TECHNICAL, ORGANIZATIONAL AND ETHICAL CHALLENGES OF MOBILE CROWDSOURCING IN CRISIS MANAGEMENT

UN-SPIDER Expert Meeting: Crowdsource Mapping for Disaster Risk Management and Emergency Response

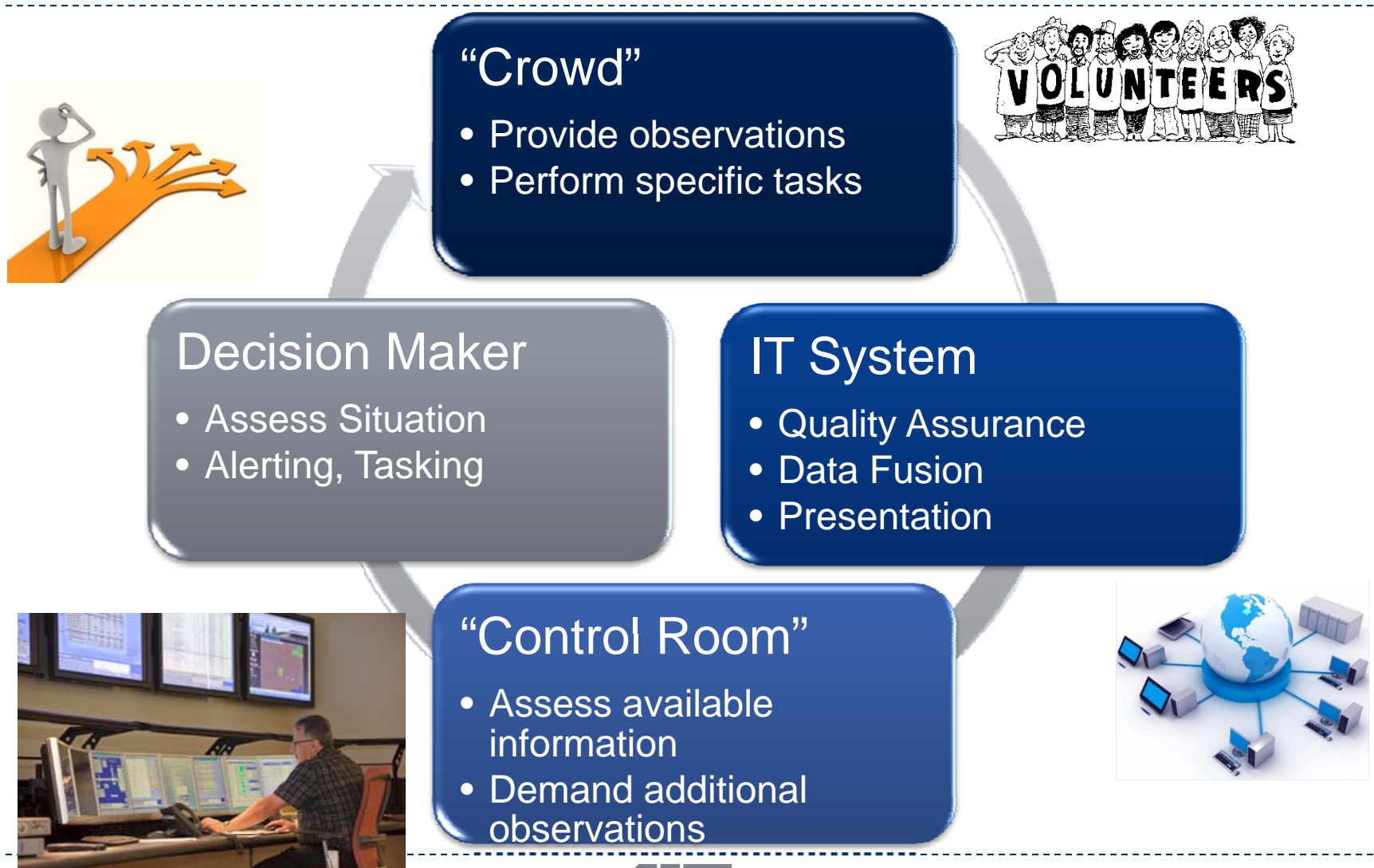Vienna, December 3rd – 5th 2012

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Mobile Crowdsourcing: Key Actors and Tasks

"Crowd"
- Provide observations
- Perform specific tasks

IT System
- Quality Assurance
- Data Fusion
- Presentation

"Control Room"
- Assess available information
- Demand additional observations

Decision Maker
- Assess Situation
- Alerting, Tasking

Mobile Crowdsourcing in various CDM phases

Mitigation & Preparedness

- Vulnerability assessment
- Field training
- Awareness

Early Warning

- Reporting incidents and deviations
- Alerting "neighbourhood"
- Dispatching instructions

Response

- Assessment of damages, losses,
- Coordination of efforts
- Situation Awareness

Recovery

- Self-organisation
- Situation Awareness

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Mitigation & Preparedness: Issues & Countermeasures

Response

- avoid tracing of users, anonymise information, don't propagate sensitive data
- dual use applications ("personal exposure", "city watch", "noise mapping"…)
- "serious gaming", education & field training

Issues

- Low motivation
- Low urgency
- Privacy concerns

Mitigation & Preparedness: some Application Scenarios

Reporting & awareness
- Report resources,
- Assess Vulnerabilities
- "my neighbourhood" risk maps

Dual/daily use
- Traffic
- Biodiversity
- Personal health, exposure

Training & serious gaming
- Targeted information, checklists
- Field training
- Geo-caching

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Early Warning: Issues & Countermeasures

Response

- use hardware sensors & external data for "alerting of alerters"
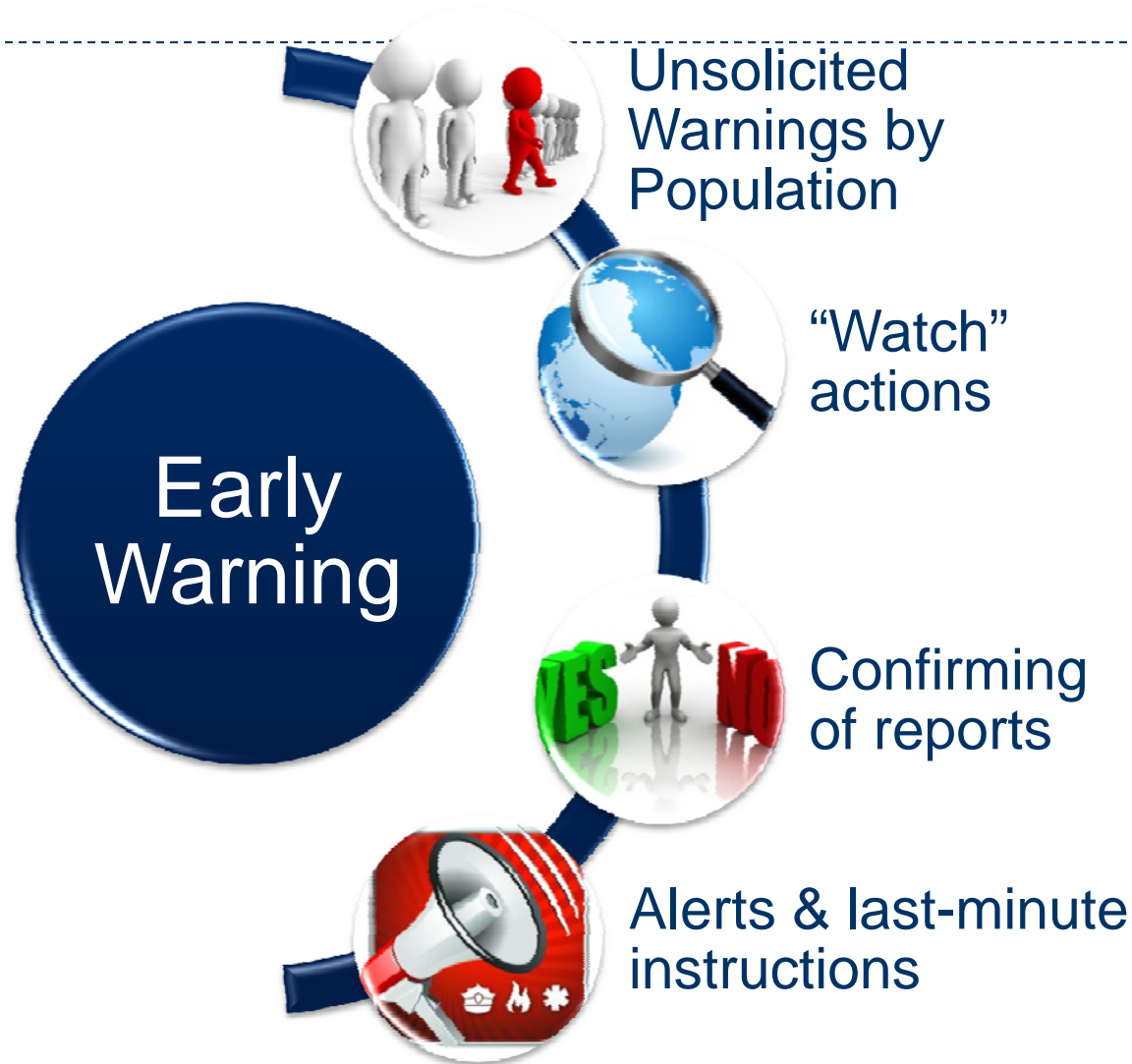- QA using external data, statistics, models, peer review…

Issues

- fading alertness
- false alerts costly & discouraging

Early Warning: some Application Scenarios

Early Warning

Unsolicited Warnings by Population

"Watch" actions

Confirming of reports

Alerts & last-minute instructions

Response: Issues & Countermeasures

Response

- Tasking of Volunteers (observations & more)
- Offline mode, P2P communication, mobile "central node"
- Simple GUI – yes/no, pictograms, Augmented Reality,
- "Offline" interface(s), e.g. with bar-codes, NFC, OCR, speech recognition.

Issues

- Patchy local situation awareness
- Damaged communication infrastructure
- No time for fiddling with smartphone
- Many new, inexperienced users

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Response: some Application Scenarios

Response

Damage assessment

Assessing need for assistance

Mobilizing available resources

Sheltering & Evacuation coordination

Recovery: Issues & Countermeasures

Response

- "Croudmapping" of changing situation on the field (supply, demand, hazards)
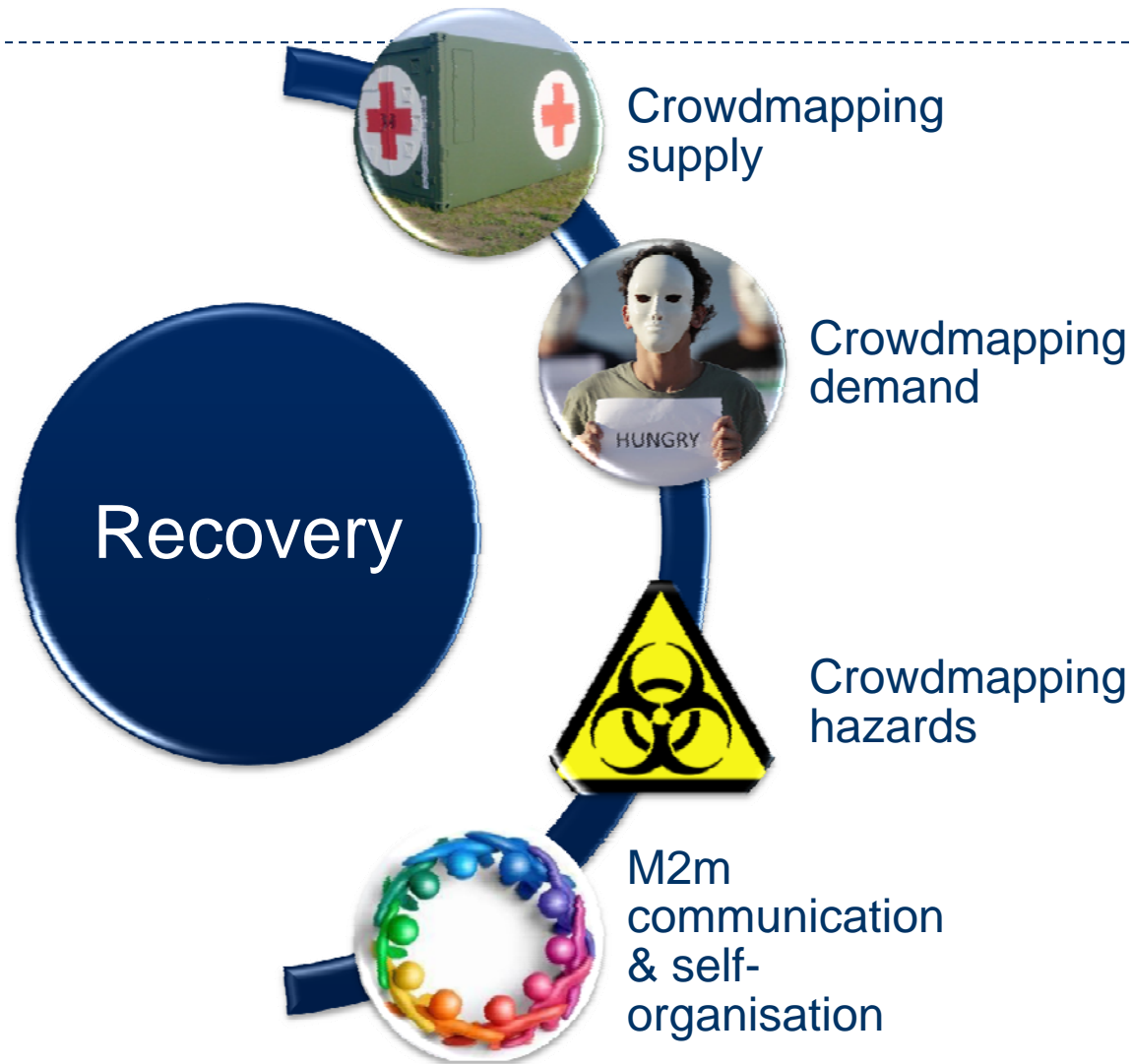- Many 2 many communication, self-organization
- "phone recharging" centres

Issues

- Fragile/patchy supply and civil society
- Less help from "outside"
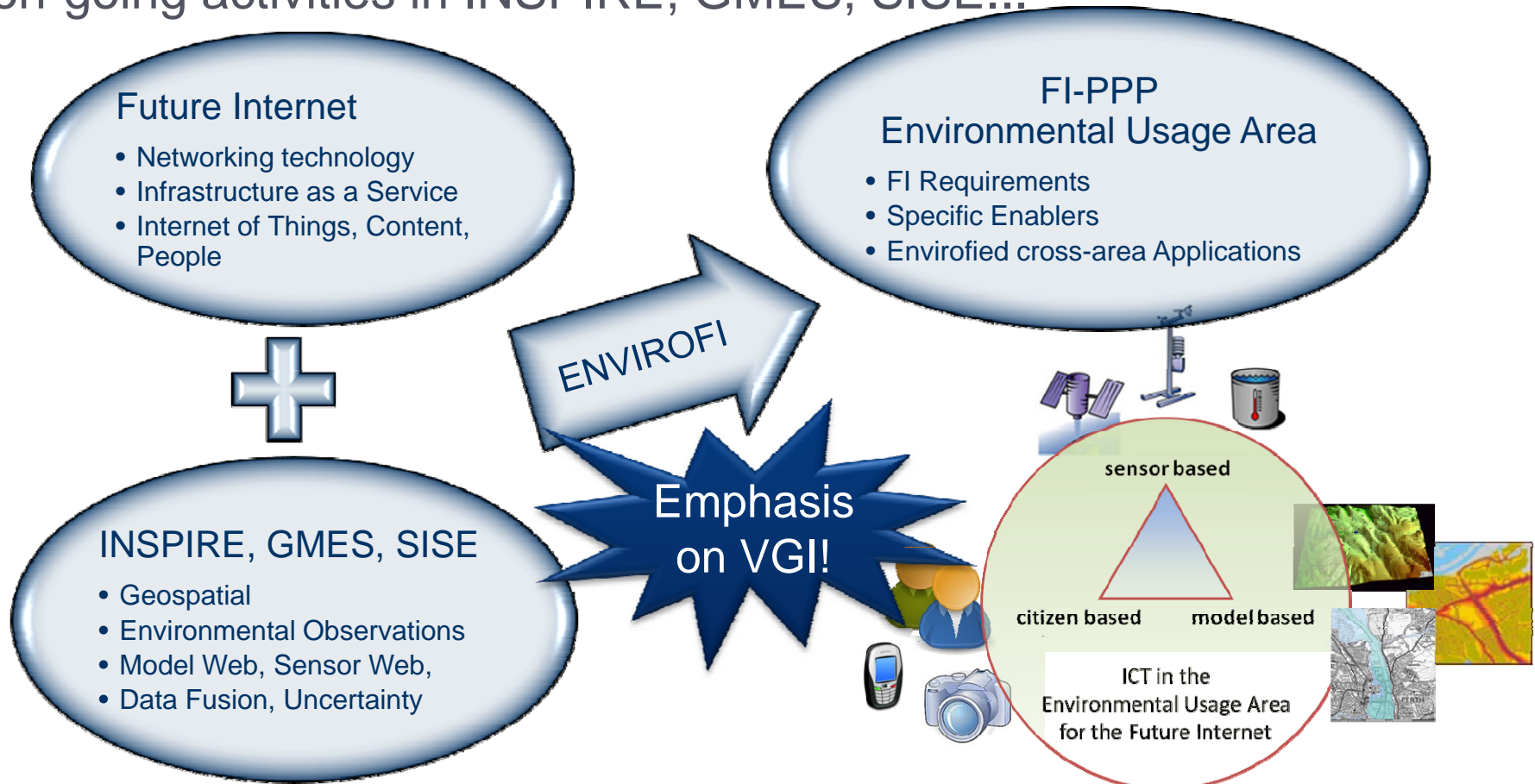- Damaged energy infrastructure

Recovery: some Application Scenarios

Recovery

Crowdmapping supply

Crowdmapping demand

Crowdmapping hazards

M2m communication & self-organisation

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1. Mobile Crowdsourcing: key Actors and Activities
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ENVIROFI Project

ENVIROFI FP7 Integration Project links the Future Internet and on-going activities in INSPIRE, GMES, SISE...

MDAF – Client View

View existing knowledge
- Map view
- Table view
- Detailed View
- Augmented reality
  (not in this project)

NFC-Tags:
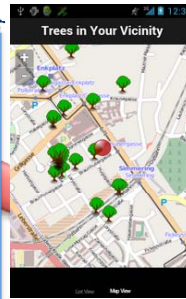- User interface (usability)
- Identification of things
- Authentication

Report observations
- Observations on "new" things, e.g. "here and now I see a tree"
- Additional obs. on existing thing, e.g. "this tree currently blossoms

Receive information (events!)
- Requests for more observations, e.g. "please send a photo of the tree leaf", "can you confirm that…"
- Warnings, e.g. "pollen warning"
- Interests, e.g. "monumental tree in vicinity"

Caching; offline mode

Observations are typed; e.g. a photo could be "leaf photo" or a "tree photo"; a number could be "tree height in meters measured with method X"
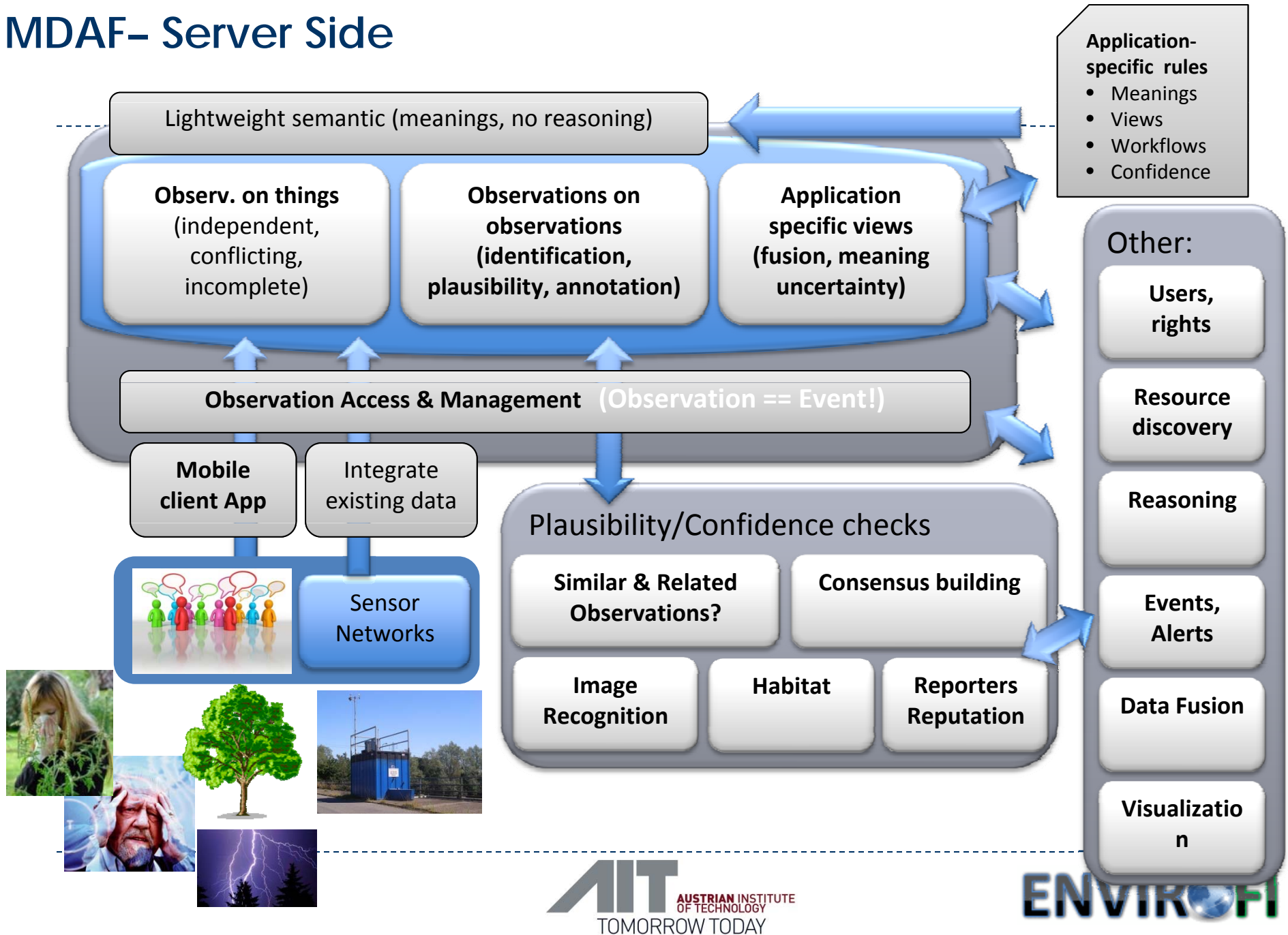
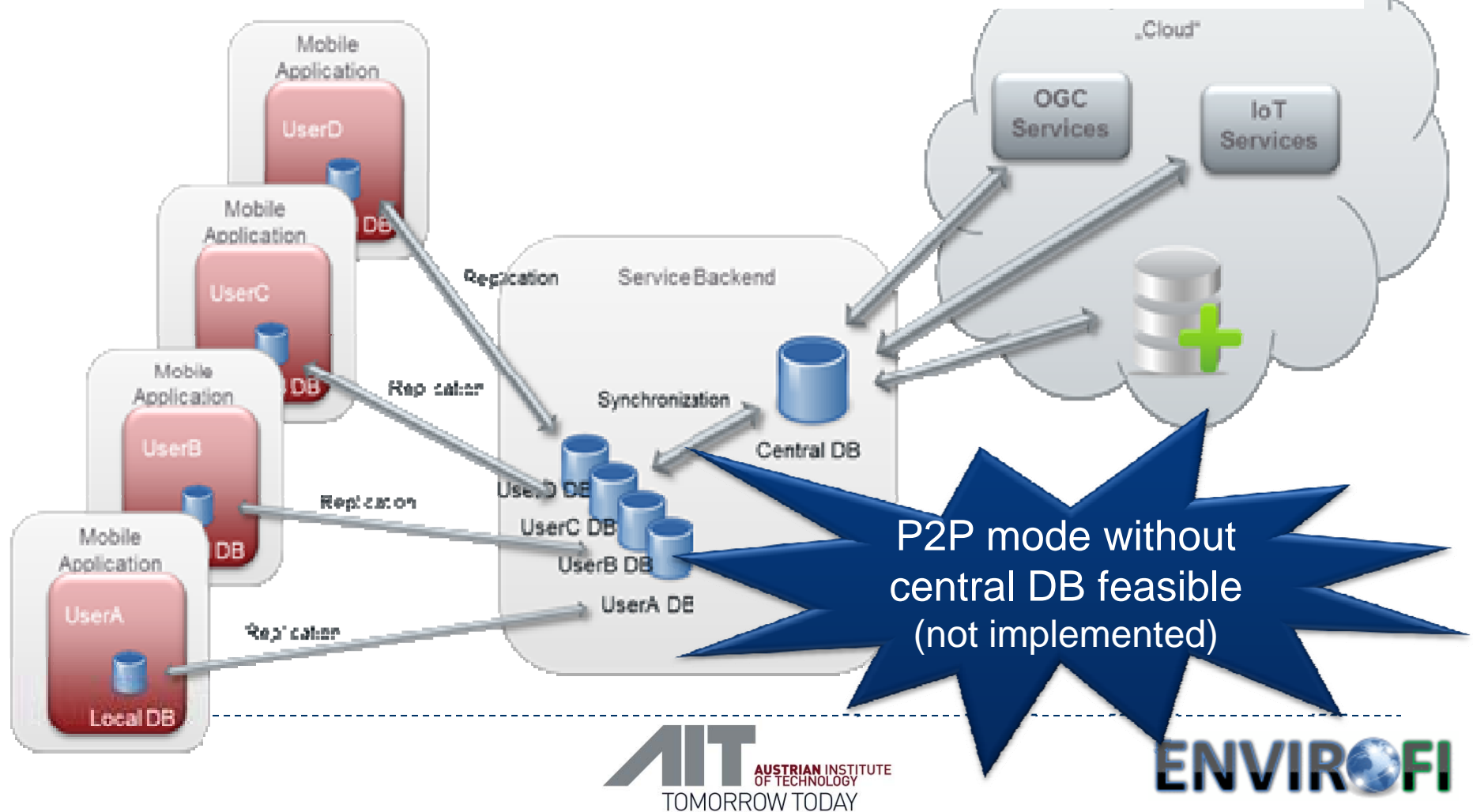**MDAF Server Backend**

Wake-up App!

Reporting observations:
- Free/controlled text (name, report)
- Multiple choice (text, photo, ..)
- Interval (from-to; area, …)
- Sensor Input (camera, microphone, position, pressure)
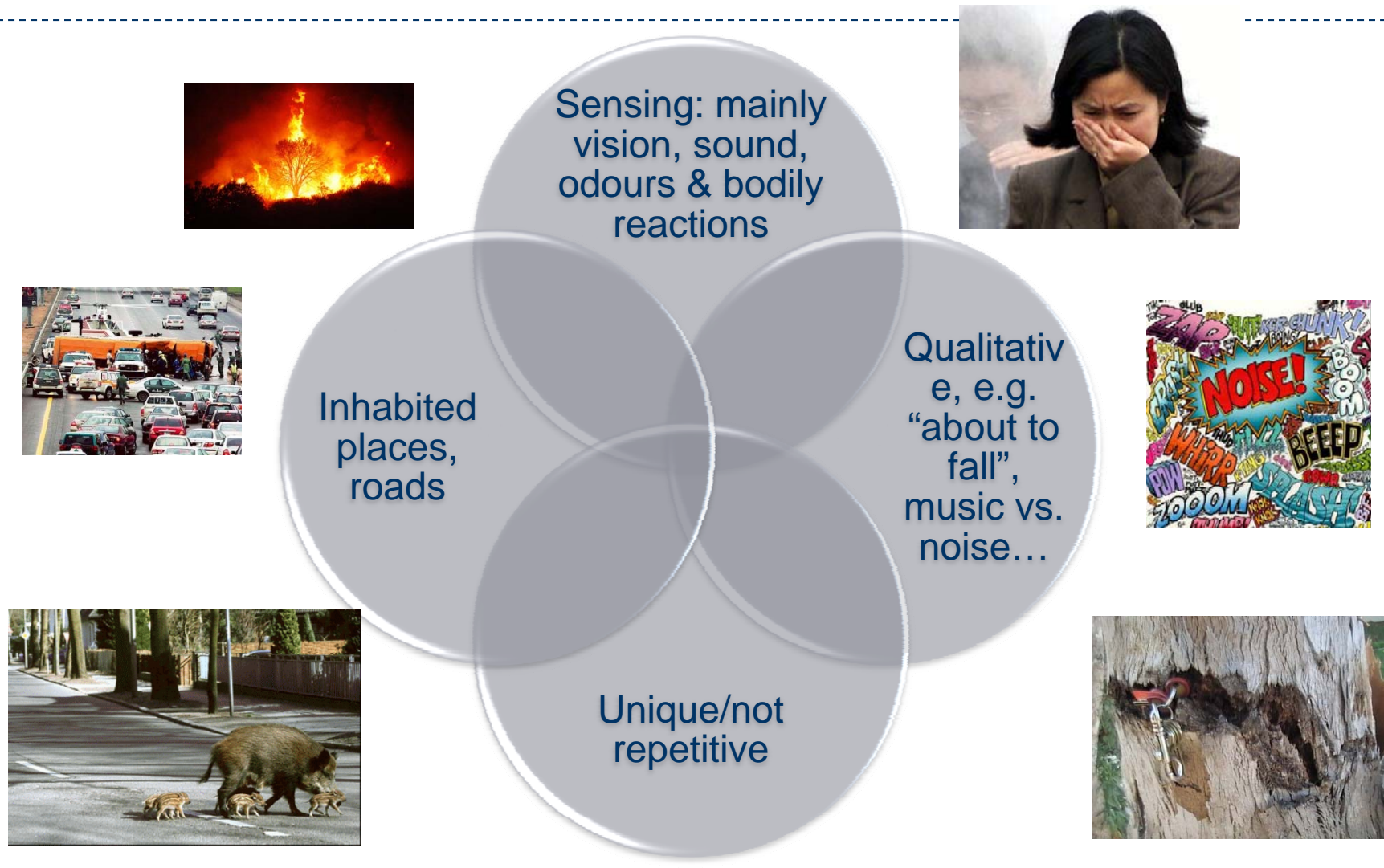- NFC Tag (offline user Interface)

Trees in Your Vicinity

2003 : Dittmanngasse	
1014 : Grillgasse	
2010 : Grillgasse	
2001 : Grillgasse	
2029 : Simmeringer Hauptstras	
1010 : Krausegasse	
1022 : Geiselbergstrasse	
1005 : Albin-Hirsch-Platz	

List View   Map View

Tree Details

TreeID:	BAUMOGD.1877514
Street:	Pretschgasse
GPS (lon,lat):	(16.4253926019031;48.1576232
TreeNumber:	1006
Area:	Strassen
DataProvider:	Datenquelle: Stadt Wien - data.wien.gv.at
Height:	7 m
CrownDiameter:	5 m
SpeciesName:	Prunus serrulata 'Kanzan' (Japan BlÃ¼tenkirsche)
PlantingYear:	1960
TrunkCircumference:	116 cm

Add Observation

MDAF– Server Side

Application-specific rules
- Meanings
- Views
- Workflows
- Confidence

Lightweight semantic (meanings, no reasoning)

Observ. on things (independent, conflicting, incomplete)

Observations on observations (identification, plausibility, annotation)

Application specific views (fusion, meaning uncertainty)

Observation Access & Management (Observation == Event!)

Mobile client App

Integrate existing data

Sensor Networks

Plausibility/Confidence checks

Similar & Related Observations?

Consensus building

Image Recognition

Habitat

Reporters Reputation

Other:
- **Users, rights**
- **Resource discovery**
- **Reasoning**
- **Events, Alerts**
- **Data Fusion**
- **Visualization**

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MDAF Synchronization & Encapsulation of Data

Offline mode, automated synchronization with users' DB on the server, no access to central DB and DBs of other users.

P2P mode without central DB feasible (not implemented)
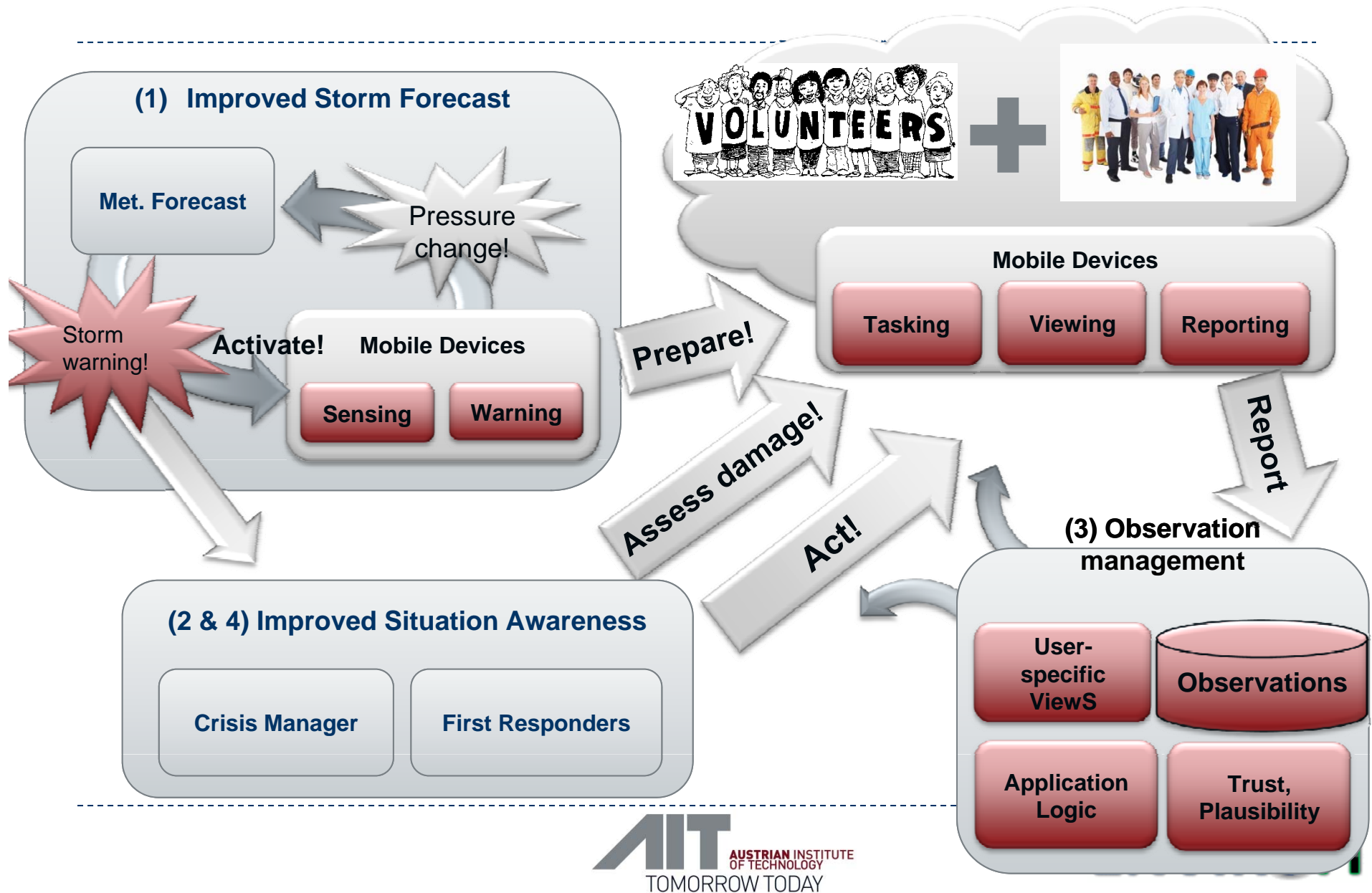
Which Observations by Volunteers?

Sensing: mainly vision, sound, odours & bodily reactions

Inhabited places, roads

Qualitative, e.g. "about to fall", music vs. noise…

Unique/not repetitive

Information Overload, Privacy & Quality

	Information Quality	Information Overload	Privacy	Motivation
Profiling	😊😊😊	😊😊	☹☹☹	😐
Tracking	😊	😊😊😊	☹☹☹	😐

Profiling & tracking of users is good for usability and optimal use of resources, but bad from ethical point of view.

MDAF approach: sensitive data is kept on users device; only "region" known to server => final filtering of requests performed by client App.

"Storm" Scenario & MDAF

(1) Improved Storm Forecast

Met. Forecast

Pressure change!

Storm warning!

Activate!

Mobile Devices

Sensing | Warning

Prepare!

VOLUNTEERS +

Mobile Devices

Tasking | Viewing | Reporting

Report

Assess damage!

Act!

(2 & 4) Improved Situation Awareness

Crisis Manager | First Responders

(3) Observation management

User-specific ViewS | Observations

Application Logic | Trust, Plausibility

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Outlook & Conclusion

- Mobile Crowdsourcing has a great potential for Crisis and Disaster Management applications in all phases of the CDM cycle
- Each CDM phase has different challenges, including:
  - Privacy & Motivation are huge issues in Mitigation & Preparedness phases
  - Information from mobile observers should be combined with other data sources, especially in Early Warning!
  - "Responders" have no time to fiddle with mobile phones
  - Infrastructure *is* unreliable, especially in response & recovery phases
  - Users profile & position are subject to misuse, but we need them for quality assurance and to avoid information overloads.
- MDAF provides various mechanisms for handling of above mentioned issues, even more is planned. We are currently looking for stakeholders interested in testing & exploiting of MDAF in CDM context.

More Information

- General information on ENVIROFI project as well as the public project deliverables are available at http://www.envirofi.eu/

- More information on ENVIROFI software is available on http://catalogue.envirofi.eu (work in progress!).

- In the future, this will also includes the descriptions of the "Biodiversity" and "Personal Environmental Information System" applications, which are based on the "MDAF" platform. This information, and android application prototypes can currently be accessed through http://catalogue.envirofi.eu/?q=pages/project-pilots

Thank you for your attention

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