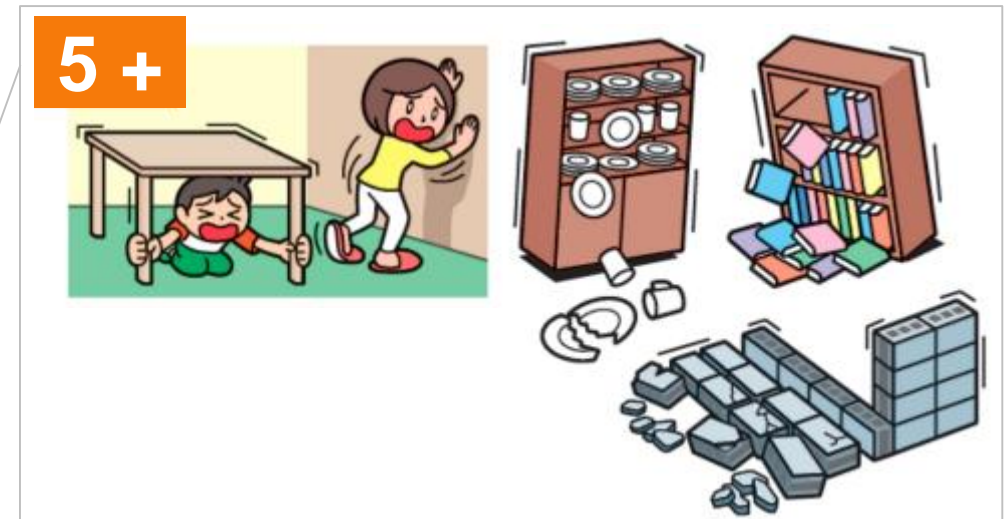




# Seismic Intensity Scales

Modified Mercalli Intensity scale	JMA* Intensity scale
I. Not felt	0
II. Weak	1
III. Weak	2
IV. Light	3
V. Moderate	4
VI. Strong	5-
VII. Very strong	5+
VIII. Severe	6-
IX. Violent	6+
X. Extreme	7
XI. Extreme	
XII. Extreme	

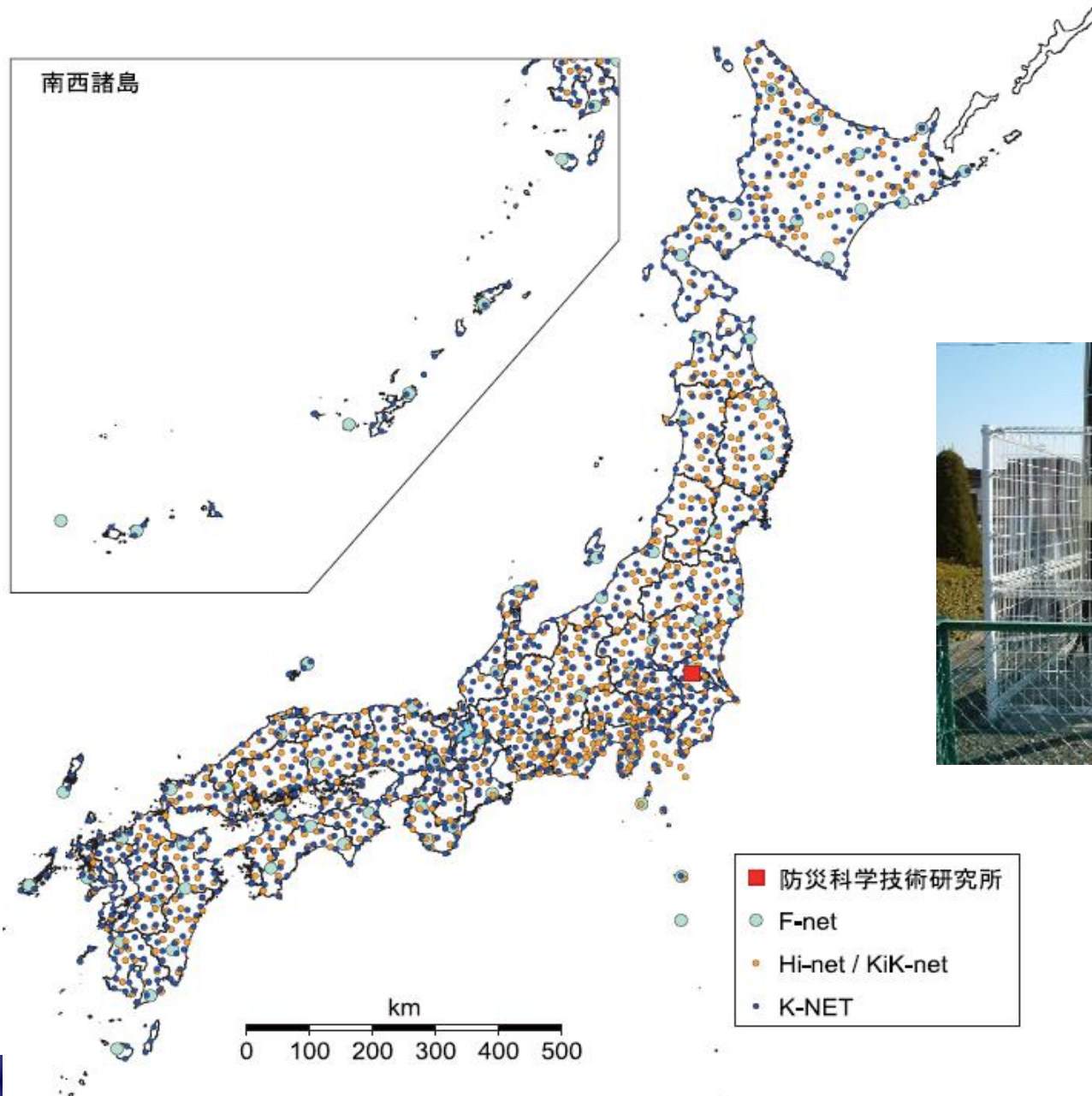
Rough comparison - not exact match  
 \* JMA: Japan Meteorological Agency



Source: <http://www.jma.go.jp/jma/kishou/known/shindo/>

# Japan's Earthquake Observation Network

K-NET: **1,000** stations  
KiK-NET: **700** stations







地震波の伝播（東北地方太平洋沖地震）

Seismic Wave Propagation of  
East-Japan Earthquake

HAKUSAN

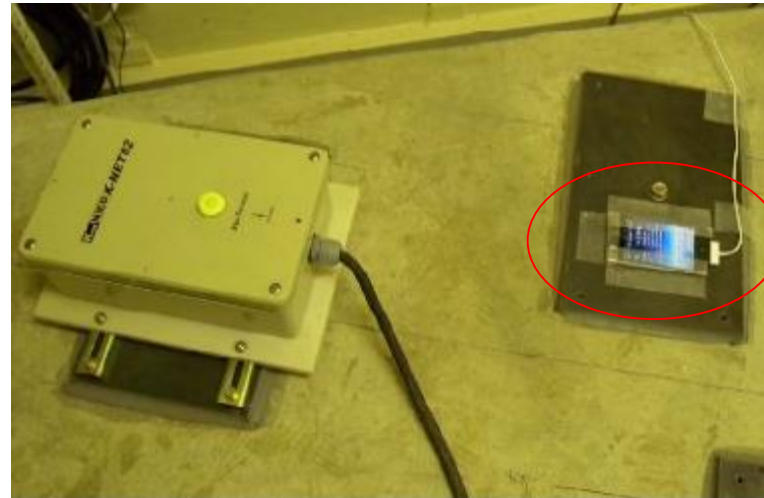
# Measuring Each Building prototype for the fourth generation network



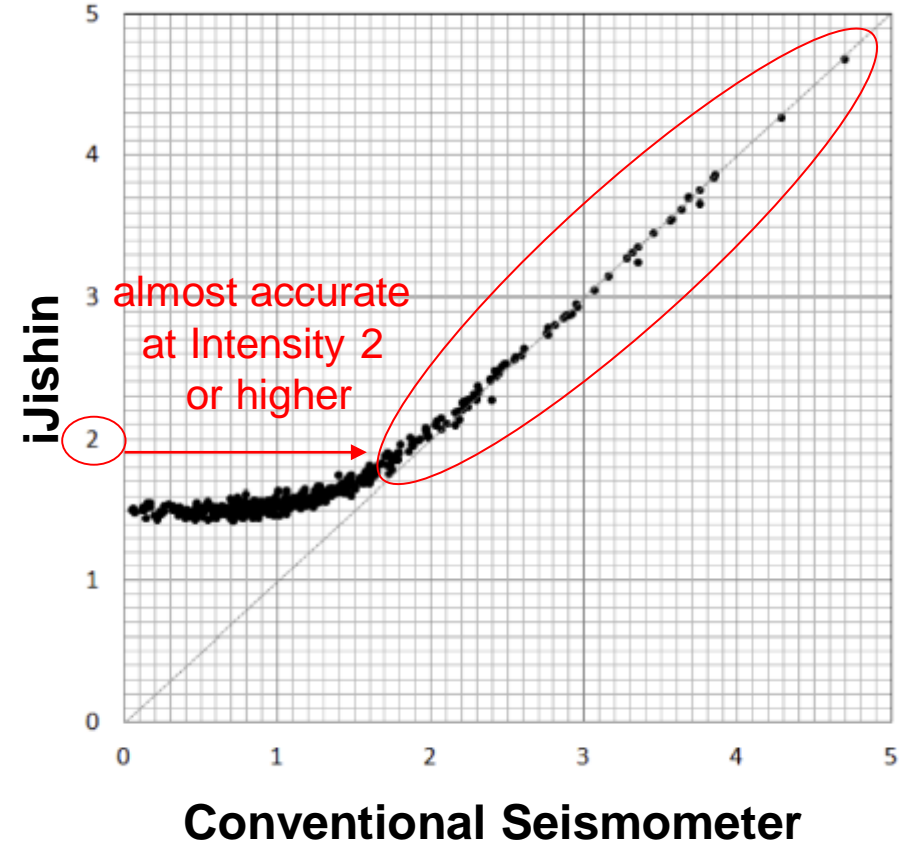
## iJishin (iOS app)



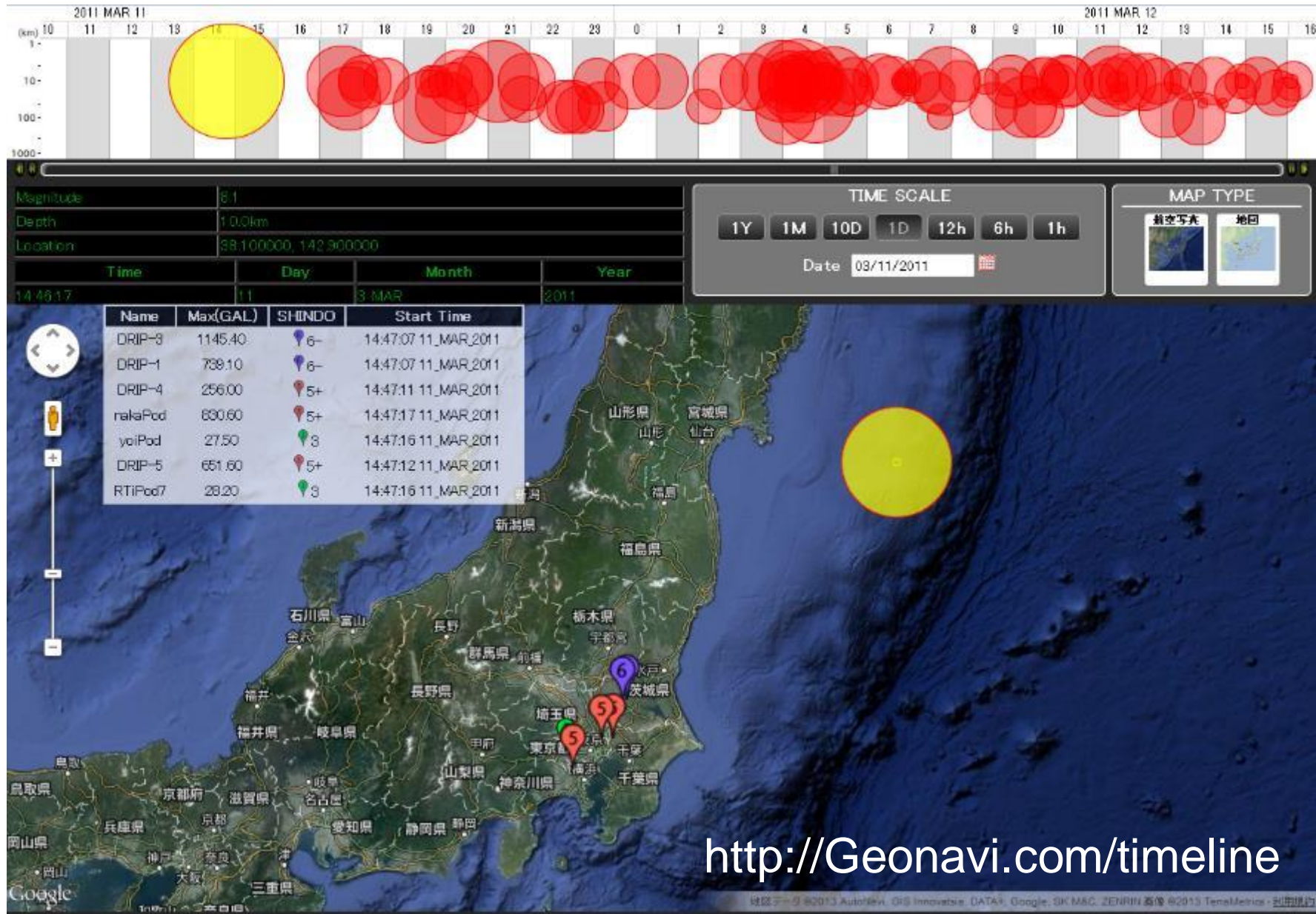
## Sensitivity test with conventional seismometer on shake simulator



## Test Result



# Geonavi – the center server to accumulate the data from iJishin



# iJishin data of a house – XYZ dimensions

**Freekick**  
Web Browser

計測データ (Observed Data)    FFTスペクトル (Power Spectrum)    速度・変位 (Velocity/Displacement)    オービット (Orbit)    計測震度 (Shindo)

表示データ情報

データ日時  
2011/03/11 14:46:38.00  
- 2011/03/11 14:51:37.99

DRIP-3(iPod4\_1)-X

CSVファイル読み込み:  
 参照...  
グラフ表示

加速度 NS [gal]  
523.0  
393.0  
263.0  
133.0  
3.0  
-127.0  
-257.0  
-387.0  
-517.0  
14:47:17.00 14:47:58.25 14:48:39.09 14:49:19.94 14:50:00.78 14:50:41.624:47:16.3

加速度 EW [gal]  
1157.0  
904.0  
651.0  
398.0  
145.0  
-108.0  
-361.0  
-614.0  
-867.0  
14:47:17.00 14:47:58.25 14:48:39.09 14:49:19.94 14:50:00.78 14:50:41.624:47:16.3

加速度 UD [gal]  
514.9  
400.9  
286.9  
172.9  
58.9  
-55.1  
-169.1  
-283.1  
-397.1  
14:47:17.00 14:47:58.25 14:48:39.09 14:49:19.94 14:50:00.78 14:50:41.624:47:16.3

オフセット[s]    39  
データ長[s]    212.39

<http://Geonavi.com/timeline>

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# Response of buildings at East-Japan earthquake (2011/3/11)

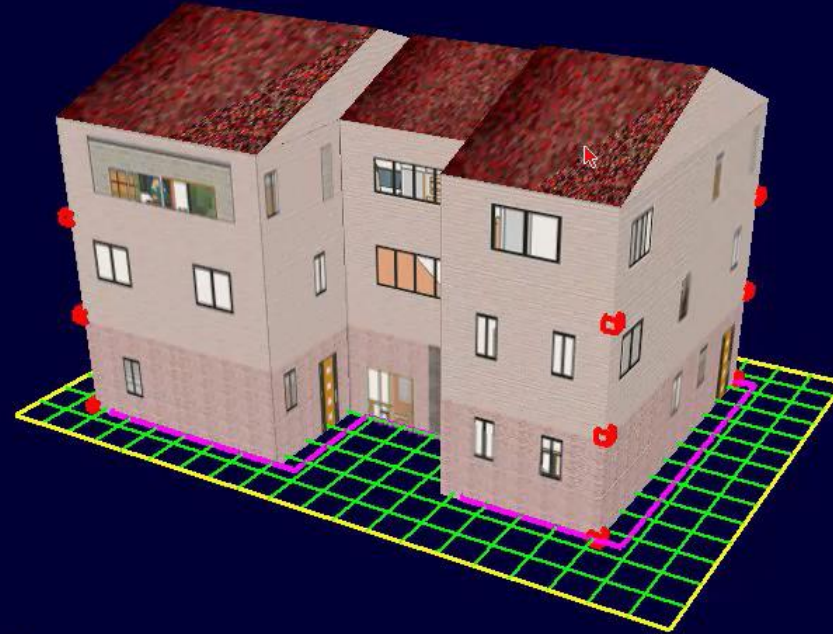
The image displays the performance of various buildings during the 2011 East-Japan earthquake. A central map shows the affected region with blue lines indicating the locations of the buildings shown in the surrounding photographs. The buildings are annotated with performance ratings:

- Top-left: 3-story building, rating 5 (pink circle), with a '+' symbol below it.
- Top-middle: 2-story building, rating 6- (red circle).
- Top-right: Small utility building, rating 6- (red circle).
- Left-middle: 3-story building, rating 5- (yellow circle), 4 (yellow circle), and 4 (yellow circle), enclosed in a red border.
- Bottom-left: Tall modern building, rating 6- (red circle), 5 (pink circle), and 4 (yellow circle), with a '+' symbol below the 5.
- Bottom-middle: 2-story building, rating 5 (pink circle), with a '+' symbol below it.
- Bottom-right: 4-story apartment building, rating 5 (pink circle), with a '+' symbol below it.
- Right-middle: Tall apartment building, rating 6- (red circle).

# 東日本大震災 2011.03.11eq

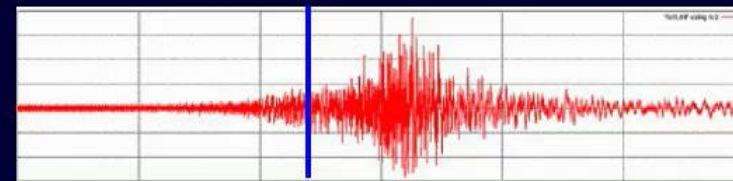
120.00 sec

地動スケール 1.0倍  
 家屋層間変位倍率 1.0倍  
 長周期側カット 5.0秒



Mesh is  
10 cm x 10 cm

	26.67	25.14	16.41										
	22.09	22.52	16.33										
	19.07	20.12	15.09										
3F_WS	25.00	32.77	21.06	0.047	0.038	0.013	0.025	0.103	0.046	0.040	0.029	0.036	0.151
2F_WS	19.58	25.62	20.31	0.047	0.039	0.004	0.015	0.199	0.048	0.010	0.020	0.069	0.213
1F_WS	18.11	20.40	17.52	0.022	0.024	0.018	0.024	0.241	0.038	0.037	0.038	0.030	0.334
	38.12	33.70	18.38										
	28.44	25.87	16.39										
	23.59	21.69	15.71										
	35.81	25.05	18.03										
	32.29	22.17	17.46										
	22.58	17.98	15.01										



DATAMARK

# **Social Implementation** **the most difficult challenge**

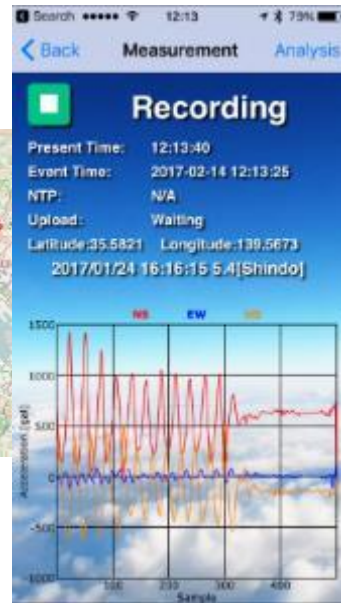
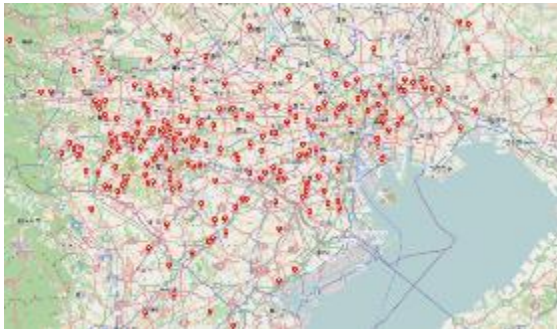


- Buildings are private property
  - need to ask to the owner one by one
- Curiosity doesn't last
  - no earthquake (2+) may occur for 3, 6, 12 months...
- Economic reason is necessary
  - academic research was not good enough
- However, we are small company
  - impossible to make a huge investment
  
- and 5 years have gone ...

# Then, SAP came to Hakusan on March 2016...

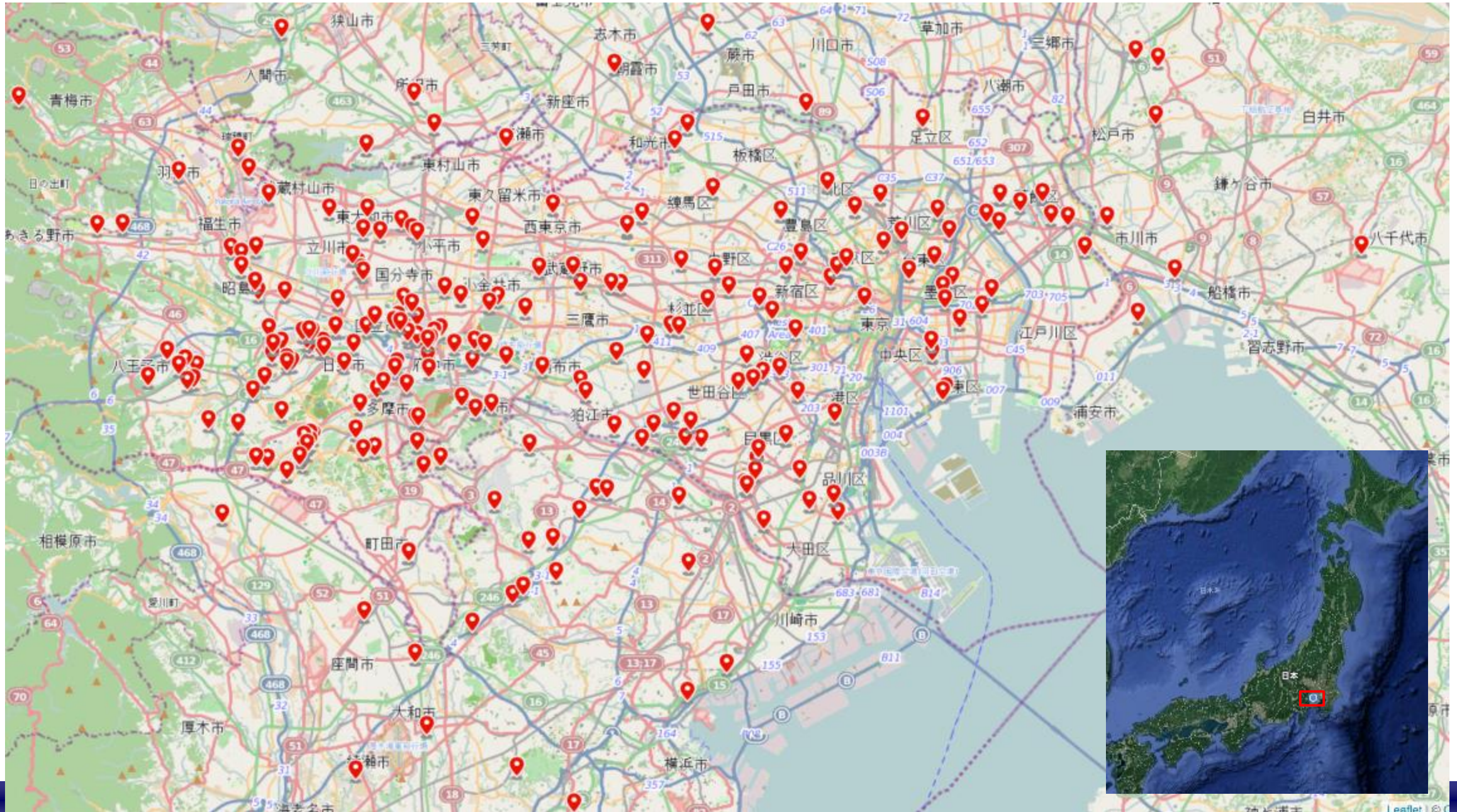


To accelerate the social implementation  
and improve peoples lives!



SAP HANA on  
SAP Cloud Platform

# 300 iPod-Touch + iJishin installed pilot project funded by Tokyo municipal government



# House Seismic Health Analysis

## 地震あんしんカルテ

我が家に設置した地震計からデータを収集・解析し、地震が発生した後の建物の健全性を評価します。

### 2016/Nov/22 5:59am Magnitude 7.4

【地震発生時刻】2016年11月22日 5時59分頃 【震源地】福島県沖 【マグニチュード】7.4 (深さ25km)

観測地点 **Concrete Apartment: 22F/26F**

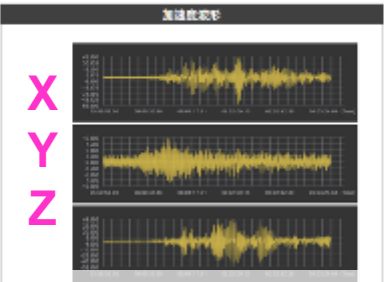
建物健全性評価: **健全** 震度: **5弱** 計測震度: **4.5**

### Evaluation: Good Intensity: 5-

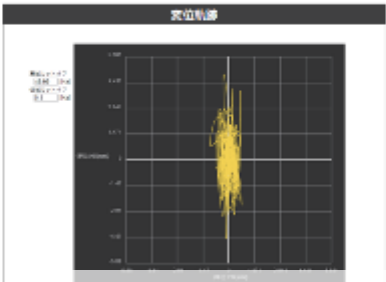
震害被害は軽微で、同とも1.1倍程度に増加しています。震害被害は軽微で、健全と判定されます。

全棟検査を実施し、計測地点のデータを収集・解析し、地震が発生した後の建物の健全性を評価します。計測地点は同とも1.1倍程度に増加しています。震害被害は軽微で、健全と判定されます。

① 計測結果 計測したデータから建物の揺れの大きさや軌跡がわかります。

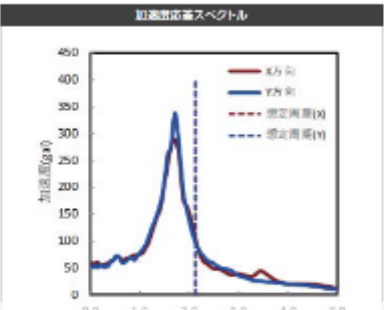


### Acceleration Waveform

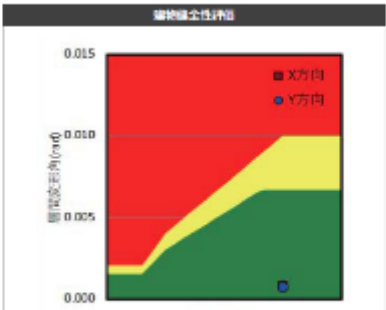


### Horizontal Orbit

② 解析結果 解析結果から建物の健康状態がわかります。



### Acceleration Response Spectrum



### Health Analysis

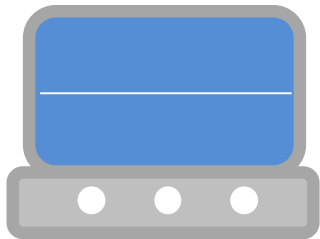
Quake Info

General Evaluation

Observed Movement

Health Analysis

## HOME DOCTOR



Earthquake ID

9156

Intensity

All

Execute

Zoom size:

10

Mesh:

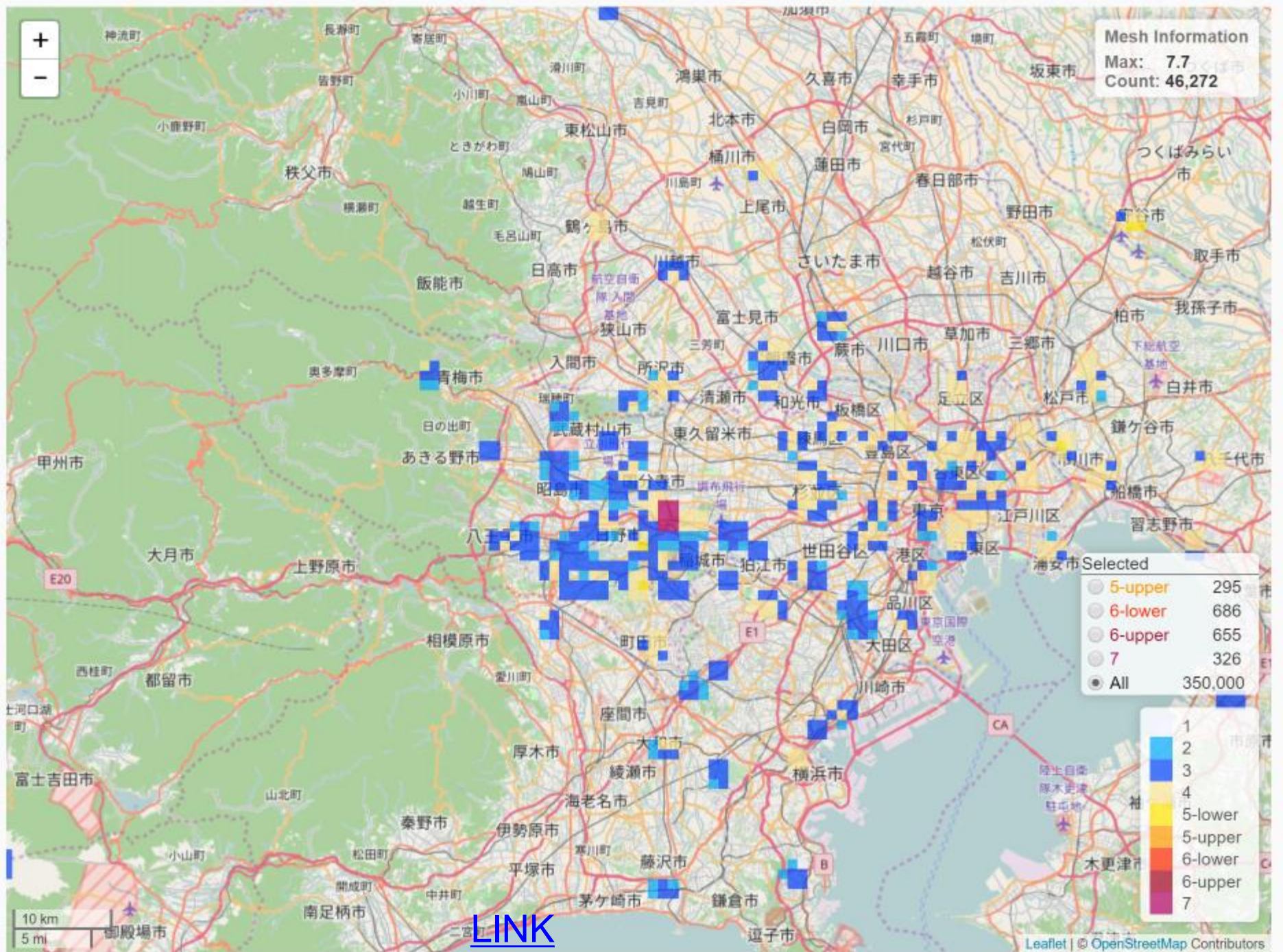
#3

Mesh size:

1km \* 1km

Total number of objects:

675



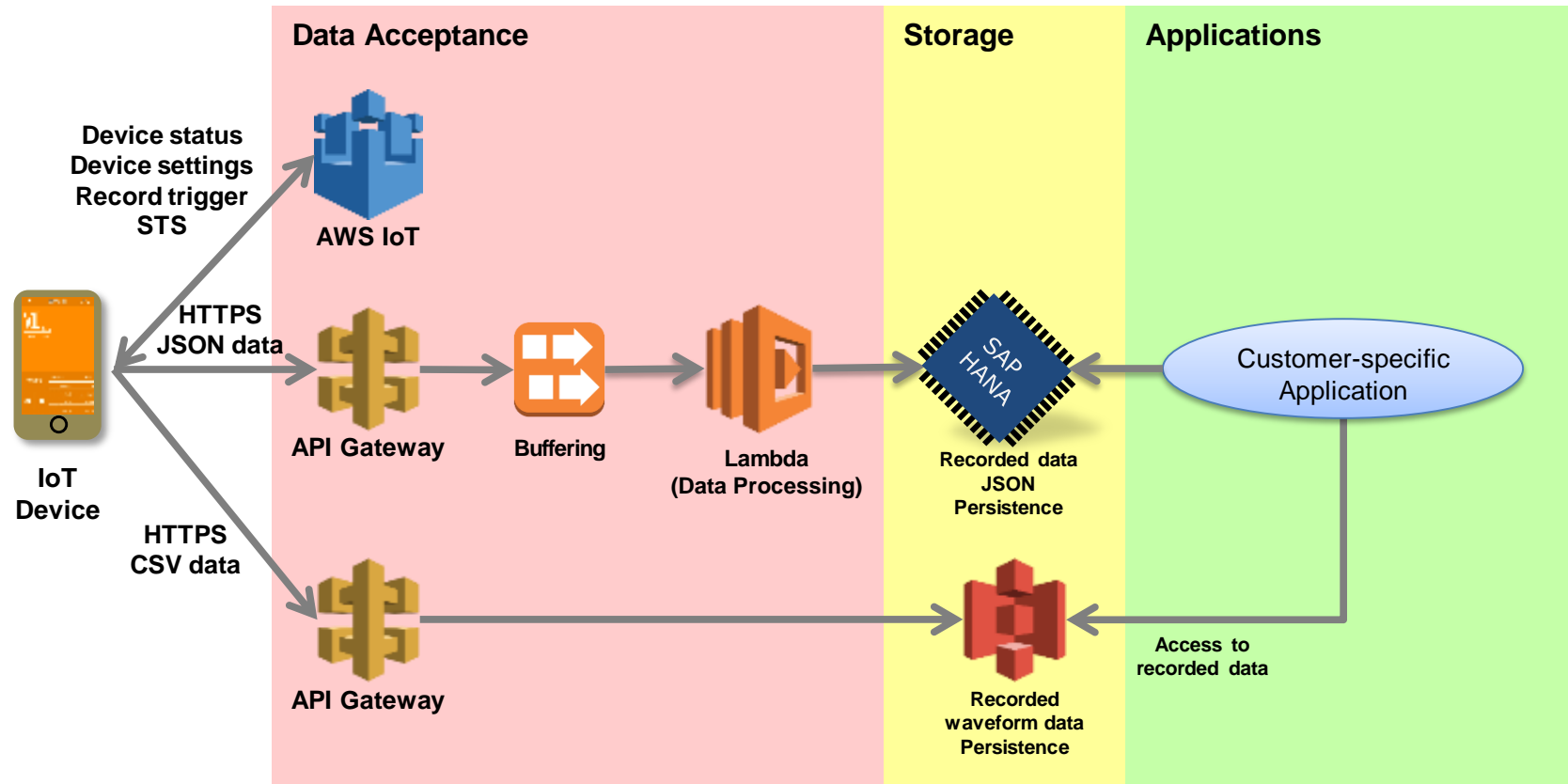
Mesh Information  
 Max: 7.7  
 Count: 46,272

Selected

5-upper	295
6-lower	686
6-upper	655
7	326
All	350,000





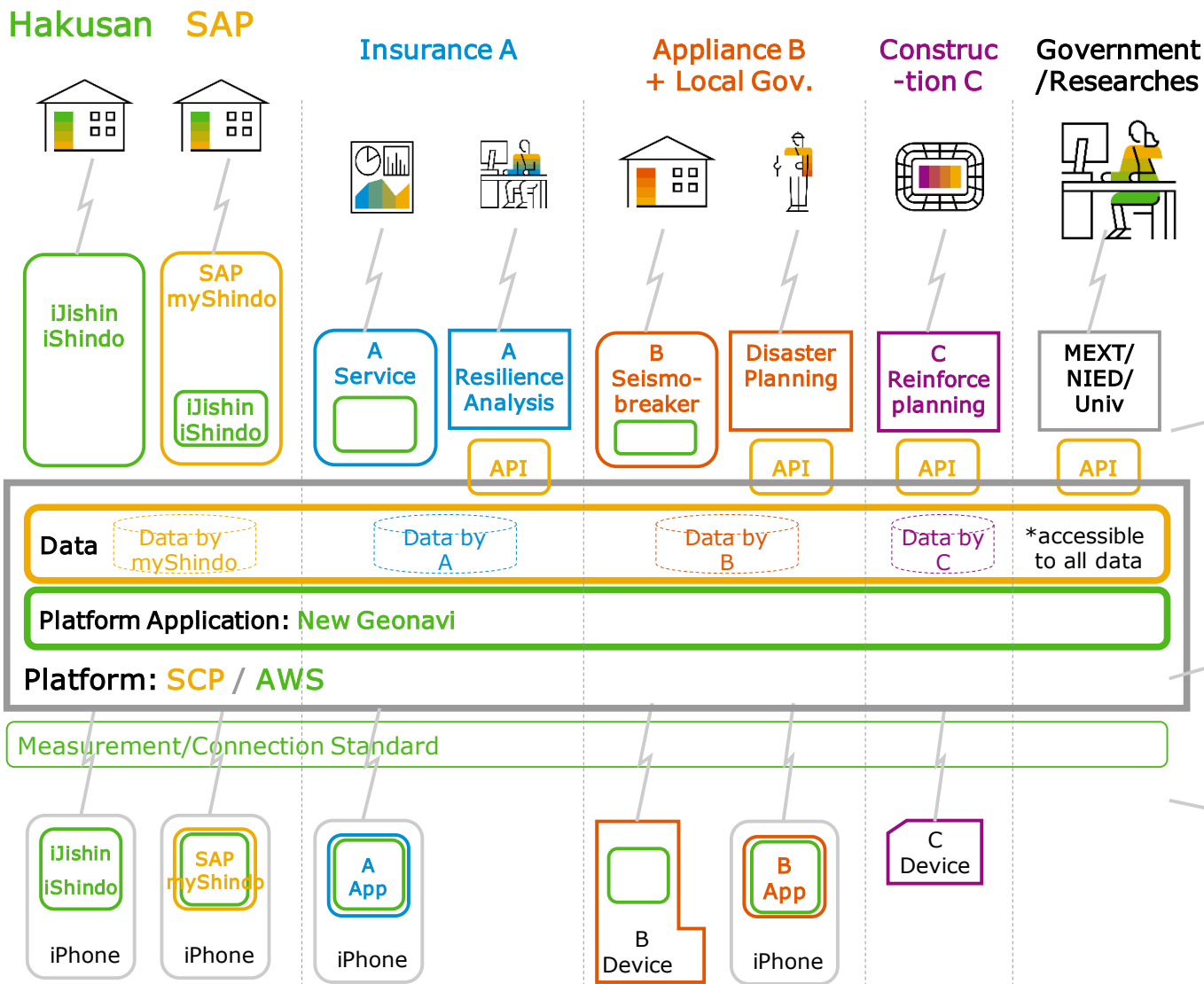


**What's Next?**

**involving enterprises, academia, government,  
& society**



SAP myShindo will promote enterprises to populate, use, and monetize the seismic data: by **free** data storage, **free** device connection and **API-access**-based usage fee



Remarks  
 Licensed by Hakusan  
 Licensed by SAP

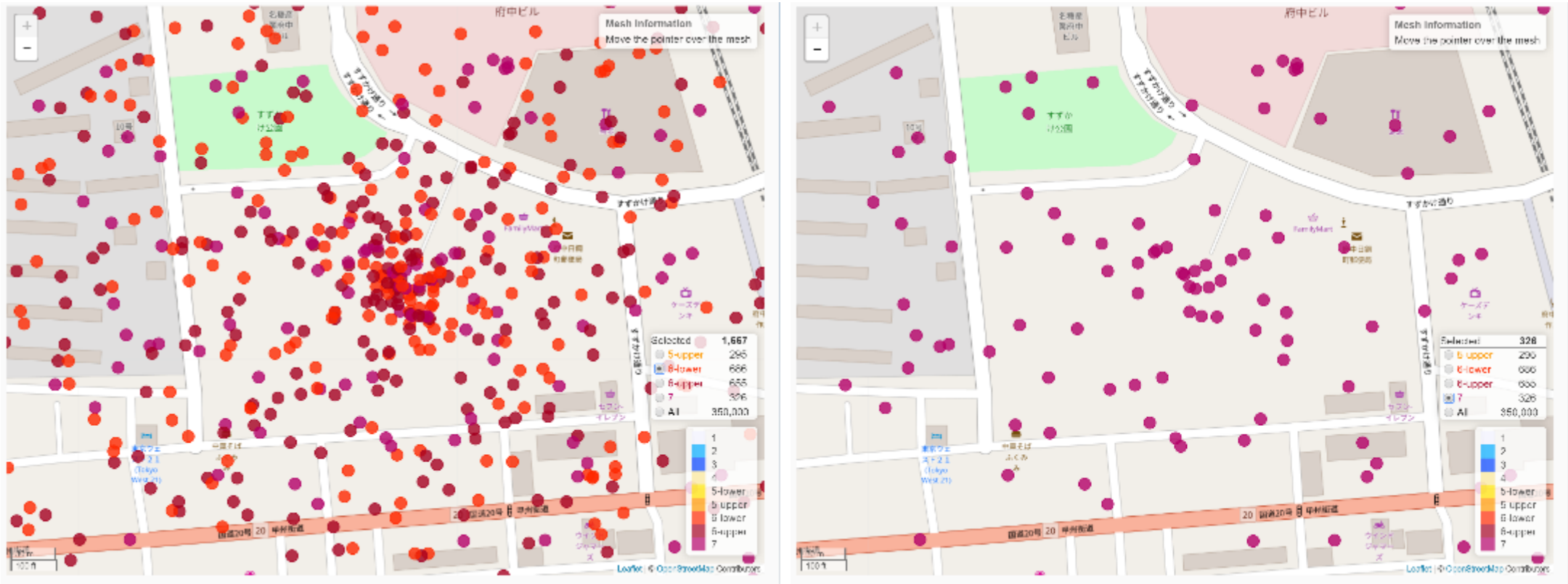
**Cost sharing by stakeholders to make this project sustainable**

- 3) Partners will be charged per API access
  - Fee metrics TBD
  - App can be sold on SCP to others
  
- 1) Platform is free for now
  - SCP funded by SAP, AWS/New Geonavi funded by Hakusan
  
- 2) Device connection will be free of charge
  - Hakusan to license the device/app technology
  - Anyone can connect if compatible with the standard

Japanese Government may be interested in "acquiring" it as national infrastructure



# Power of real-time disaster assessment by myShindo

If a major earthquake hit now, it takes days or even weeks only to grasp the disaster status...



Thus, if we can measure the actual shake  $\hat{=}$  actual damage of each structure in real-time, (i.e. within 12 hours,) it will give tremendous advantages to the government to save lives

# Why SAP ?

		
# of People	80	80,000
Industry	Manufacturing	Digital
Expertise	Seismic technology	IoT, Bigdata
Access	Earthquake industry (incl. government & academia)	Enterprises
Market	Japan domestic	Global
Vision	<b>Help the world run better and improve peoples lives</b>	

- **Complementally matchup**
- **Shared vision**
- **SAP HANA, the super-fast in-memory technology**

### (1) More reliable device

- iOS-based device is great, but...
- dedicated hardware is feasible and functional, but...

### (2) Many viable use cases

- no one have come up with the good use case yet, which is understandable...

### (3) More devices

- need to reach to 10,000, and then 100,000 devices - until then it is not really meaningful

### (4) More countries & societies

- our "fourth generation" network can be applicable to any other regions

# Thank you !

- Join us, for your country & society !



# Thank you.

Contact information:

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- [Soichiro.Murata@sap.com](mailto:Soichiro.Murata@sap.com)

