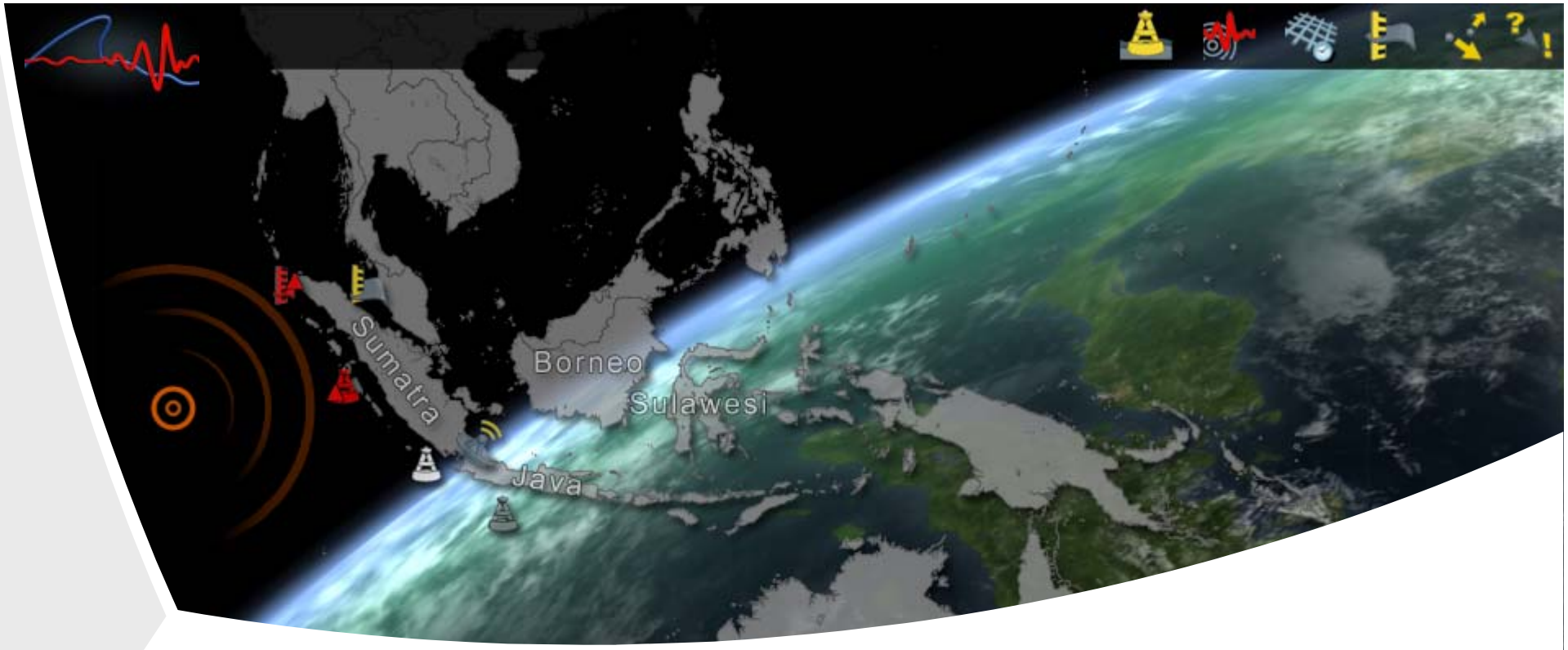

Standardized CAP Messages from GITEWS DSS – how they are useful for national and international warning message dissemination

DEWS Midterm Conference – Potsdam July 2009
Interoperability Issues – System for Interoperable Advisory and Warning Centres

T. Steinmetz, U. Raape, T. Riedlinger

German Aerospace Center (DLR)
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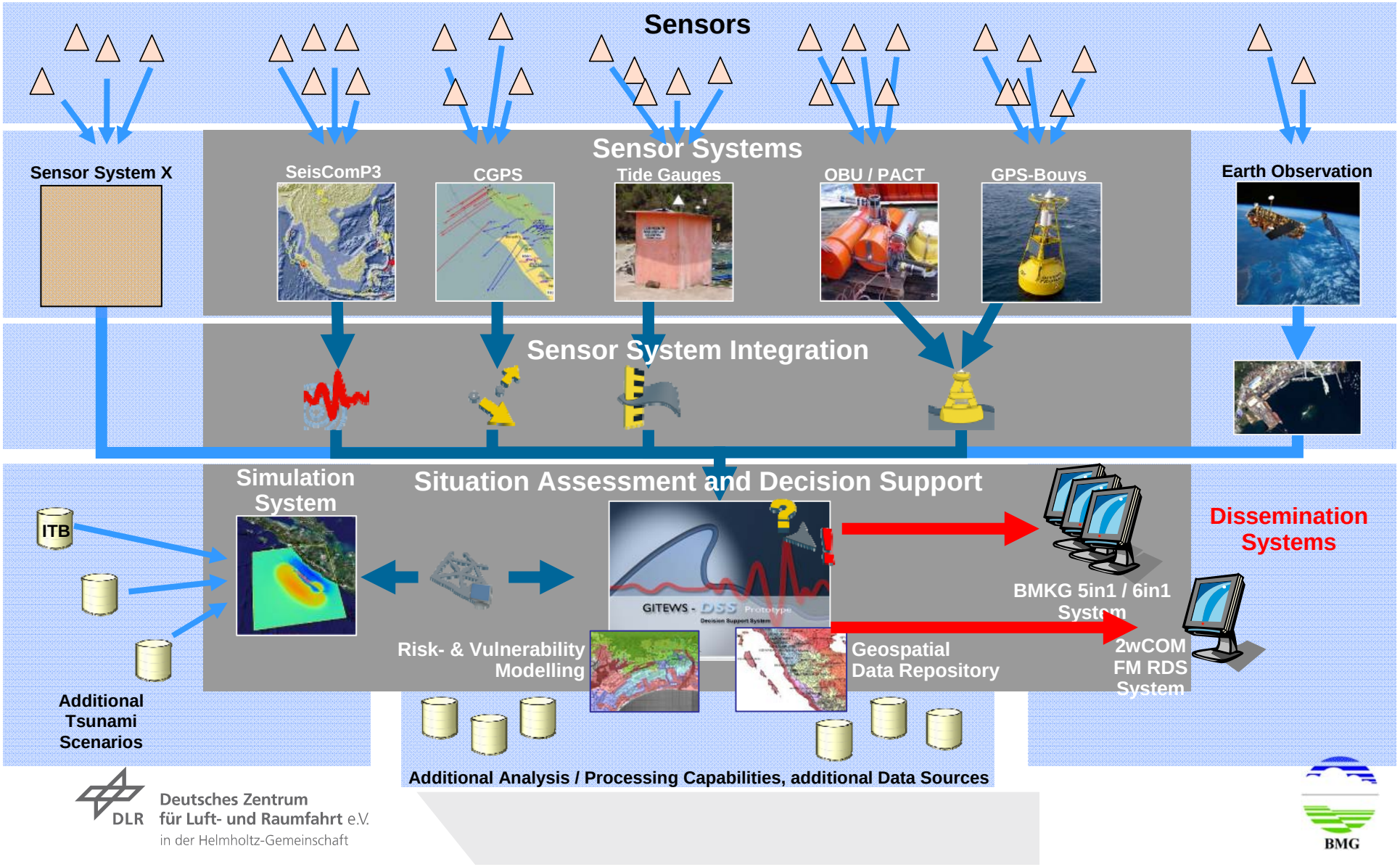
in der Helmholtz-Gemeinschaft

BMG

Overview

- Status Quo in Interoperation of GITEWS/InaTEWS
  - How do we use CAP?
  - What messages are needed in the InaTEWS context?
- Standardization in GITEWS DSS warning dissemination using CAP
  - What is CAP?
  - How does it improve the dissemination process?
- Proposals for interoperable IOTWS RTWP message exchange

InaTEWS Open Architecture to support Integration of Components



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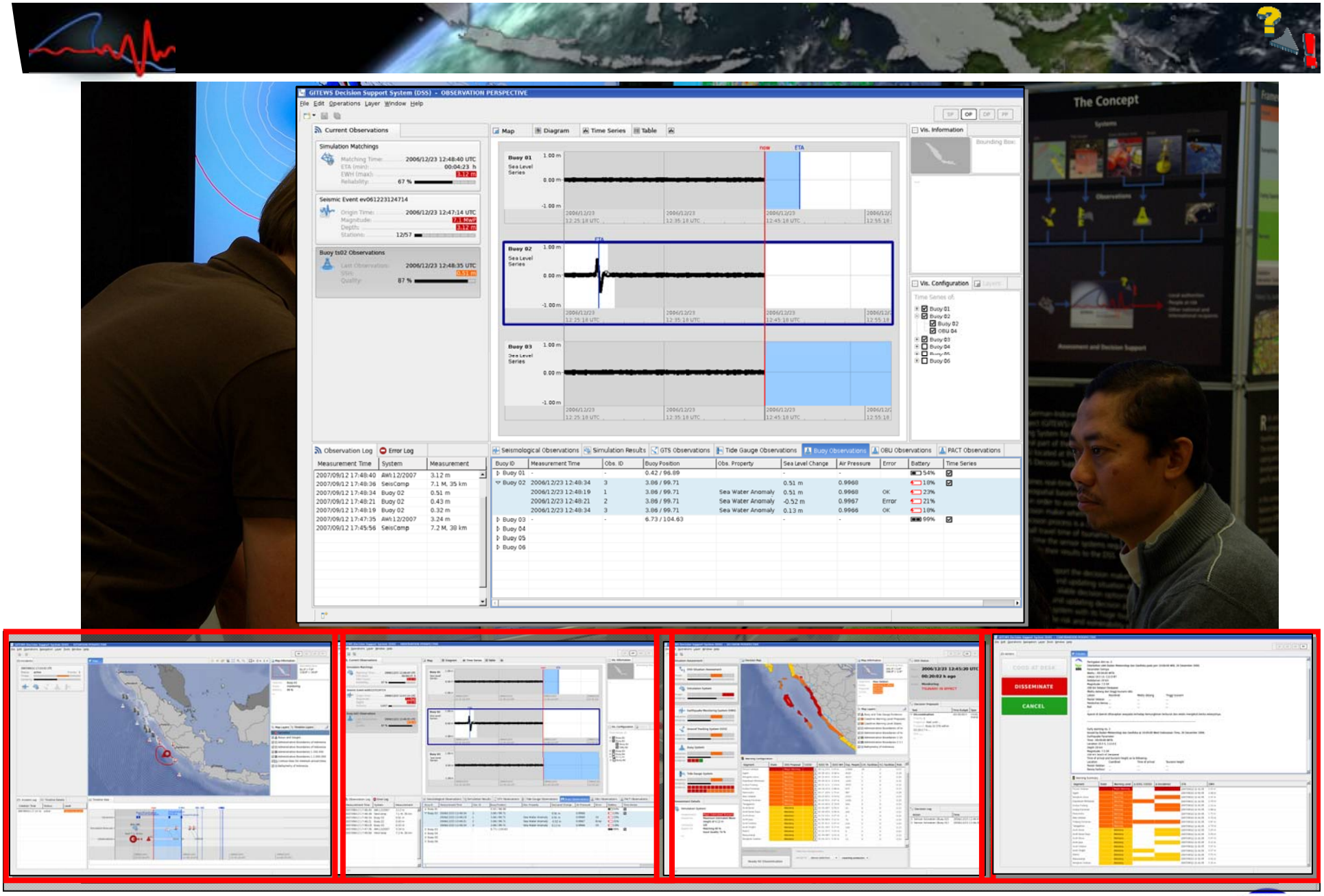

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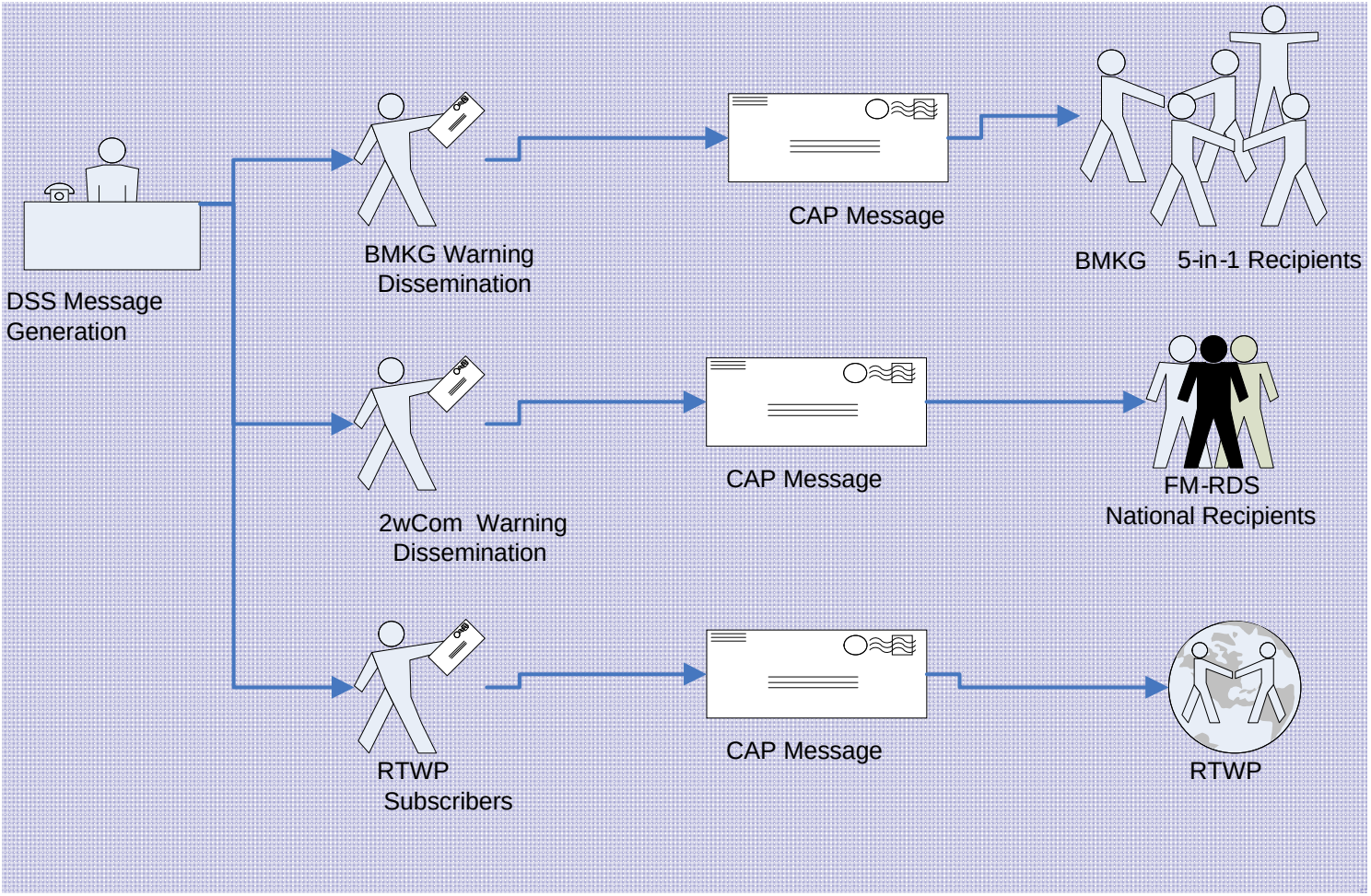
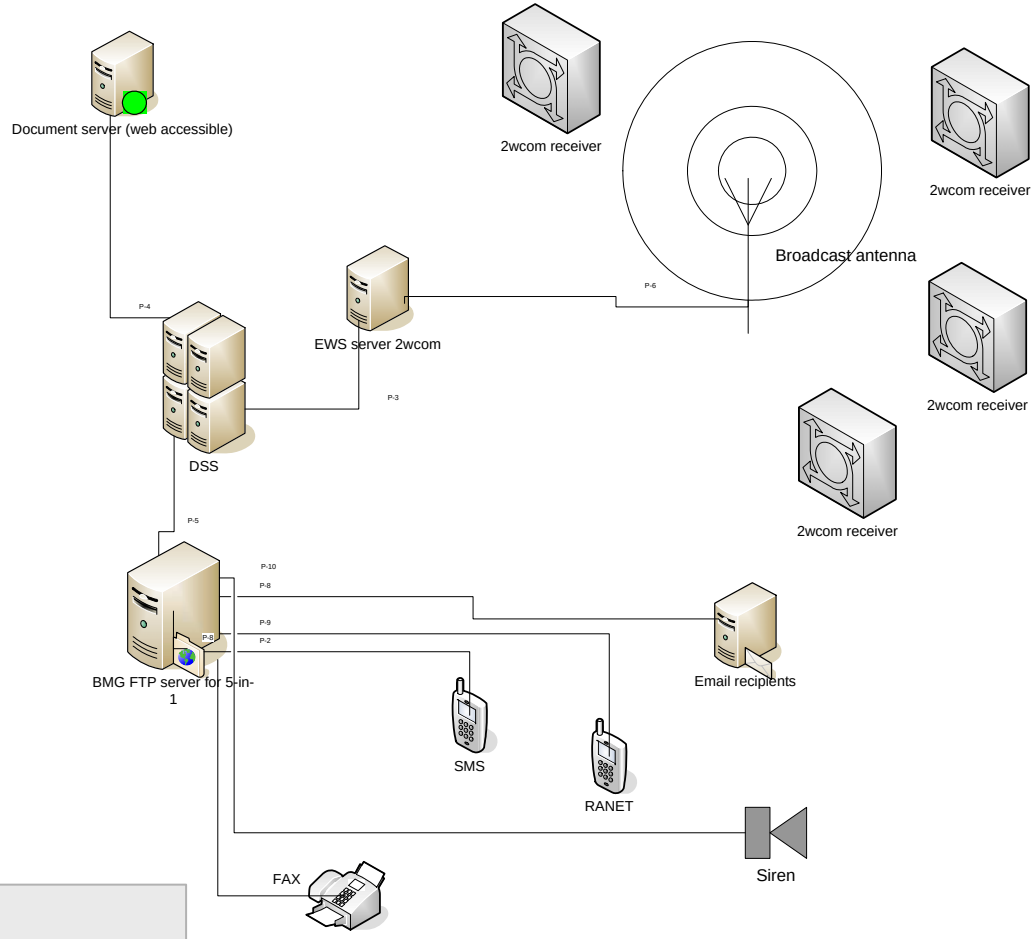
Message Dissemination



Dissemination of Warning Products: dissemination channels

- DSS has interfaces to different dissemination systems
- Dissemination system receives the warning product from the DSS
- Dissemination system alone has the task to disseminate warnings through different channels
- Recipient systems may be (e.g.):
  - Email
  - SMS
  - 2wcom FM-RDS radio receivers
- 2wcom sends regionalized warnings to specific targets



MAJOR TSUNAMI WARNING for BENGKULU,LAMPUNG,JABAR,JATENG,DIY,JATIM;WARNING for BANTEN,BALI,NTB,NAD,SUMUT,SUMBAR. Origin 08:23WIB,M9.9,Loc:3.04S-101.10E::BMG

DSS Product Generation and Dissemination Process

- DSS can generate targeted products (messages)
  - **regionalized** (with specific information for the individual area)
  - **target group** specific (public, media, government, NTWCs, ...)

- DSS can generate different **product types** in different **versions**
  - Text messages (short/long),
    Reports, Maps, ...
  - plain text, image, PDF,
    Common Alerting Protocol (CAP), ...

- DSS initiates dissemination process by pushing products to connected **Dissemination Systems**
  - BMKG dissemination system (5-in-1)
  - 2wcom FM-RDS System
    (regionalized dissemination of warning segment specific products)

Use of CAP in InaTEWS

- CAP is used by InaTEWS:
  - DSS creates
    1. CAP conforming messages
    2. which are disseminated using existing systems and
    3. which are decoded by the recipient systems
- DSS can (and will) address arbitrary new distribution/dissemination systems
- CAP is standardized, yet flexible enough to address the diverse needs of a variety of international systems and recipients
- CAP can be used to address up to level 3 of RTWP and NTWC

What is the current status in interoperation in the UNESCO IOC-IOTWS context?

Why is CAP your friend?

Status quo in exchanging Tsunami watch messages

- Assumption: Different systems use non-interoperable techniques (files, services, protocols)

  → *The (technical) message format is only apt for an exchange after mutual agreements have been made.*

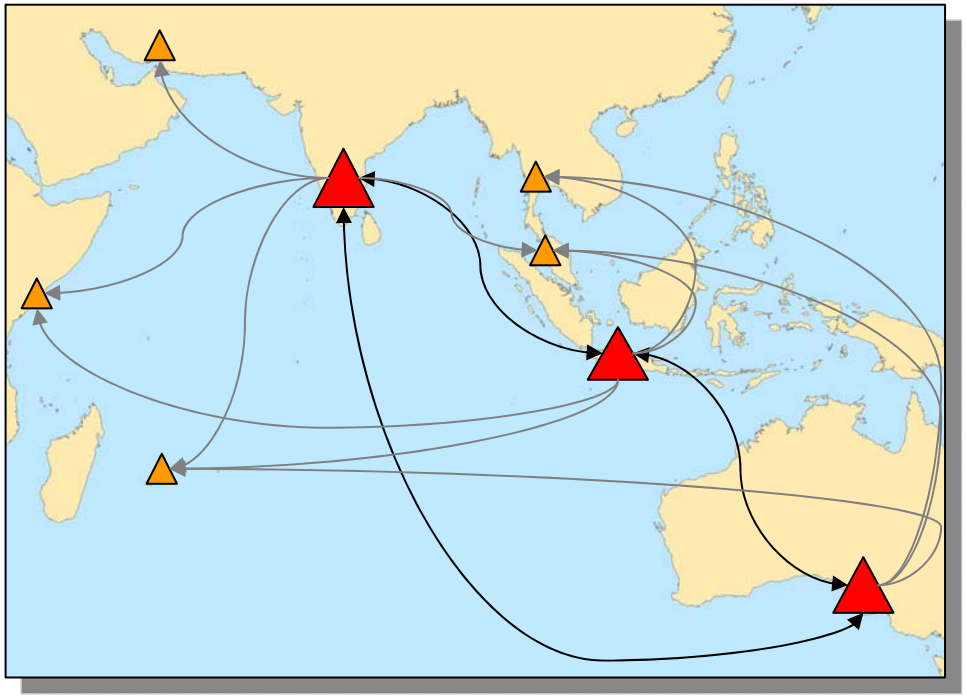
  → *Its meaning is unclear to the technical system exchanging it.*

Requirements for interoperability

- In order to exchange messages in an international context there is a need for:
  - Common technical standard
    → technical interoperability
  - Use of a common IT language
    → syntactical interoperability
  - Common mutual understanding of the meaning of forecast points (or warning segments)
    → semantical interoperability
  - Common understanding of warning levels (according to wave heights or seismic)
    → semantical interoperability

Syntactic and semantic interoperability

- CAP can be used for technical standardization and
- CAP messages can contain the semantically correct warning elements optimized for interoperability of RTWPs and NTWCs.



Example (not complete)

Interoperability enhanced by using CAP

- CAP enables interoperability in terms of:
  - enables the exchange of messages in a way that
    - makes the recipient computers know something about the message *semantics* (severity, warning level, exercise or true)
    - makes them act accordingly

    → ***„System can alert you when you should really know it“***

  - Ability to address different *dissemination mechanisms* → *„send it the way you like“*
  - Ability to address different warn devices (SMS, Fax, email, siren) with taylor-made *message content* → *„receiver takes what he needs“*
  - Ability to address multiple different recipients (like different receiving countries, different warning segments, different institutions) – each with a message content which is relevant to them

→ *All „cast“ into a single message, accompanied with relevant metadata.*

Requirements for IOTWS: how CAP meets them

- Common technical standard for messages
  - CAP protocol presents a way for an easy, standardized message format usable in a flexible way (on different distribution channels)

- Common understanding of warnings
  - CAP can support the need for commonly used semantics by using pre-defined warning levels and warning segments and the metadata like severity, certainty etc. that we agree upon.

  - CAP can basically contain arbitrary payload messages
  - Please note: semantic issues are not solved by CAP

What is this CAP anyway?

CAP: Common Alerting Protocol

- Message in XML format contains:

```
<?xml version="1.0" encoding="utf-8" ?>
<cap:alert xmlns:cap="urn:oasis:names:tc:emergency:cap:1.1"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="urn:oasis:names:tc:emergency:cap:1.1 cap
<cap:identifier>BMG1111</cap:identifier>
<cap:sender>dss@bmg.go.id</cap:sender>
<cap:sent>2006-12-22T20:56:00+07:00</cap:sent>
<cap:status>Actual</cap:status>
<cap:msgType>Alert</cap:msgType>
<cap:scope>Private</cap:scope>
<cap:addresses>1120 1121 1122</cap:addresses>
<cap:incidents>13970876</cap:incidents>
<cap:info>
<cap:language>id</cap:language>
<cap:category>Geo</cap:category>
<cap:event>Tsunami</cap:event>
<cap:urgency>immediate</cap:urgency>
<cap:severity>major warning</cap:severity>
<cap:certainty>likely</cap:certainty>
<cap:senderName>Badan Meteorologi dan Geofisika (BMG), Jakarta
<cap:headline>Tsunami W of Nias Island in Effect. EQ M8.4 @ 9:53
<cap:description>Diterbitkan oleh Badan Meteorologi dan Geofiska
    Desember 2006. Earthquake with possible major tsunami in Ni
    diharapkan waspada terhadap kemungkinan terburuk dan sela
    Explanation: A major earthquake measuring 8.4 on the Richter
    PM West Indonesian Time on Wednesday, December 22, 2006.
    been caused. Expect tsunami to affect coast of Nias Selatan wa
    minutes (expected time of arrival appprox. 10:18 AM)</cap:des
```

Message ***metadata*** (information about the information)

Message „***payload***“ (the message itself)

Advantage of using CAP protocol for messages

- CAP can contain multiple message parts for multiple receivers/recipient system and each receiver takes what he needs

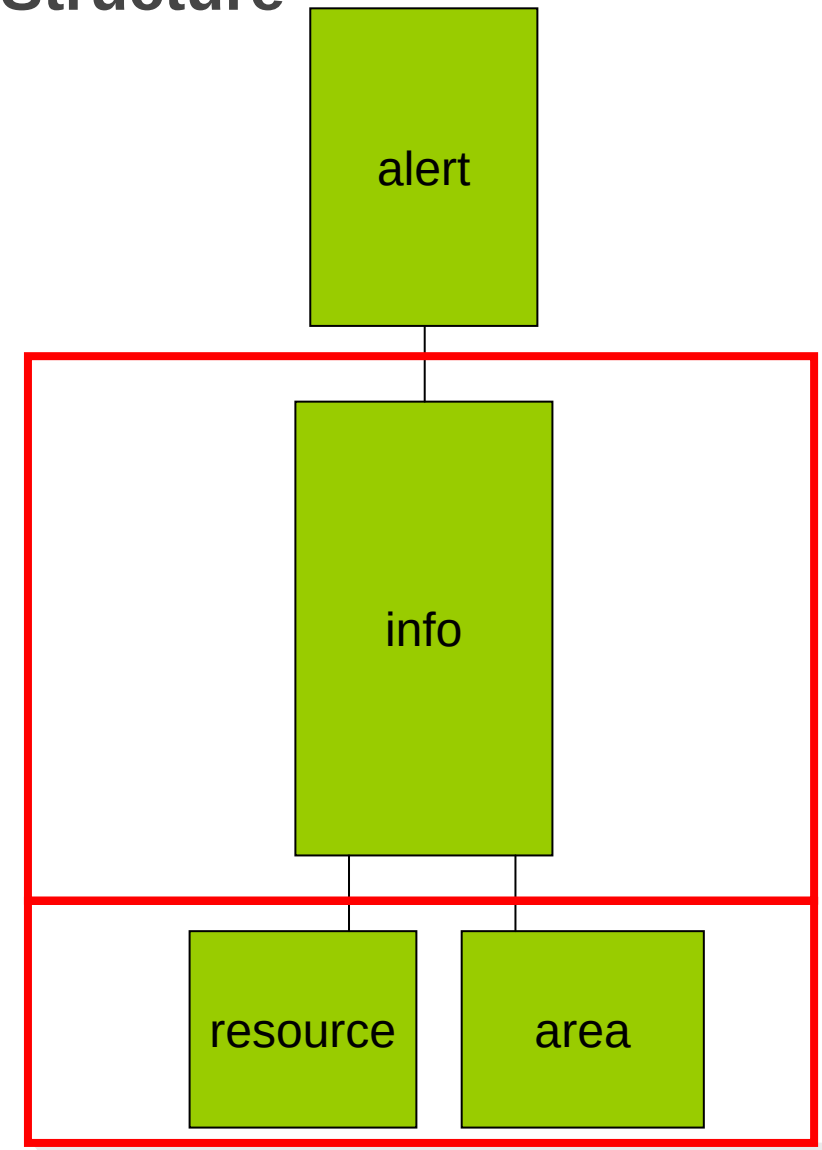
  restriction: Public, Restricted

  scope : Public, Media, Government, International)
- CAP messages reference the geographical area for which they are valid
- CAP messages can contain external resources
- CAP messages can be multilingual

- In addition:
  - CAP is secure (messages can be digitally signed for trustworthiness)
  - CAP can be embedded (EDXL,TWML, with even more meta data and the possibility to structure the content)

CAP Message Structure

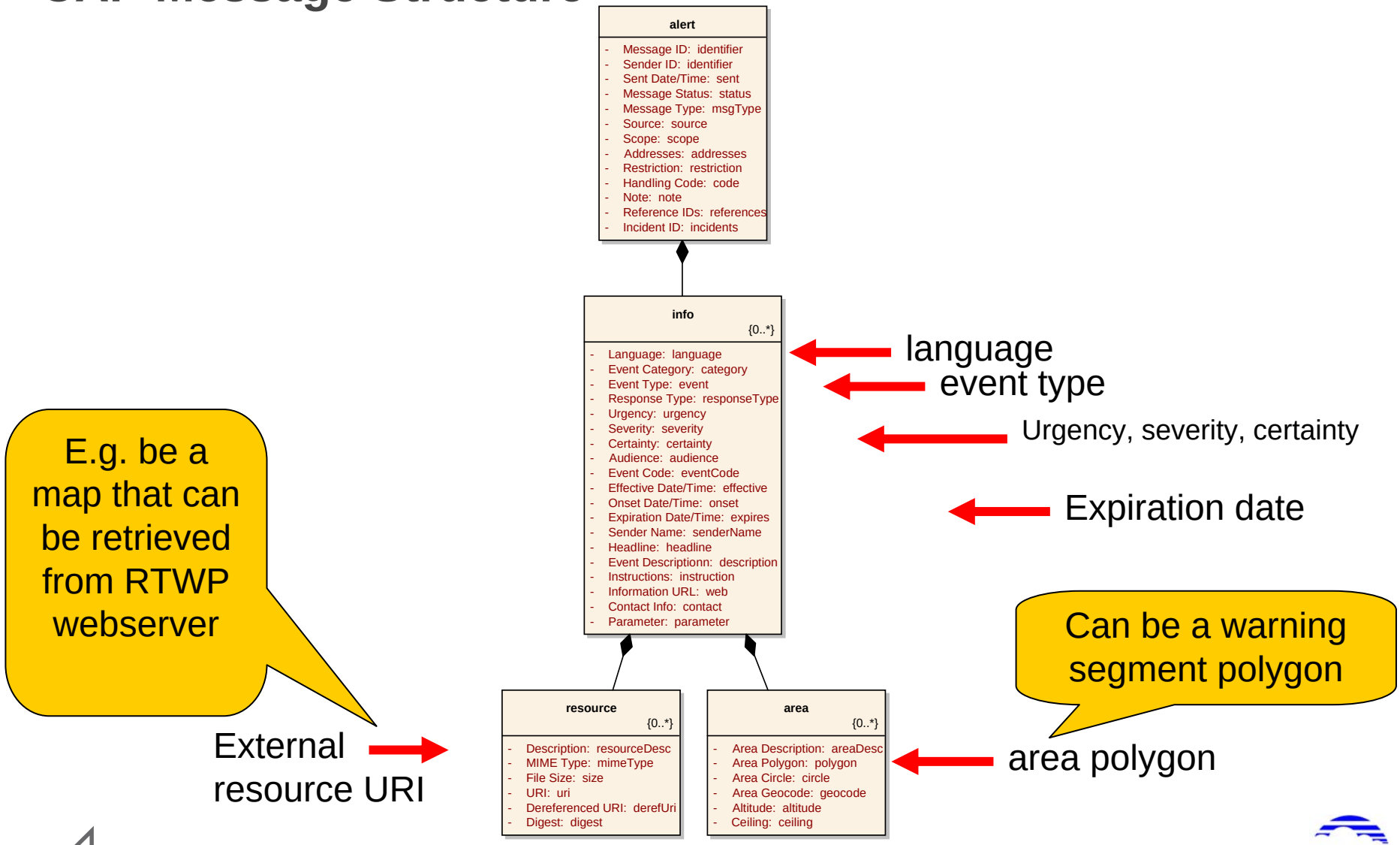
- simplified



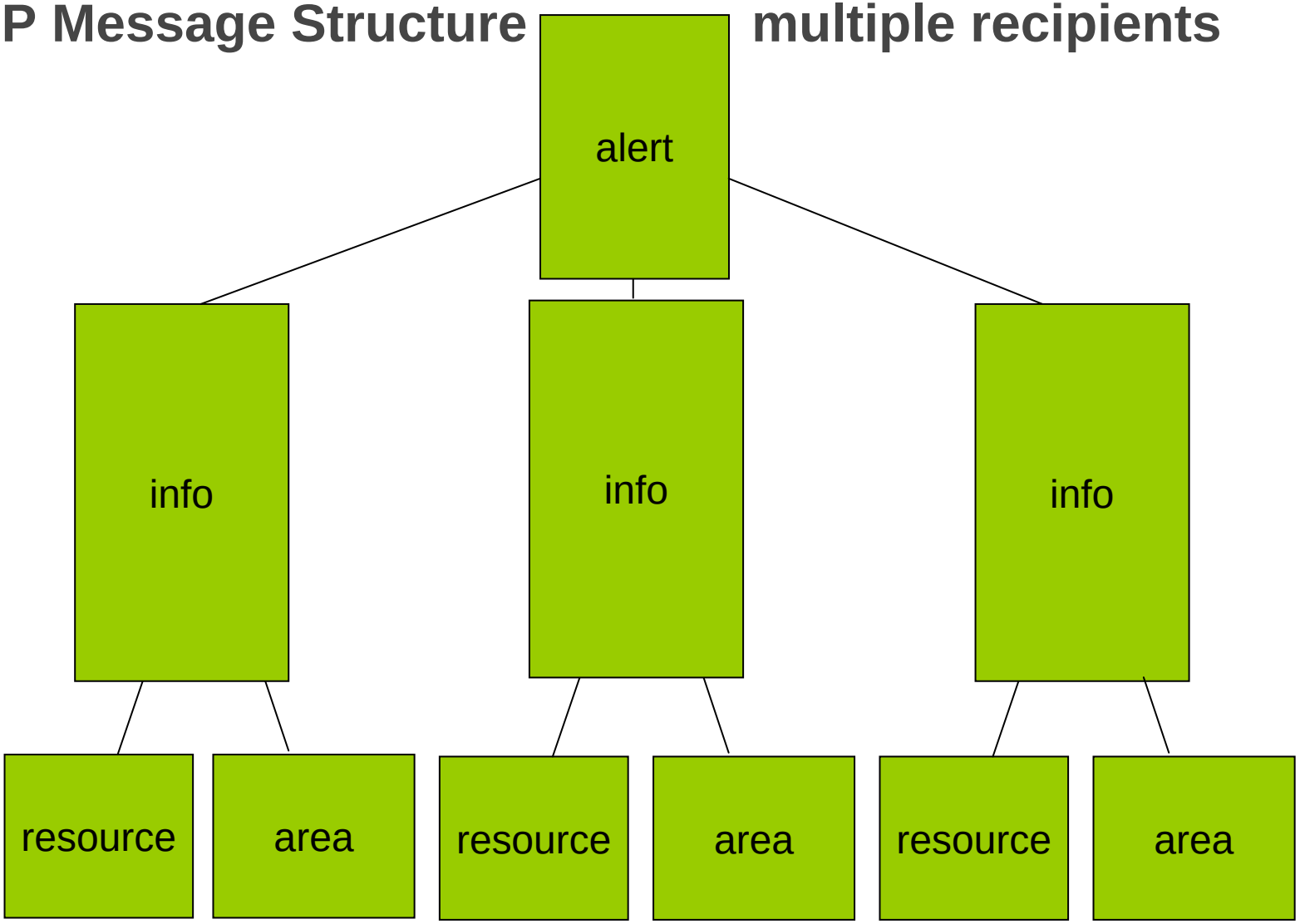
optional

optional

CAP Message Structure

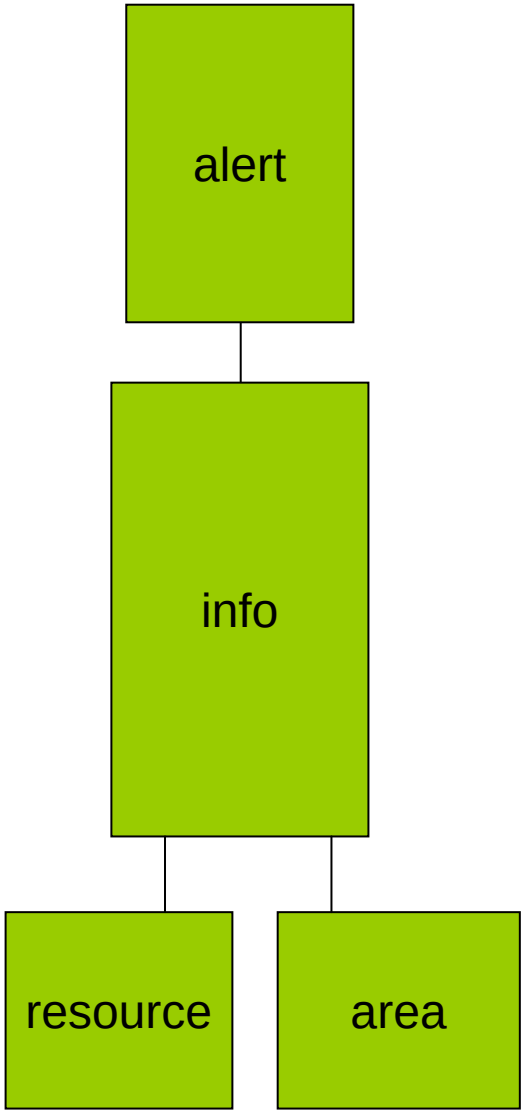


CAP Message Structure multiple recipients



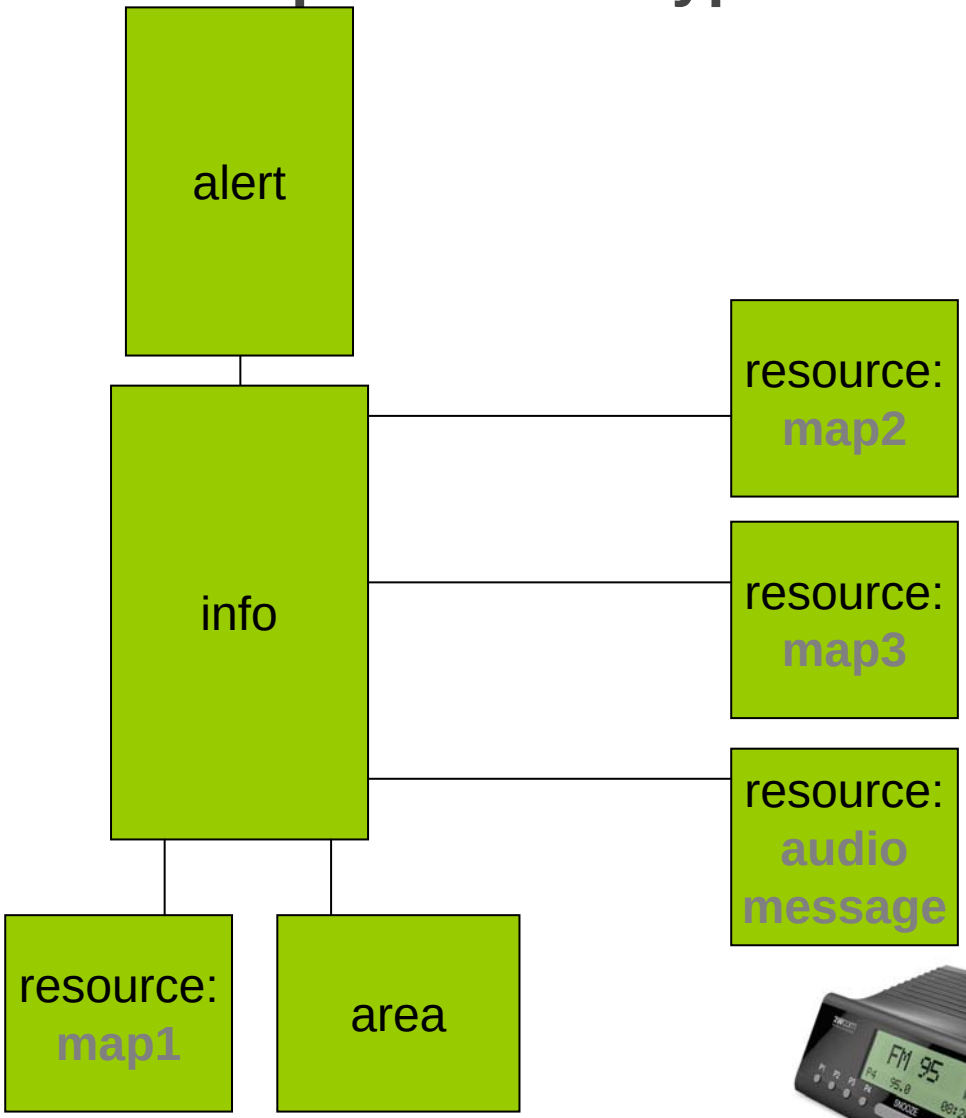
CAP Message Structure

- simplified



CAP Message Structure: multiple content types

- simplified
- multiple resource parts



IOTWS RTWP Support

- InaTEWS DSS is prepared for future RTWP extensions (up to Level 3)
- Future support for information exchange on all levels based on relevant standards

Other warning centers (national/international)

Exchange of Warning Information

(CAP, EDXL,TWML, ...)

Exchange of Situation Assessments, Risk and Vulnerability Information, ...

Risk- & Vulnerability Modelling

Geospatial Data Repository

(CAP, EDXL,TWML, OGC, ...)

Exchange of Sensor Data

(OGC, ...)

Other warning centers (national/international)

Int. watch products: technical levels of data exchange

- *CAP can perform this way*:

Level	Data exchanged	Example tech. Solution/protocol
RTWP Level 1/2	Warning message	**CAP**, TWML, EDXL
RTWP Level 3	Situation data (e.g. risk, inundation, ...)	**CAP**, TWML, EDXL, OGC
Inter-System communi-cations	Sensor data	OGC - SWE

CAP-based Activation of Devices*

CAP is often used to activate digital devices (to display or distribute warnings)

Interfaces between the CAP messaging (transport) infrastructure and the activated device or system have three components:

- **CAP Messaging Client** - mechanism for obtaining individual CAP messages from the infrastructure. Sometimes referred to as the "CAP client" part of the interface.

- **CAP Policy Filter** - Logic that determines whether an individual CAP message is appropriate for action by the device or system served by this interface. May include
  - geospatial ("Is this alert for my area?"),
  - source ("Is this from somebody I'm supposed to listen to?"),
  - threshold ("Is this alert above my urgency/severity/certainty thresholds for activation?")
  - or other factors derived from the CAP message.
  - It also may consider "extrinsic" factors such as time of day, current state of the target system, etc.

- **Device/System Actuator** - Transforms any message that passes the policy filter stage into a form acceptable to the target system;
  - e.g., a switch closure for a light or siren,
  - a formatted text command string for a digital device,
  - an audio output to feed radio broadcasts, etc.

* http://www.incident.com/cookbook/index.php/Creating_CAP_Applications#CAP-based_Activation_of_Devices

InaTEWS Dissemination Interface: Status and Outlook

- Central Component for Tsunami Early Warning Systems to
  - automate targeted product (message) generation

- Future Extensions for
  - additional recipients
  - additional message types

- Support for interoperability and reusability
  - use of open standards like the CAP protocol

- CAP can be embedded into messages further structuring the information in the message payload
  - This further improves the automatic understanding of a message.

Links and contents: OASIS

Oasis Common Alerting Protocol, v.1.1

from Oasis Standard CAP-V1.1, October 2005
http://www.oasis-open.org/committees/download.php/14759/emergency-CAPv1.1.pdf :

Document Identifier:
CAP-V1.1

Location:
http://www.oasis-open.org/apps/org/workgroup/emergency/download.php/14205/emergency-CAPv1.1-Committee%20Specification.pdf
Technical Committee:
OASIS Emergency Management TC
Editor(s):
Elysa Jones, Warning Systems, Inc <ejones@warningsystems.com>
Art Botterell, Individual <acb@incident.com>

About OASIS

„OASIS (Organization for the Advancement of Structured Information Standards) is a not-for-profit, international consortium that drives the development, convergence, and adoption of e-business standards. Members themselves set the OASIS technical agenda, … Approved OASIS Standards include AVDL, CAP, DITA, DocBook, DSML, ebXML CPPA, ebXML Messaging, ebXML Registry, OpenDocument, SAML, SPML, UBL, UDDI, WSDM, WS-Reliability, WSRP, WS-Security, XACML, XCBF, and XML Catalogs.
http://www.oasis-open.org

The OASIS Emergency Management Technical Committee remains open to new participation and particularly seeks input from those in the international community to advance CAP in alignment with other specifications in its Emergency Data Exchange Language (EDXL) suite. All interested parties are encouraged to exchange information on implementing CAP via the cap-dev mailing list (http://www.oasis-open.org/mlmanage/). As with all Consortium projects, archives of the OASIS Emergency Management Committee's work are accessible to both members and non-members, and OASIS hosts an open mail list for public comment on the standard."
(http://xml.coverpages.org/CAPv11-OASIS-Standard.html)

Links and contents: CAP

Common Alerting Protocol (CAP)

“The Common Alerting Protocol "is an open, non-proprietary standard data interchange format that can be used to collect all types of hazard warnings and reports locally, regionally and nationally, for input into a wide range of information-management and warning dissemination systems. The specification has been under development since 2001 through the efforts of an international ad-hoc Common Alerting Protocol Technical Working Group composed of technical and public safety experts. The developers have implemented the protocol in a number of prototype demonstrations. The chief benefits for public safety include (1) better coordination of warnings to the public across the wide range of available warning and notification systems; (2) reduction of workload on warning issuers, since a single warning message is compatible with all kinds of warning delivery systems; (3) enhanced situational awareness, since CAP will permit the aggregation of all kinds of warning messages from all sources for comparison and pattern recognition."

CAP website

CAP Version 0.7, March 07, 2003:

- Data Dictionary. [cache]
- Message Diagram
- XML Schema [cache]

"OASIS Standardizes Emergency Data Exchange Language (EDXL) Specifications."

“CAP Cookbook. "A collection of application notes, supporting documents and commentaries about the Common Alerting Protocol. This is a wiki, a collaborative editing environment, which means that the documents here are undergoing editing and revision by a variety of authors." The use of this resource is not restricted to OASIS members, as explained in the announcement.

"Common Alerting Protocol (CAP) Provides XML Interchange Format for Public Safety Reports."

(http://xml.coverpages.org/emergencyManagement.html)

Tsunami Warning Markup Language TWML

- Tsunami Warning Markup Language
  - Tsunami Warning Markup Language (TWML) is a Standards-based language for Tsunami Bulletins.
  - Can be used to embed CAP messages
  - As such it structures the message payload – giving a meaning of the message content itself to a machine receiving this message

- This document seeks to establish structured semantic data models for tsunami bulletins. The benefits of structured semantic data models include:
  1. less ambiguity of tsunami bulletin contents than with purely textual bulletins, as elements of structured documents can have well-defined semantics;
  2. improved consistency of bulletins across the different tsunami warning centres;
  3. improved opportunities for machine processing of bulletins, allowing bulletins to be generated, checked/validated, disseminated, combined/aggregated with related information, and mapped to visual (or other) presentations suitable for decision makers and the public in a more efficient manner, allowing crucial information to reach the affected public faster. *

- http://nicta.com.au/__data/assets/pdf_file/0007/7567/TsunamiWarningML-V10.pdf
- http://www.ogcnetwork.net/node/378
- NICTA is Australia's Information and Communications Technology (ICT) Centre of Excellence

Wrap-up: CAP at a glance

- CAP is standardized, yet flexible enough to address the diverse needs of a variety of international systems and recipients

- CAP can be used to address up to level 3 of RTWP and NTWC

- **SUMMARY:**
  - Flexible **geographic targeting** using latitude/longitude shapes and other geospatial representations in three dimensions
  - **Multilingual** and **multi-audience** messaging
  - Phased and delayed effective times and expirations
  - Enhanced message **update and cancellation features**
  - Template support for framing complete and effective warning messages
  - Compatible with **digital encryption and signature** capability
  - Facility for **digital images and audio**

Warning segments vs. forecast points

- InaTews uses *Warning Segments* (WS)
  - Warning Segments are the smallest units to which messages can be addressed
  - WS are always a geographic region of a pre-defined extent

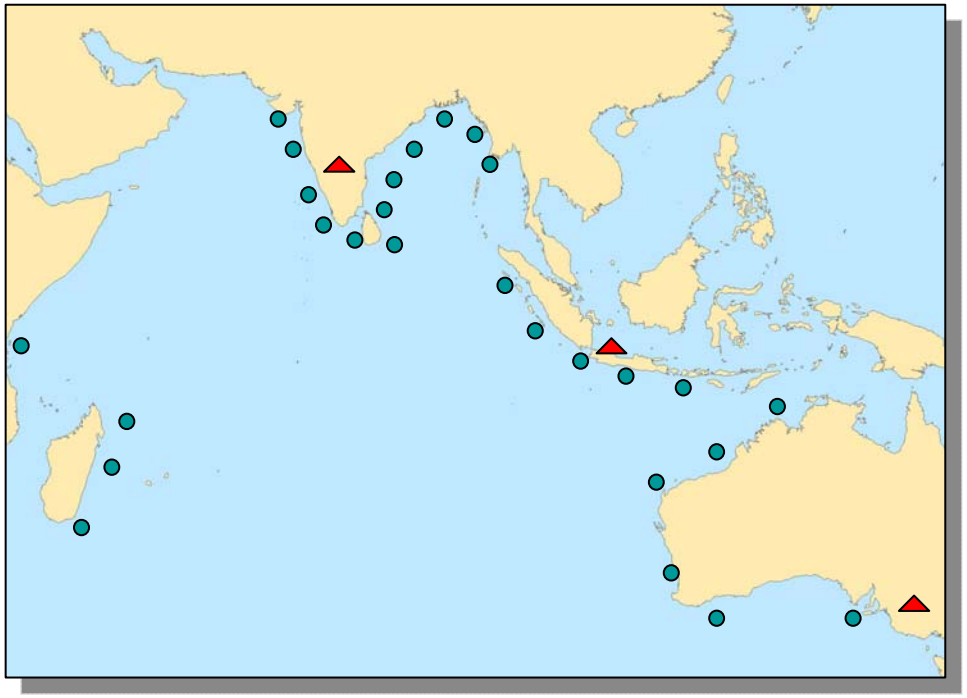
- *Forecast points* are geographically referenced points for which
  - wave heights
  - arrival times
  - additional information (e.g. risk information, inundation)

  can be forecasted

- This approach could be used in IOTWS context as well

Use of forecast points

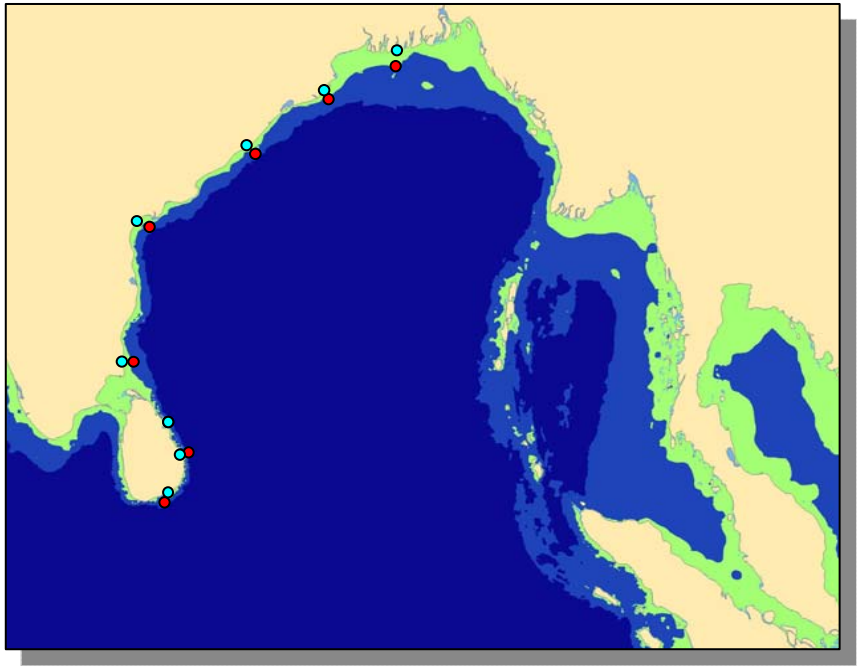
- Forecast points can be used as the locations to be notified of an event
- These would be the individual country‘s duty to define
- Depend on hydraulic model: shallow water or coast point? (both shall be possible)



Forecast points

- Proposal to allow complimentary sets of forecast points

1. Forecast points **at sea**
2. Forecast points **on the coastline** (arrival time, wave height at coast)
3. Forecast points **on land** (inundation, risk, vulnerability etc.)



Maps for warnings (2)

- Including maps in watch messages is feasible even in small bandwidth connections.

- raster format (recommended lossless format PNG)
- Vector format (recommended SVG/SVGZ; scaleable vector graphics)