WORLD TELECOMMUNICATION
DEVELOPMENT CONFERENCE

ITU WTDC
BAKU 2025
17–28 November 2025
Baku, Azerbaijan

Early Warning information dissemination and communication, Pillar 3 of the EW4ALL initiative

Workshop on Resilient Infrastructure for Effective Early Warning Dissemination

September 2025
Sendai, Japan

Scope

- EW for DRR in ASP region
- Need for CAP in EW dissemination
- CAP Infrastructure, Integration and Policy
- Mobile-based Early Warning Dissemination
- Use of AI in EW Dissemination
- Partnerships and Collaboration

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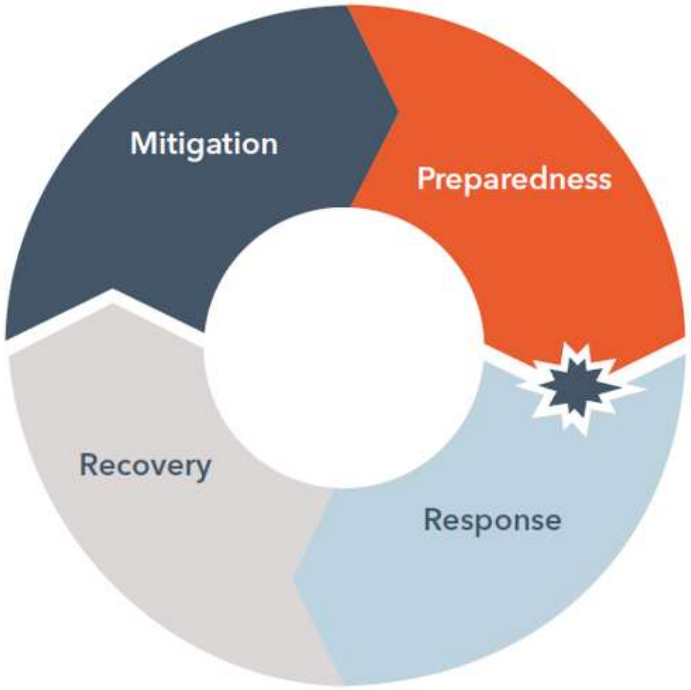
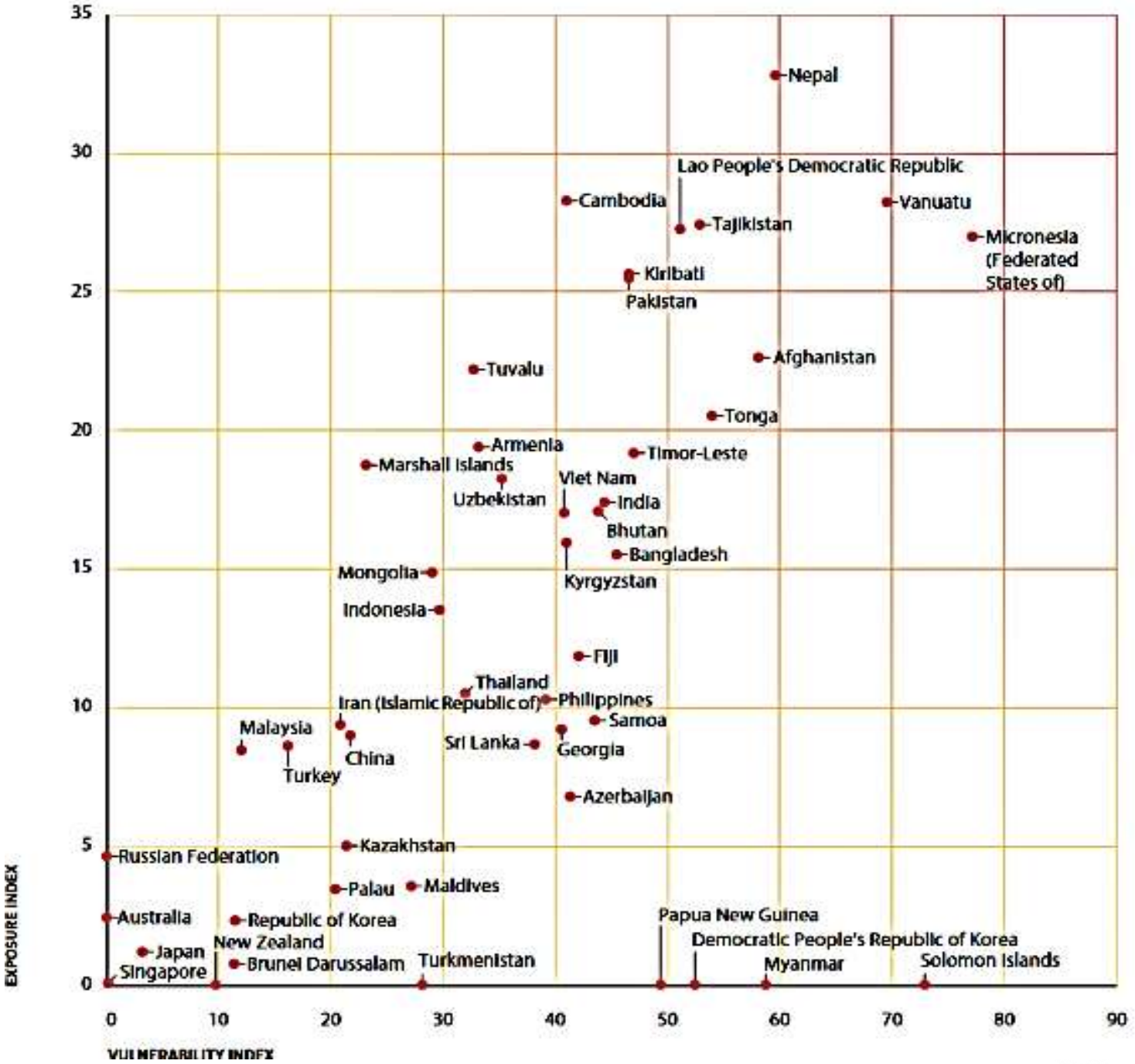
Vulnerability v/s Exposure





Source: ESCAP

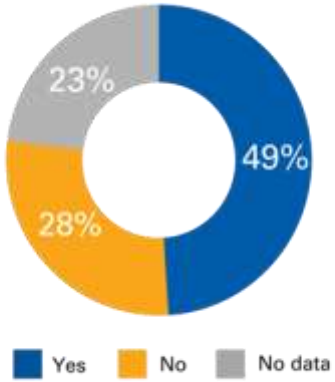
However,

Only half of the world is covered by multi-hazard early warning systems (MHEWS).

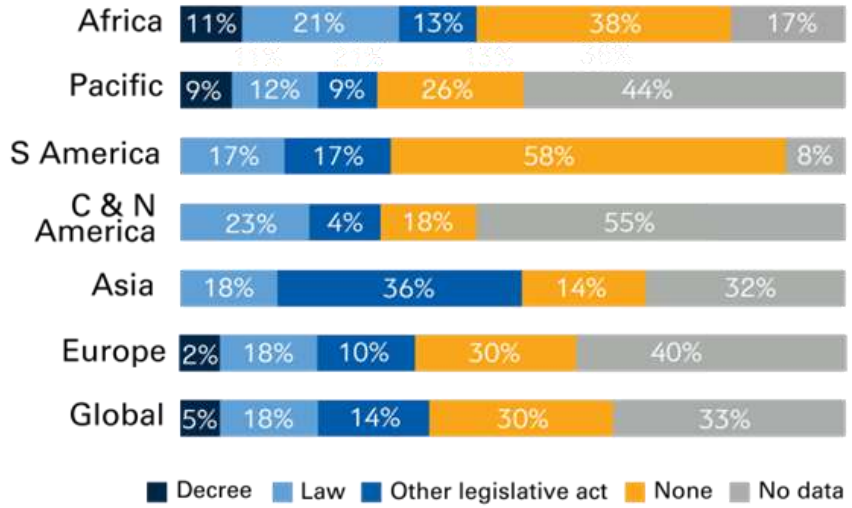
Global incapacity to translate early warning into early action.

Extreme weather events continue to cost the countries billions of dollars in economic losses.

State of Multi-hazard Early Warning Systems (MHEWS) Globally



Percentage of WMO Members reporting to have MHEWS



Percentage of Members reporting to have legislation on MHEWS

An enhanced data collection campaign through WMO Performance Monitoring System conducted (since March 2022) shows that significant gaps remain globally.

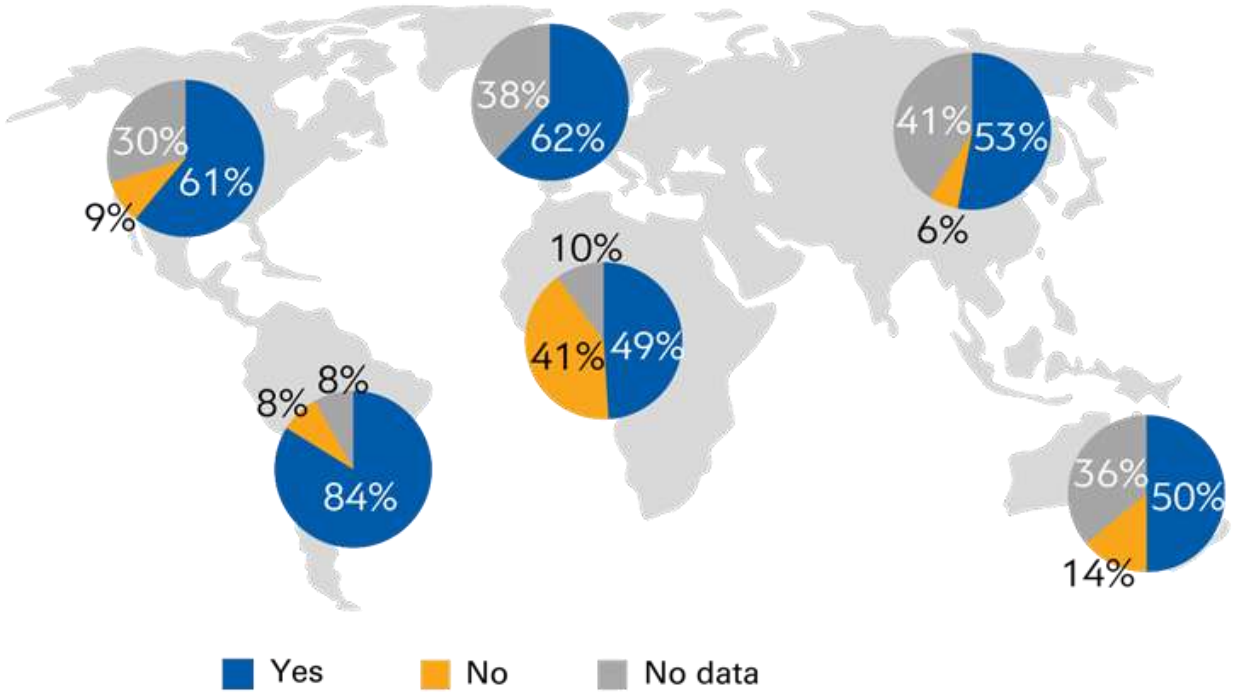
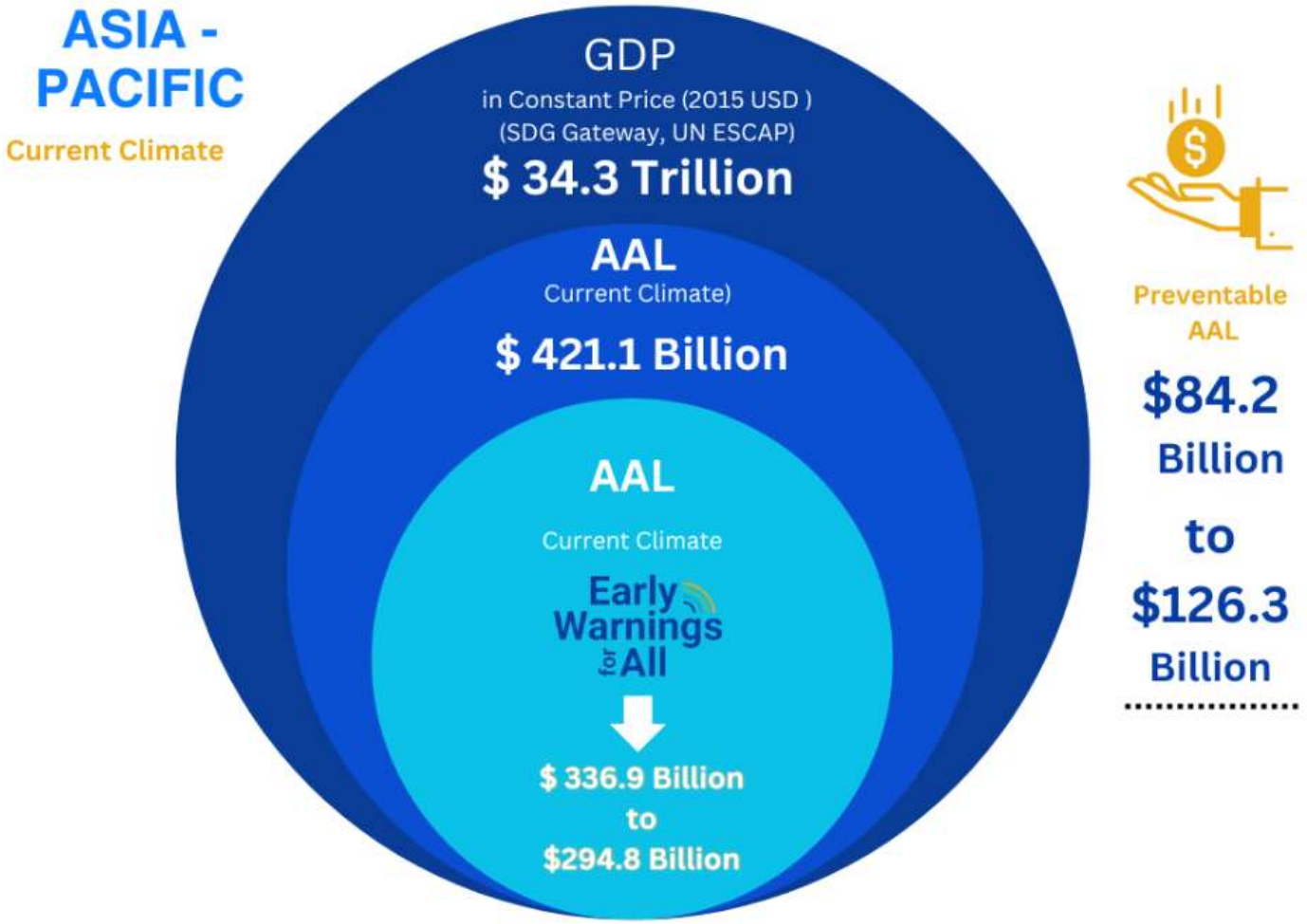


Figure 4: Percentage of countries reporting to have Standard Alerting Procedures (SAPs)

Asia-Pacific: Average Annual Losses



Studies have outlined how only a **24-hour warning** of an oncoming storm or heatwave **could reduce damages by**

30%

and how **flood warnings could alone avoid**

32.85 %

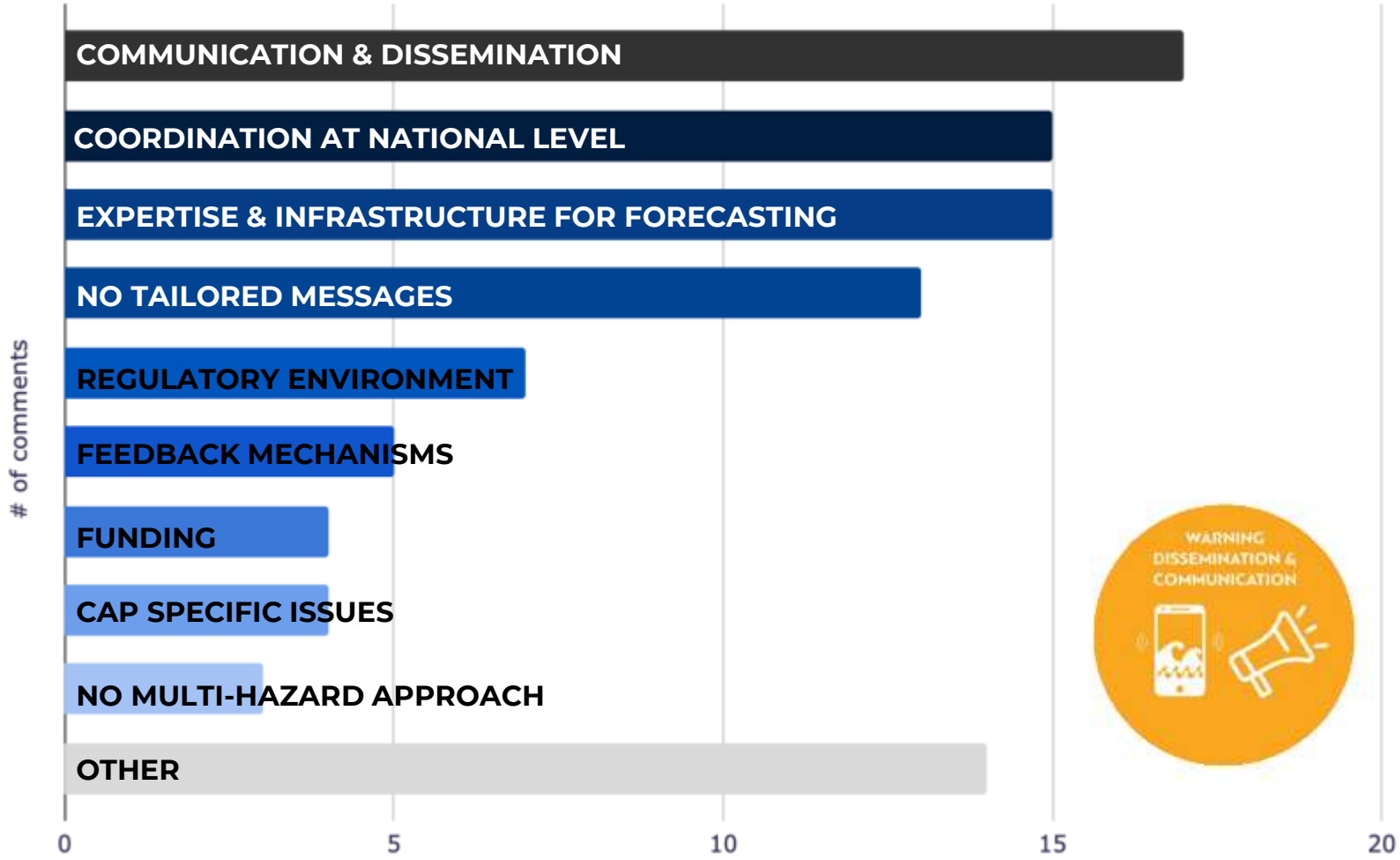
of damages

(Global Commission on Adaptation, 2019; Pappenberger and others, 2015).

Source: ESCAP

Warning Dissemination & Communication

-- **Is the main challenge for EWS,** according to research conducted in 13 countries in Africa & Caribbean



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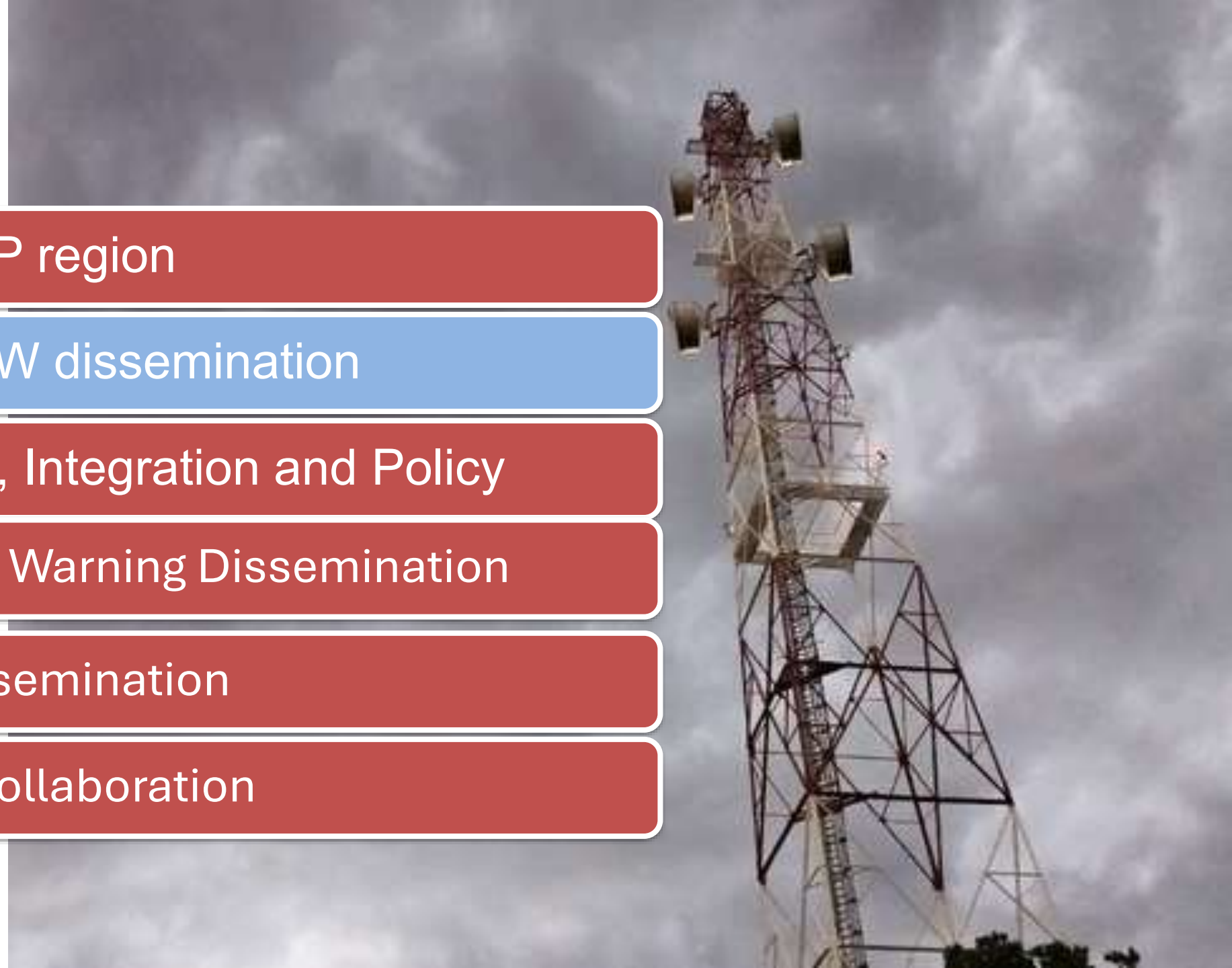

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Emergency Broadcast Example

Emergency Broadcast Example

How would you compare two approaches?

Reaction

- ✓ Need for <u>time sensitive coordinated national approach</u>

What IF Questions?

- ➢ Someone is not listening/viewing the regular broadcast

OR

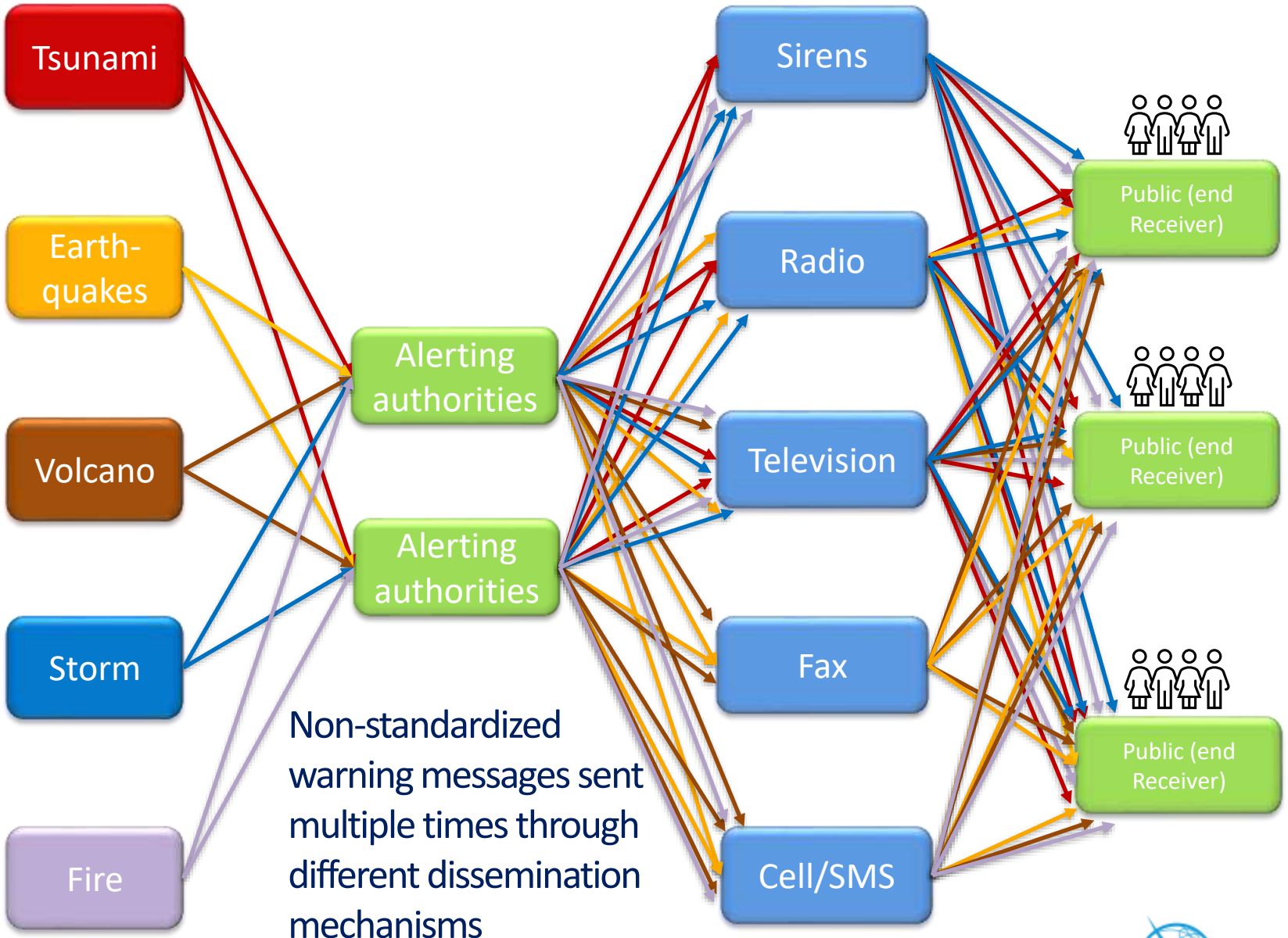
- ➢ Consumes information through another preferred medium?

The Challenge of Alerting without CAP

All governments have various public alerting systems. It creates a "public alerting patchwork":

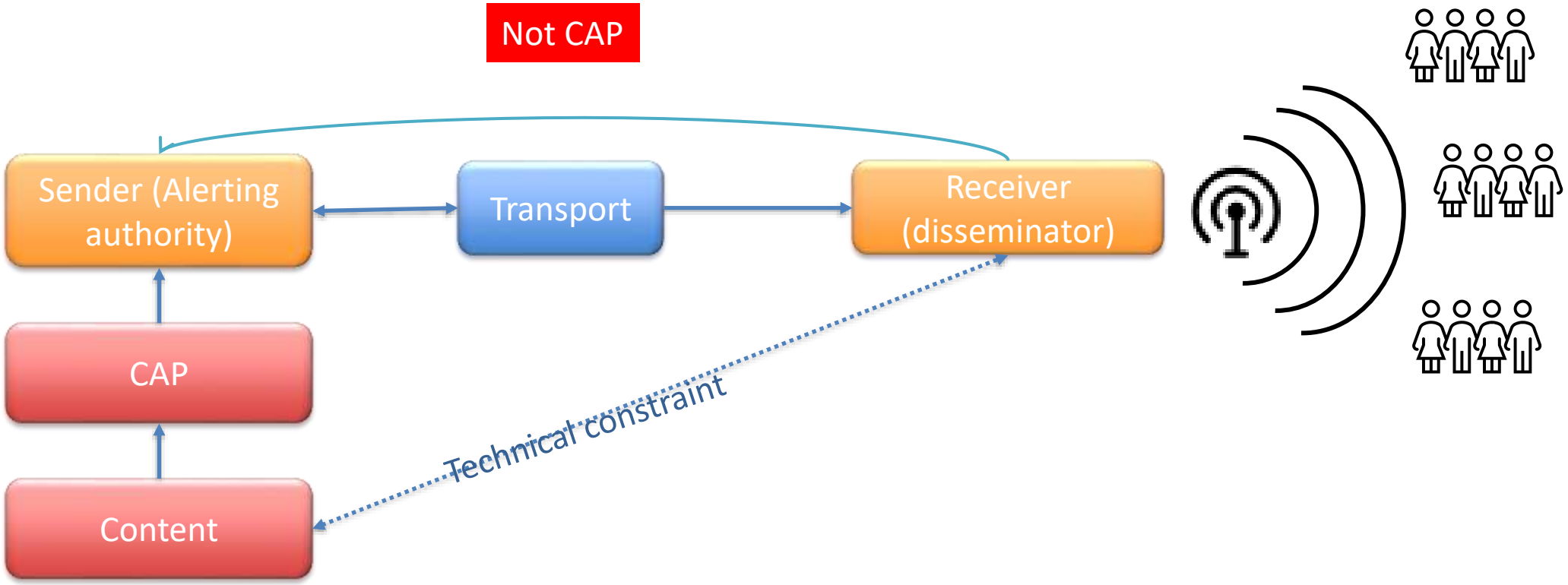
- multiple alerting authorities send multiples alerts through multiple channels (first receivers or disseminators) to multiple audiences (end receivers).

This can lead to missed or misdirected alerts and confusion.

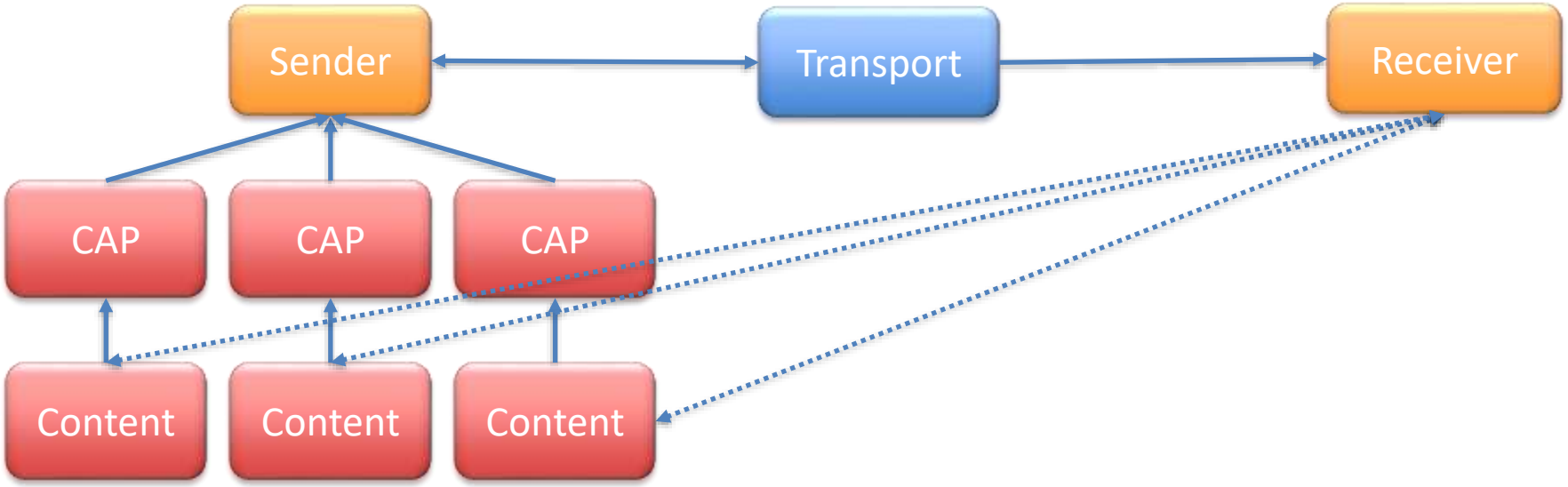


Overview of the flow

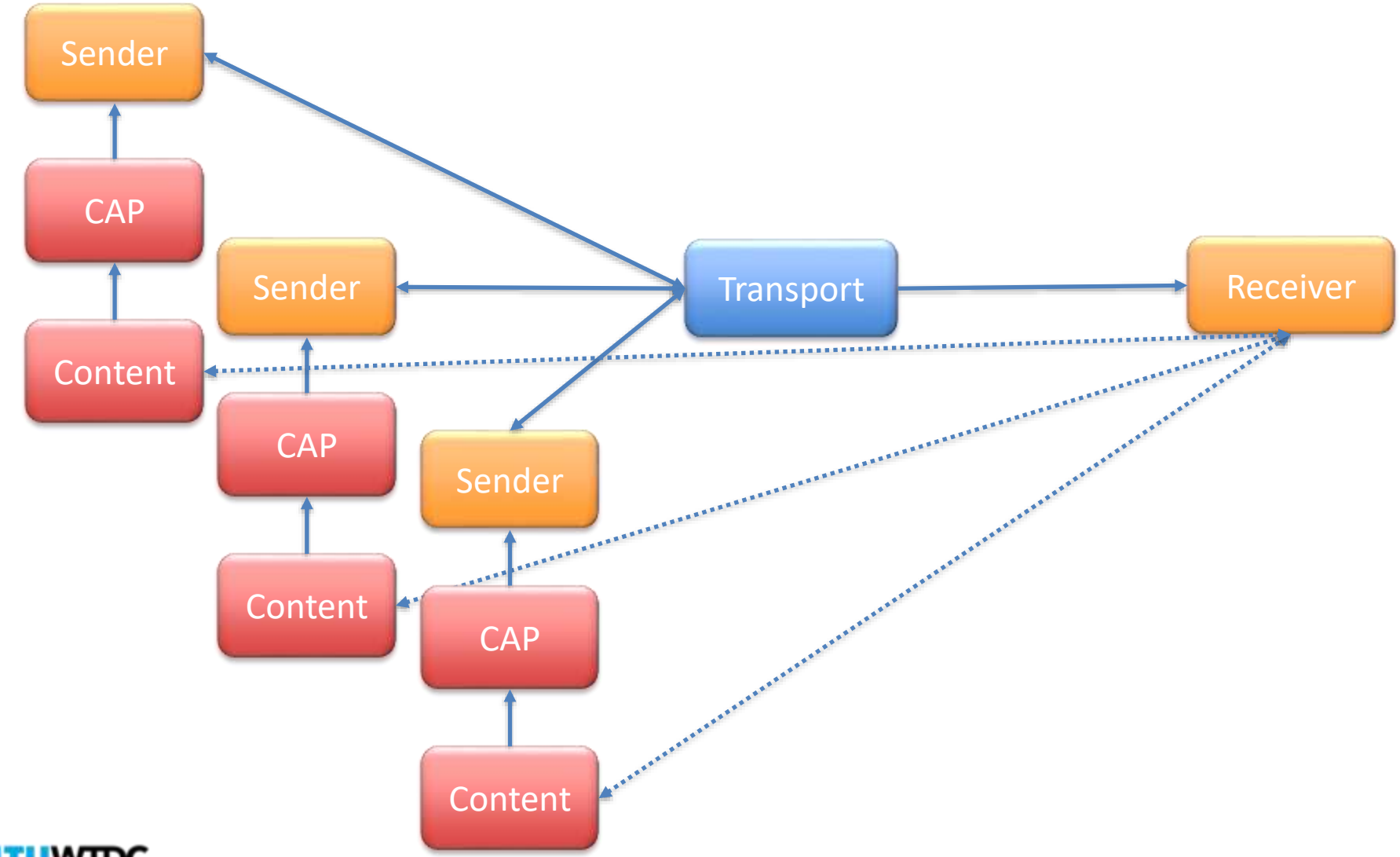
Understanding how to share a CAP information



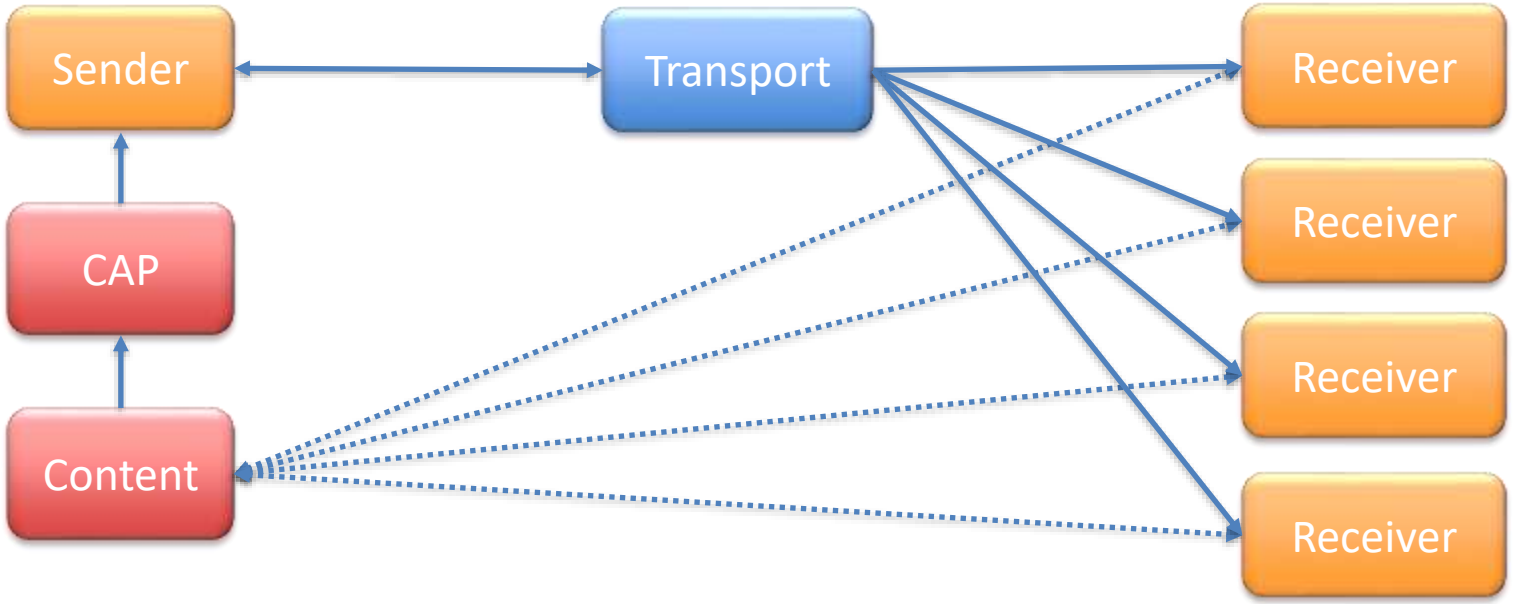
Overview multiple CAP



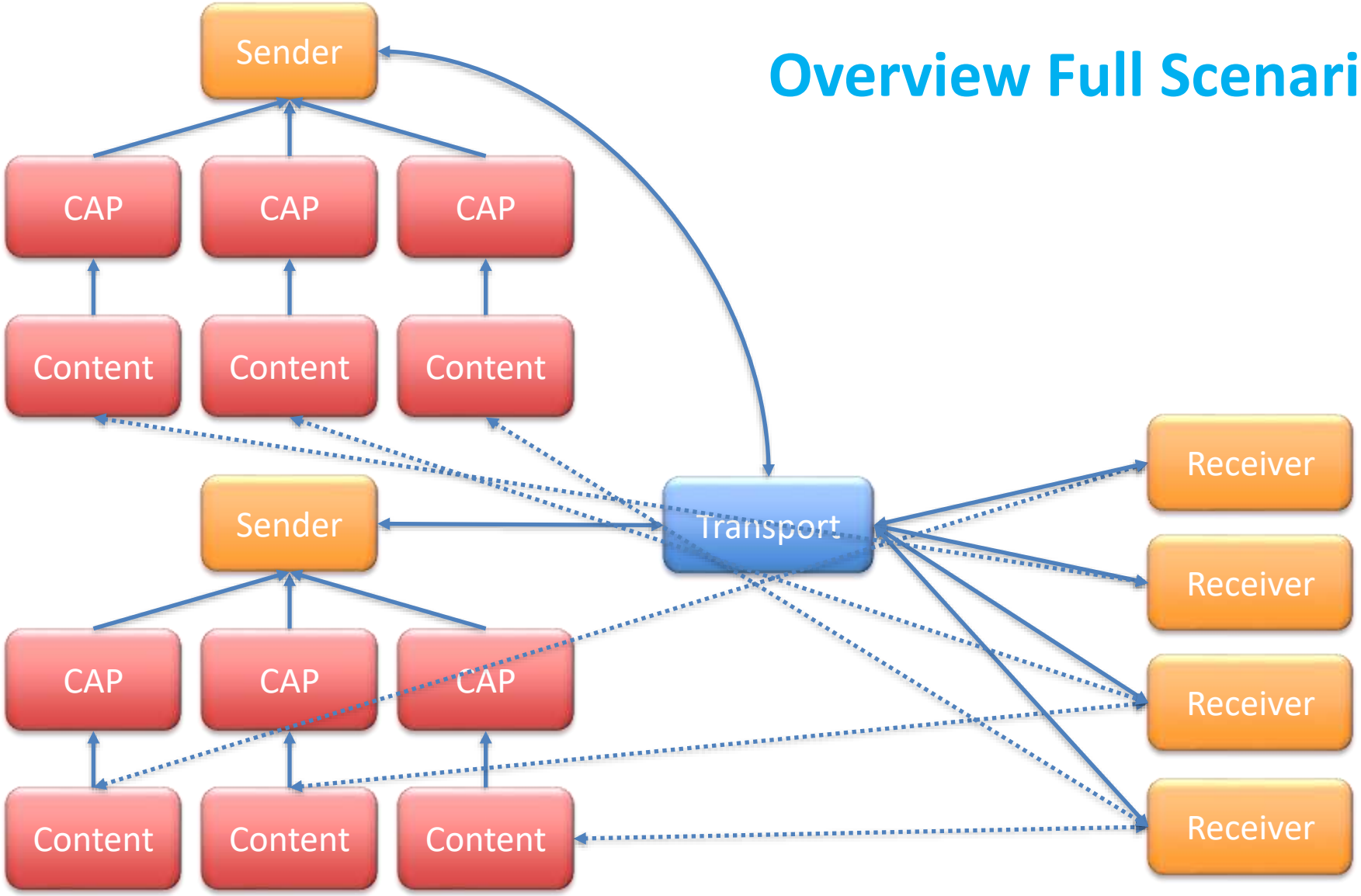
Overview Multiple Senders



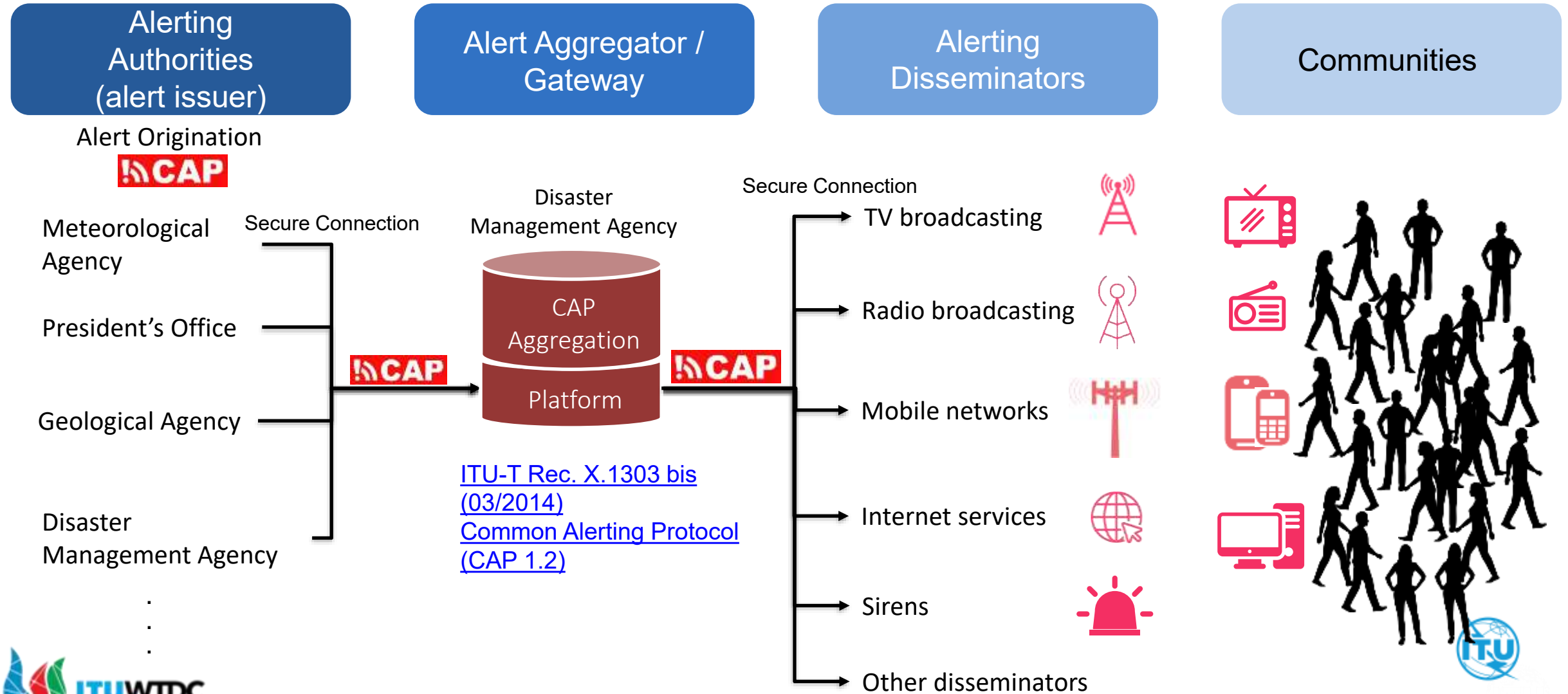
Overview Multiple Receivers



Overview Full Scenario



Early Warning System and CAP



[ITU-T Rec. X.1303 bis (03/2014) Common Alerting Protocol (CAP 1.2)]

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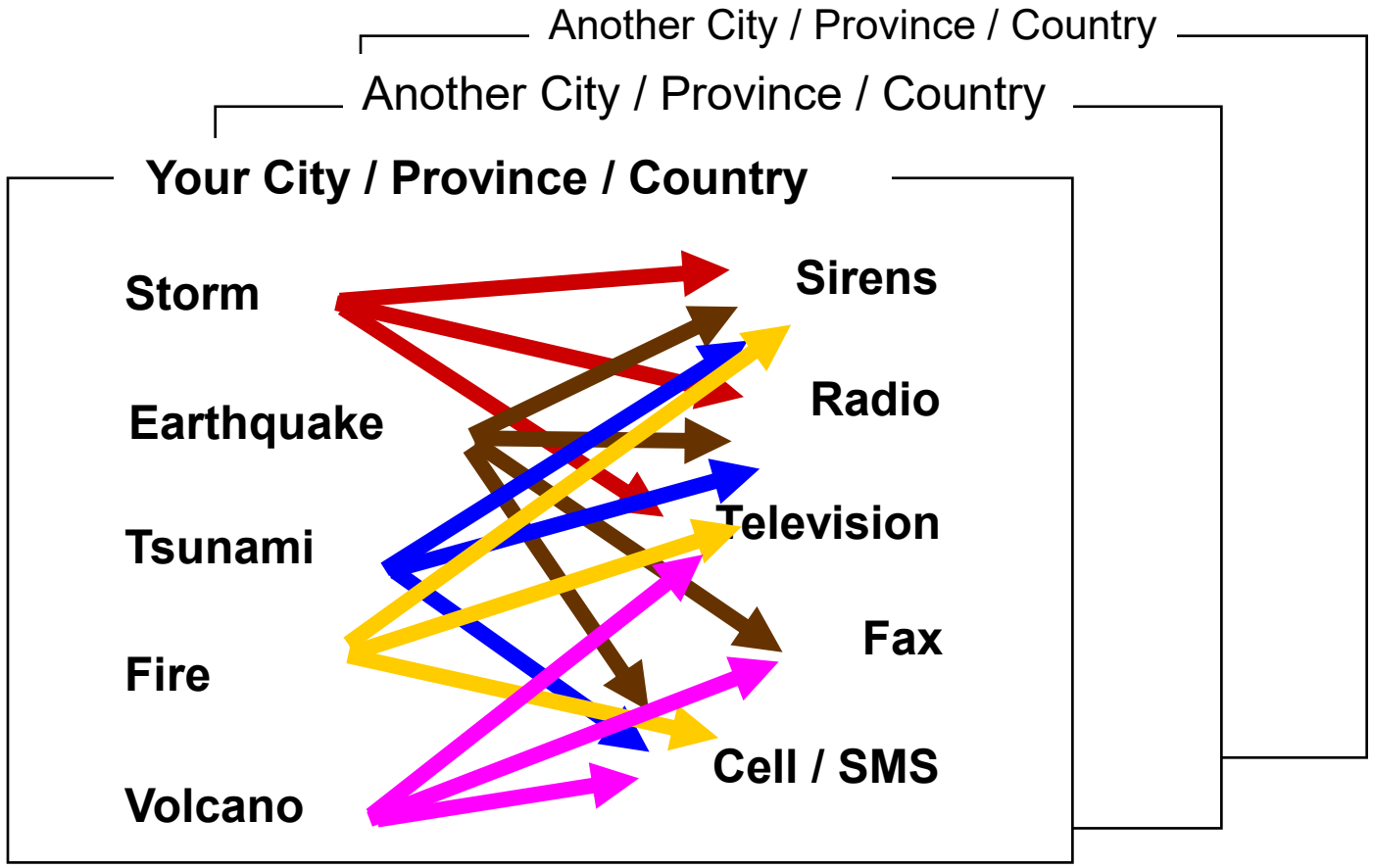
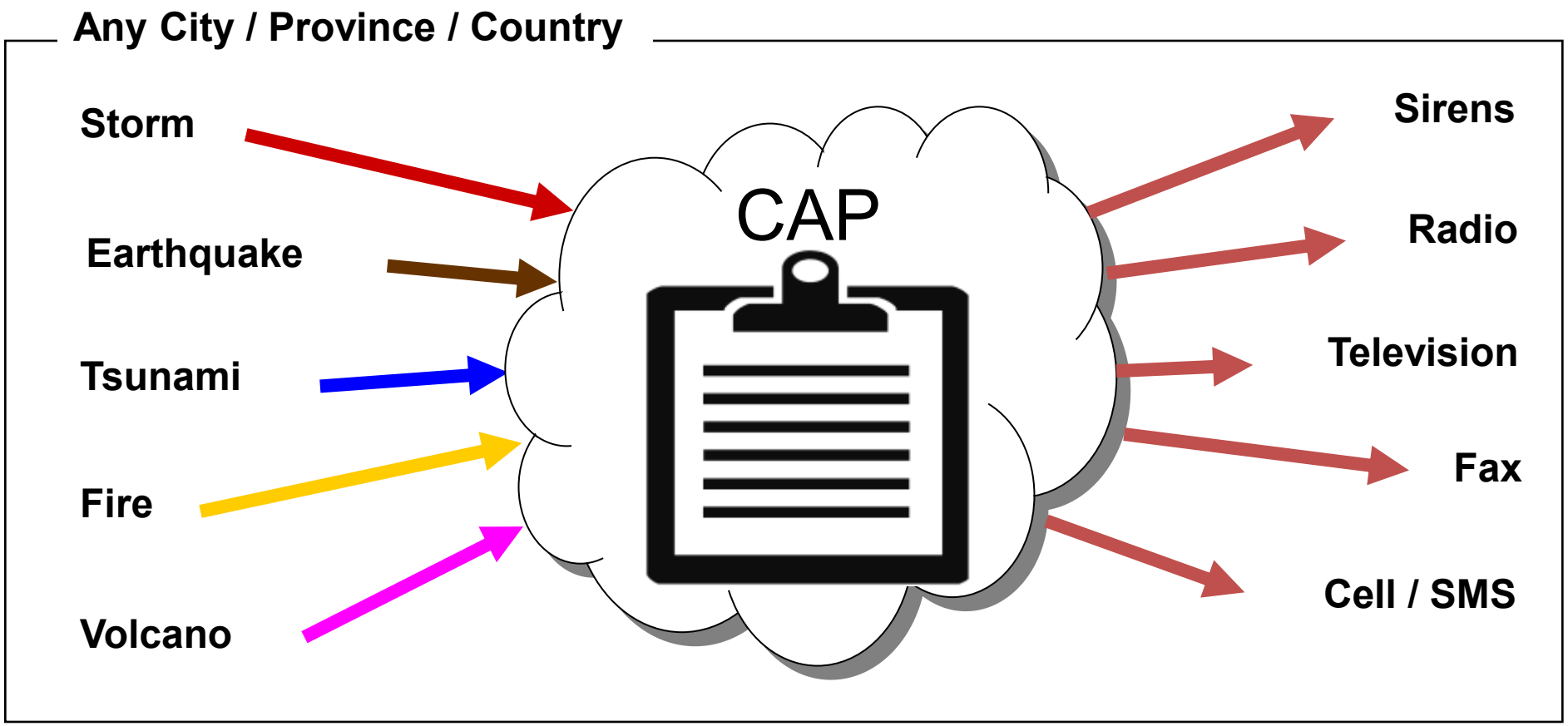
Benefits of implementing CAP

Public alerting patchwork…



Benefits of implementing CAP

All-hazard, All-media message format



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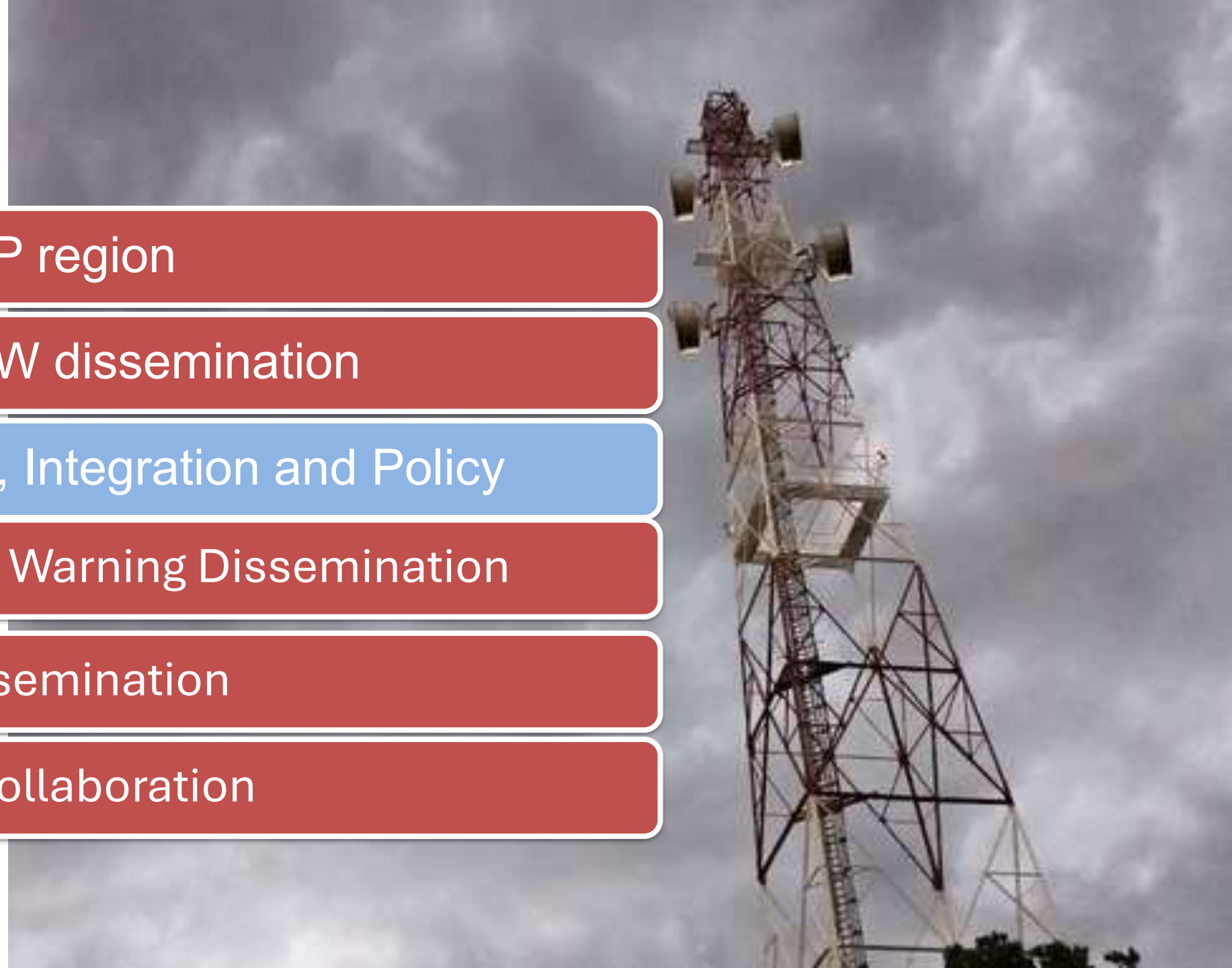

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Integrating Common Alerting Protocol (ITU-T X. 1303)

International standard format for emergency alerting to ensure the interoperability and consistency of alerts via different communication networks.

- **Requires an alerting agency**
- **Requires tools to be effective**
  - *Input information such as meteorological forecasts and monitoring systems*
  - *Tools and systems for implementation such as maps, CAP tools, integration with operators and other actors*

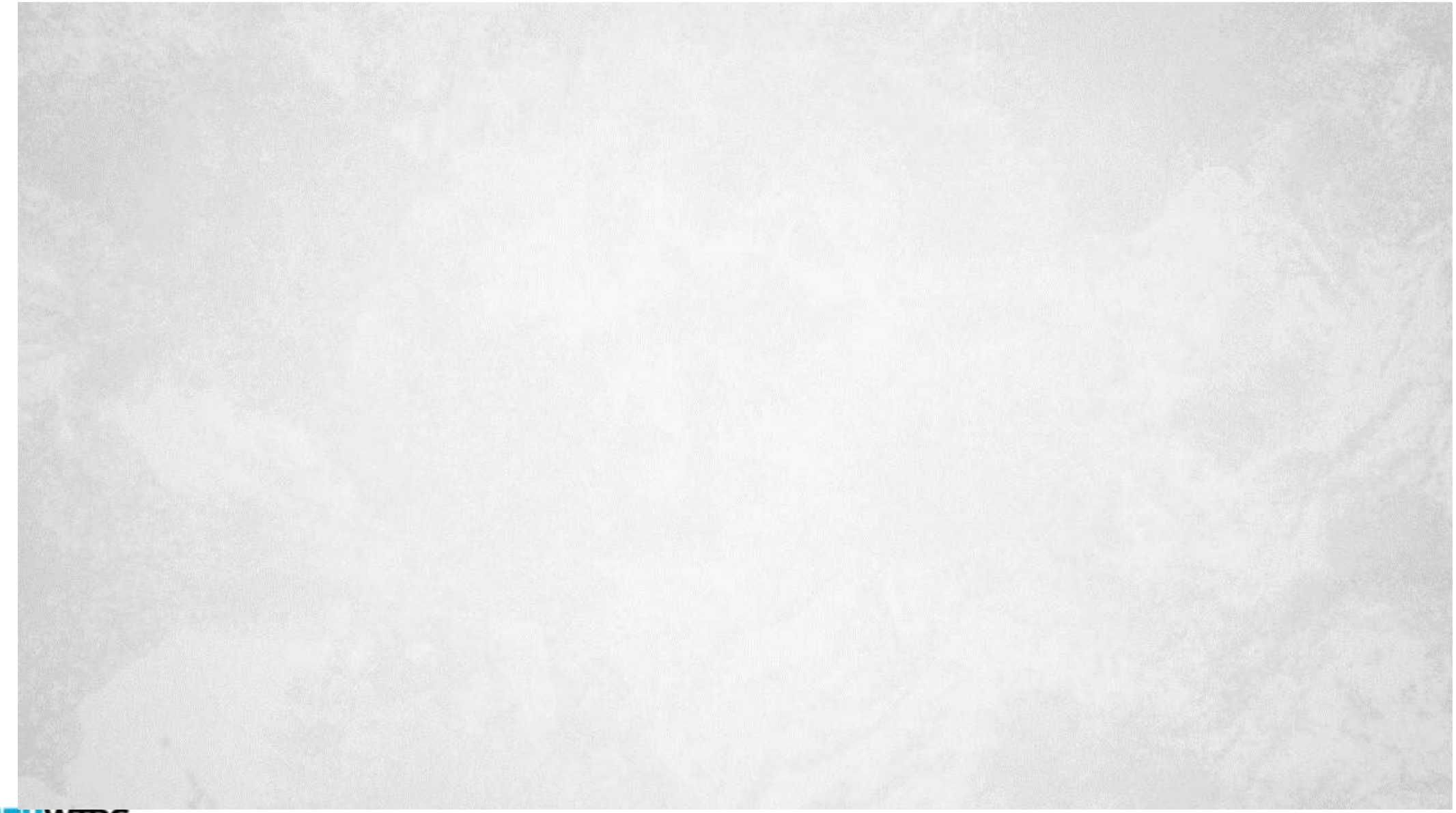
- ✓ **OVER ANY AND ALL MEDIA**
- ✓ **ABOUT ANY AND ALL KINDS OF HAZARD**
- ✓ **TO ANYONE**

Introduction to Common Alerting Protocol

Some history …

- **2000**: The U.S. National Science and Technology Council's (NSTC) report "Effective Disaster Warnings" recommended the development of a standard method to collect and relay instantaneously and automatically all types of hazard warnings across various dissemination channels.
- **2001**: an international independent group began specifying and prototyping the CAP data structure based on the recommendations of the NSTC report.
- **2004**: CAP v1.0 was developed and ratified as an OASIS (Organization for the Advancement of Structured Information Standards) Standard.
- Updates:
  - 2005: OASIS Standard CAP v1.1
  - 2010: OASIS Standard CAP v1.2
- Adopted by the International Telecommunication Union – Standardization Sector (ITU-T) in 2006 and updated in 2014 as Recommendation ITU-T X.1303bis Common Alerting Protocol (CAP 1.2) (03/2014).
- Today, CAP has been extensively adopted worldwide.

CAP – Common Alerting Protocol



Definitions

- **Alert Origination:** Usually, software that provides alerting authorities the ability to compose, send and receive CAP-based messages.
- **Receiver**: Disseminator
- **Sender:** Alerting authority
- **Alerting Authority:** are those government agencies that have been given the authority to initiate (issue) alerts to be disseminated to the public at risk of an imminent disaster, or to initiate (issue) alerts to disseminate detailed public safety messages.
- **Transport:** Ways of transmitting the information.
- **CAP Feed:** Continuously available or regularly updated data source that distributes CAP messages. It provides a structured stream or repository of CAP-formatted alerts, allowing automated systems, applications, or users to access, retrieve, and process emergency notifications in real time.
- **CAP Hub:** Centralized platform that aggregates Common Alerting Protocol (CAP) alerts from various official alerting authorities and republish them to its subscribers.

XML: a Digital Document Format

CAP alert messages are created and disseminated using XML (eXtensible Markup Language).

XML is designed to store and transport information via the internet. It contains information readable both by humans and software.

```
<?xml version="1.0" encoding="UTF-8"?>
<note>
   <to>John</to>
   <from>Jane</from>
   <heading>Weather Report</heading>
   <body>This weekend's forecast is for clear and sunny skies.</body>
   <importance>Not important</importance>
</note>
```

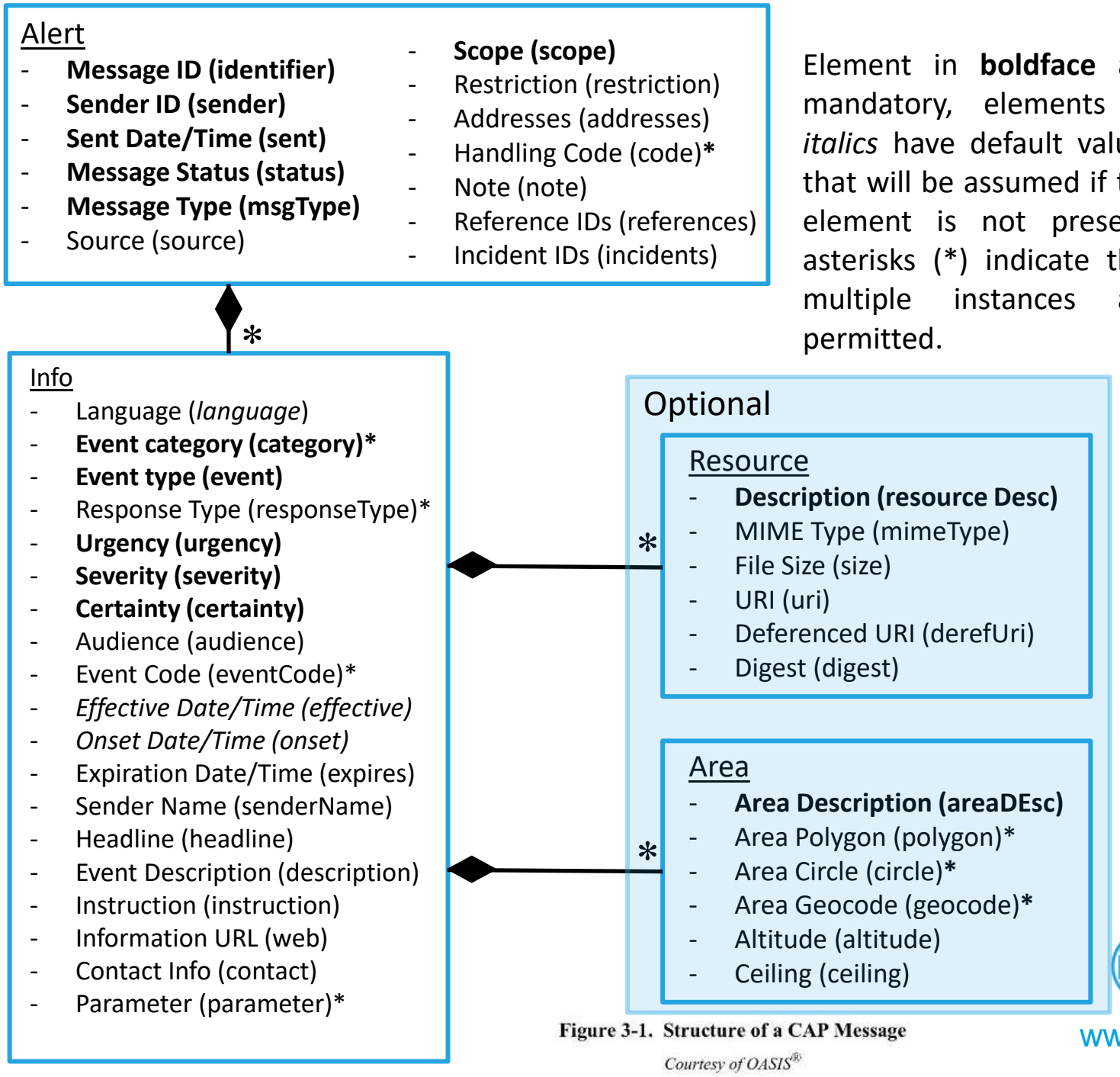
Sample CAP Message

```
<alert xmlns="urn:oasis:names:tc:emergency:cap:1.2">
  <identifier>urn:oid:2.49.0.1.840.0.4a7952ab2edbf8d01b2536baeb6010cd08e36524.001.1</identifier>
  <sender>w-nws.webmaster@noaa.gov</sender>
  <sent>2025-01-31T07:59:00-10:00</sent>
  <status>Actual</status>
  <msgType>Alert</msgType>
  <scope>Public</scope>
  <code>IPAWSv1.0</code>
  <info>
    <language>en-US</language>
    <category>Met</category>
    <event>Flash Flood Warning</event>
    <responseType>Avoid</responseType>
    <urgency>Immediate</urgency>
    <severity>Severe</severity>
    <certainty>Likely</certainty>
    <eventCode>
    ...
    </eventCode>
    <eventCode>
    ...
    </eventCode>
    <effective>2025-01-31T07:59:00-10:00</effective>
    <onset>2025-01-31T07:59:00-10:00</onset>
    <expires>2025-01-31T11:00:00-10:00</expires>
    <senderName>NWS Honolulu HI</senderName>
    <headline>Flash Flood Warning issued January 31 at 7:59AM HST until January 31 at 11:00AM HST by NWS Honolulu HI</headline>
    <description>FFWHFO The National Weather Service in Honolulu has issued a * Flash Flood Warning for... The island of Hawaii in Hawaii County * Until 1100 AM HST. * At 759
    AM HST, radar and rain gages indicated heavy rainfall over the west and south sides of the Big Island. Peak rain rates of up to 2 inches were moving onshore. Area streams
    remain elevated, and additional rainfall is likely to continue to move over the Big Island from the southwest this morning. HAZARD...Flash flooding caused by heavy rain.
    SOURCE...Radar and automated gauges. IMPACT...Flooding in drainages, streams, rivers, roads, properties, and other low-lying areas. Public road closures possible in some
    areas. Landslides are possible in steep terrain. * Some locations that will experience flash flooding include... Kailua-Kona, Captain Cook, Waikoloa Village, Kapaau,
    Pohakuloa Training Area, Honaunau, Kealakekua, Kainaliu, Honalo, Holualoa, Kahaluu-Keauhou, Wood Valley, Puuanahulu, Kalaoa, Pahala, Punaluu Beach, Hawaiian Ocean View,
    Kawa Flats, Naalehu and Hawaii Volcanoes National Park. </description>
    <instruction>Stay away from streams, rivers, drainage ditches, and culverts, even if they are currently dry.</instruction>
    <web>http://www.weather.gov</web>
    <area>
      <areaDesc>Hawaii in Hawaii, HI</areaDesc>
      <polygon>19.98,-155.85 20.2,-155.92 20.27,-155.89 20.28,-155.88 20.26,-155.76 20.12,-155.59 19.44,-155.68 19.37,-155.47 19.43,-155.06 19.34,-154.98 19.25,-155.16
      19.25,-155.29 19.13,-155.5 18.96,-155.59 18.9,-155.67 19.03,-155.89 19.14,-155.93 19.46,-155.93 19.73,-156.08 19.98,-155.85</polygon>
    </area>
  </info>
</alert>
```

Structure of a CAP Message

CAP Messages contain:

- Text values for human readers ("headline", "description", "instruction", "area description", etc.)
- Coded values useful for filtering, routing, and automated translation to human languages

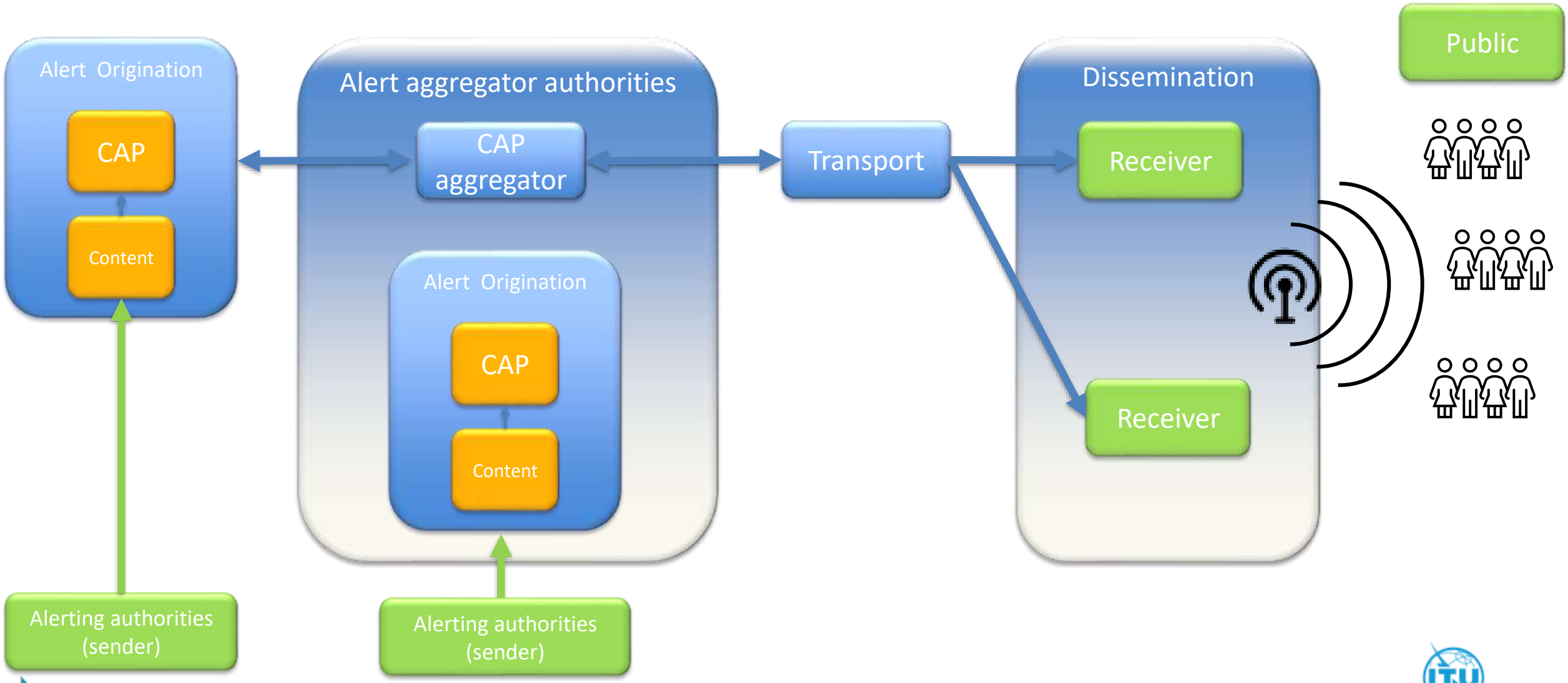


Element in **boldface** are mandatory, elements in *italics* have default values that will be assumed if the element is not present; asterisks (*) indicate that multiple instances are permitted.

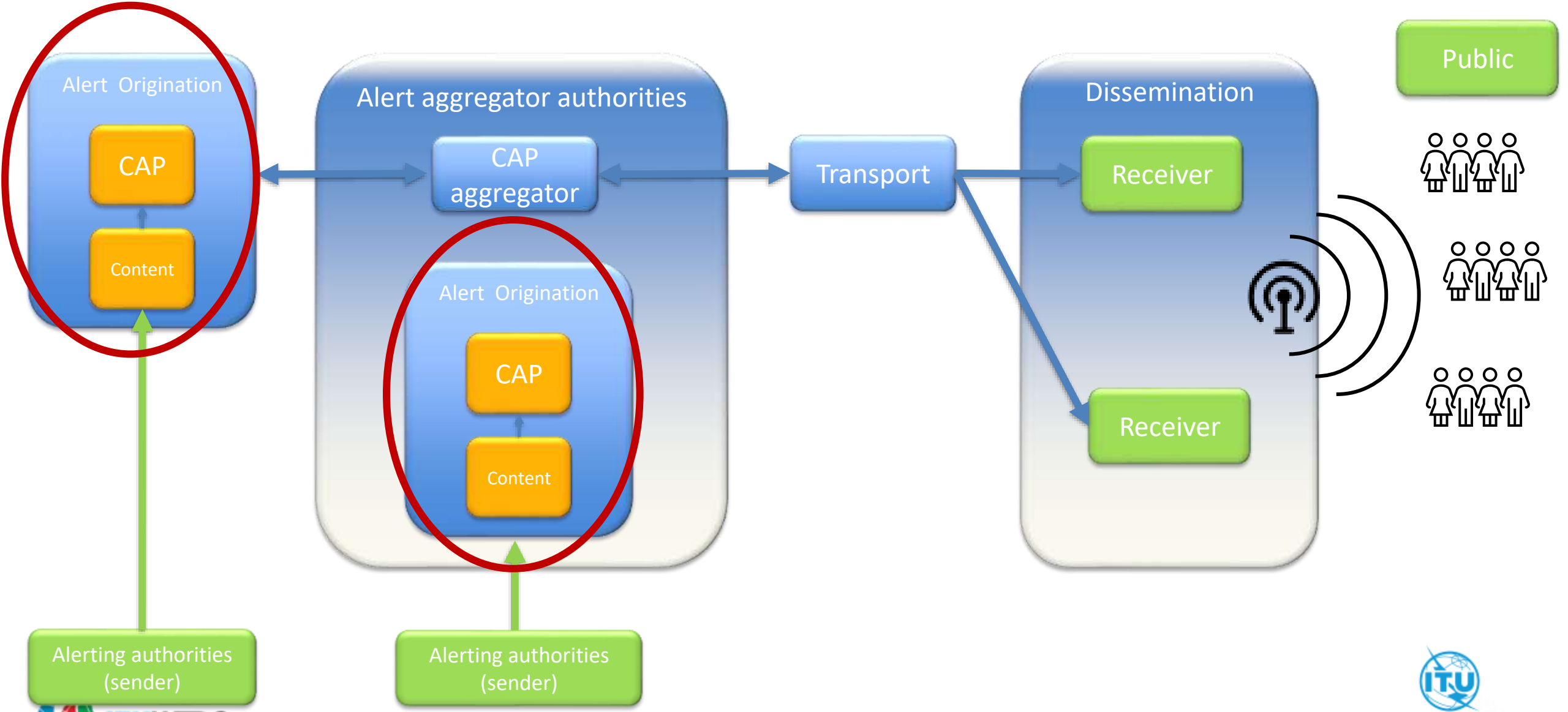
Figure 3-1. Structure of a CAP Message

Courtesy of OASIS®

All-Hazards, All-Media Message Format

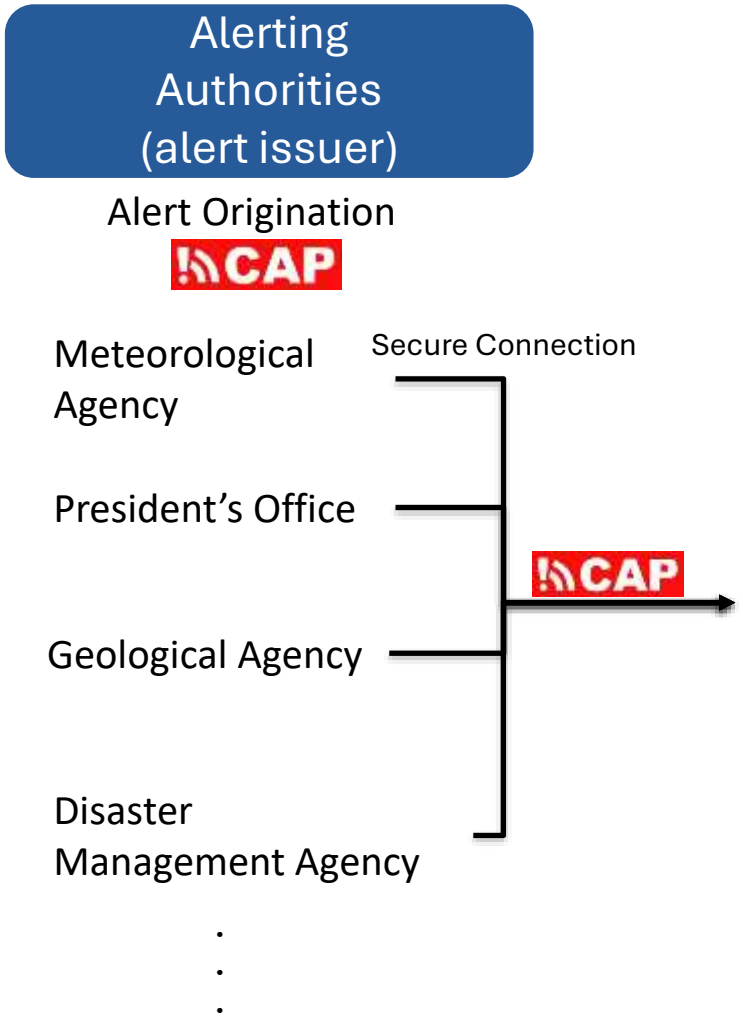


Alert Origination



Early Warning System and CAP

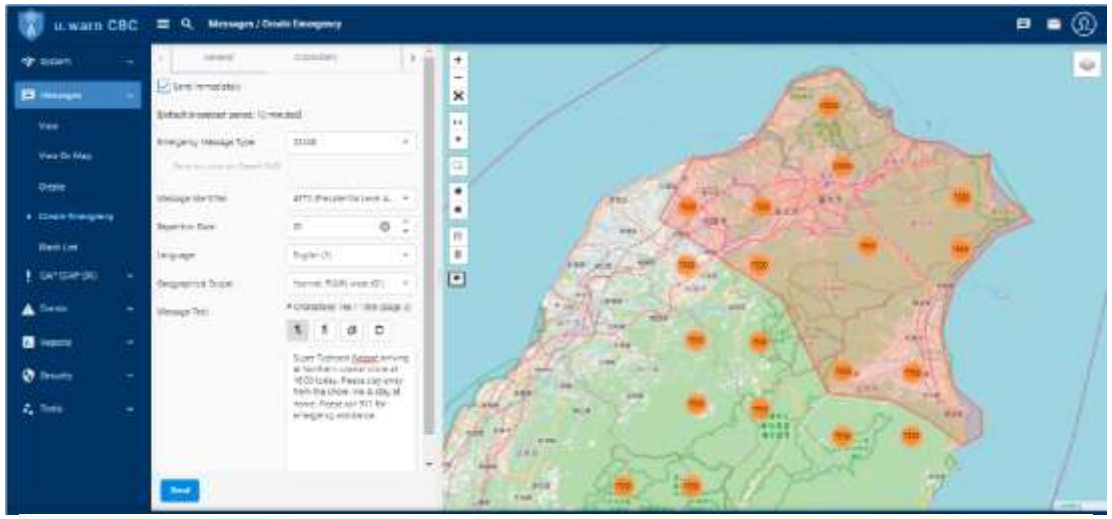
CAP Alert Origination

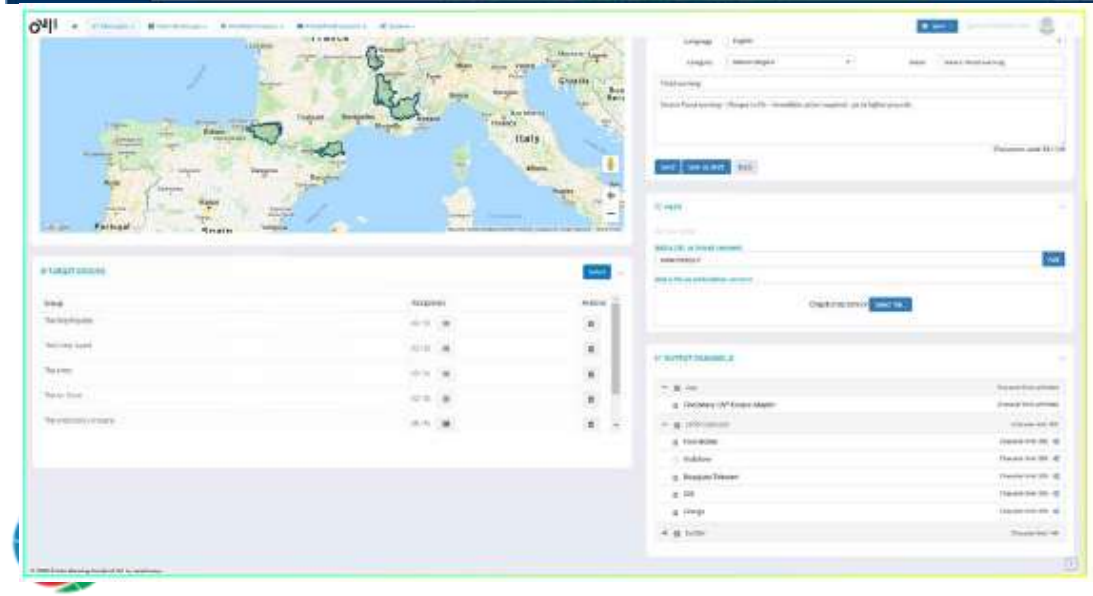


- What is CAP Origination?
- CAP Origination is the process where an **authorized entity** (e.g., government, emergency management center, NDMA) creates and sends an emergency alert in **CAP format**. This is the **first critical step** in the emergency communication chain before dissemination through various public and private alerting channels.

Early Warning System and CAP

CAP Alert Origination

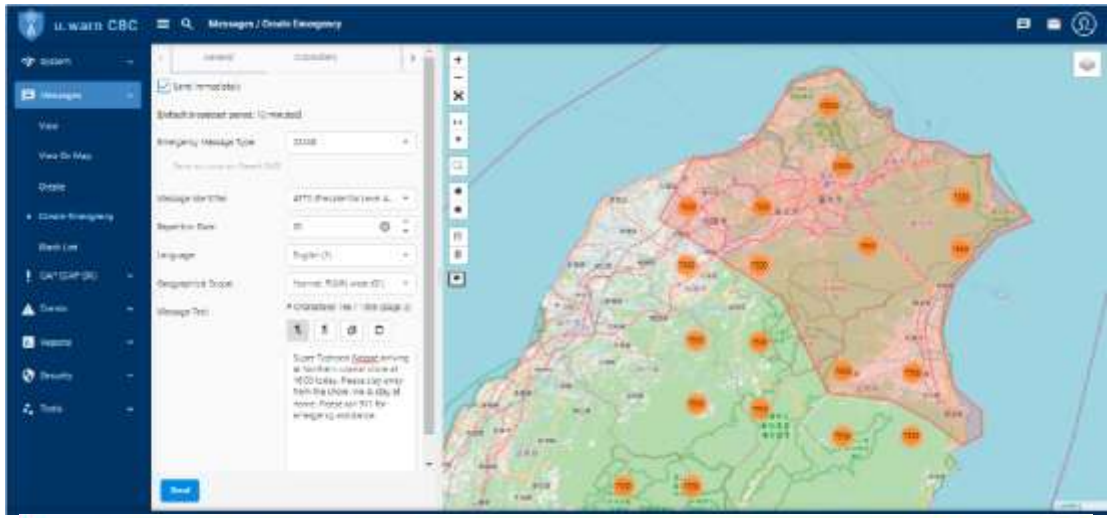


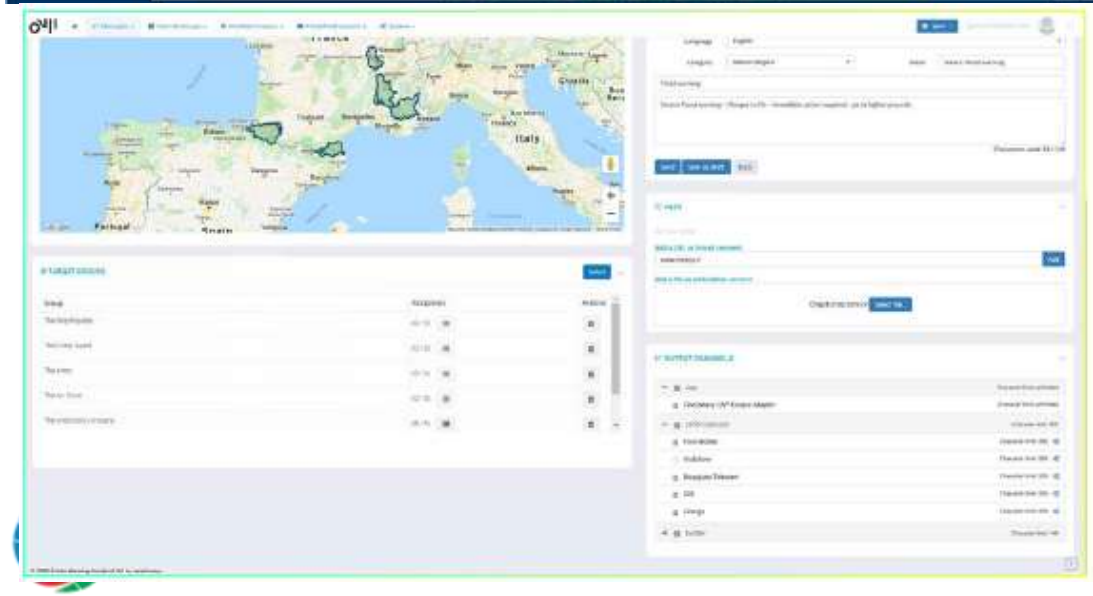


- Alert origination software
- A smart interface (software) that interprets business workflows manages roles and seamlessly generates dissemination orders and collect feedback — ensuring coherence and transparency, including CAP messages and beyond.

Early Warning System and CAP

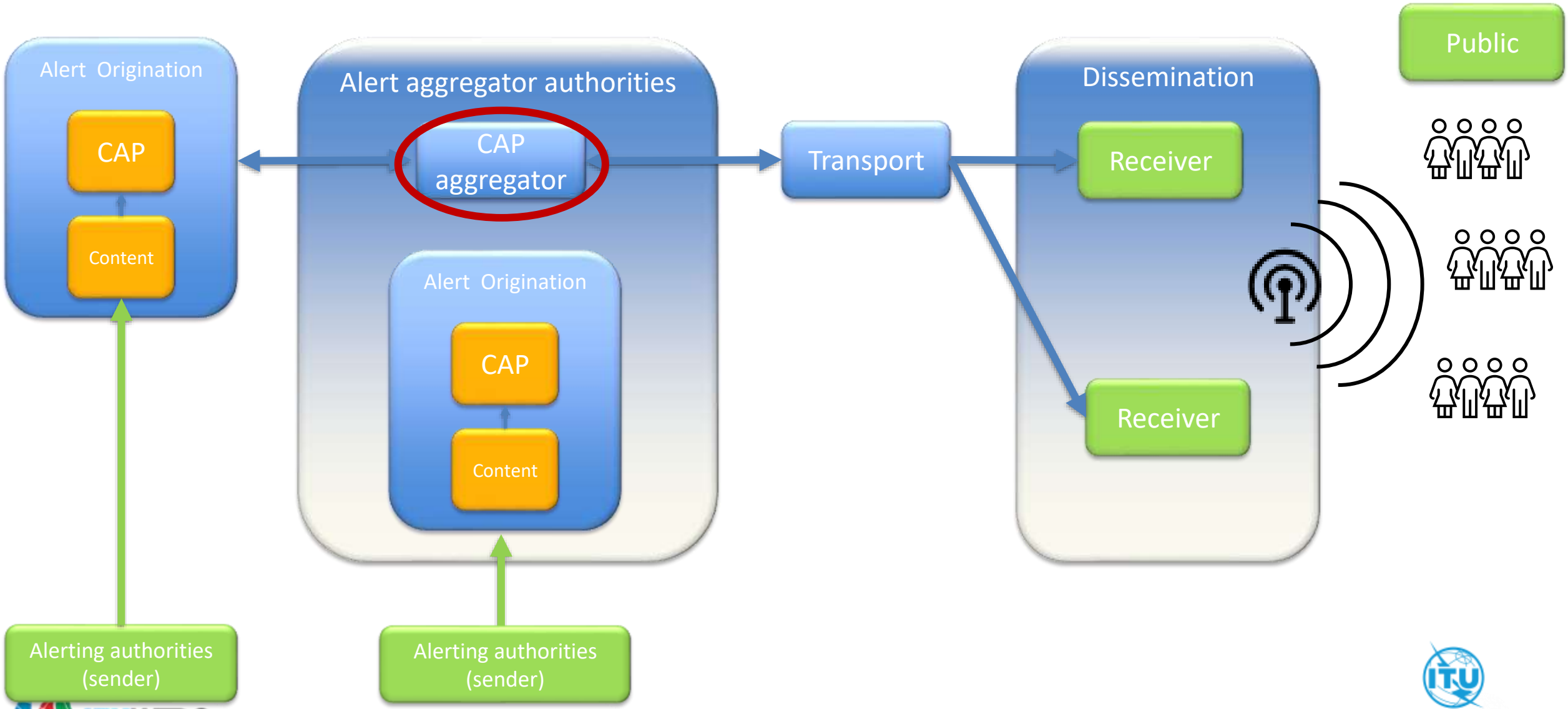
CAP Alert Origination





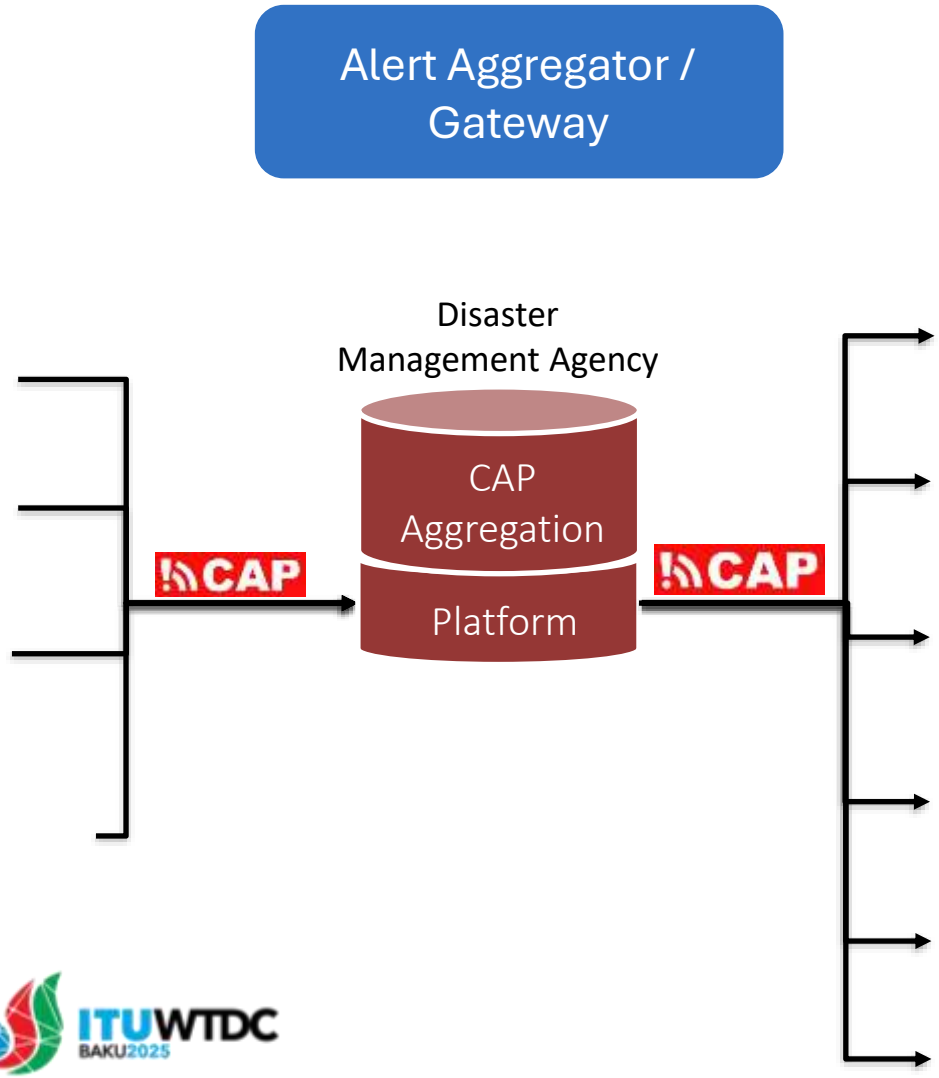
- Alert origination software
- **Step 1: Alert decision**
  - Alert sending is decided (*can be automatized)
- **Step 2: Authentication & logging (role and responsibilities)**
  - Determinate the responsibility for the software and area of use.
- **Step 3: Message Composition**
  - CAP message is structured (all parameters including geo-targeting), validated, and assigned a priority level
- **Step 4: Approval & Authorization**
  - Ensures compliance with alerting policies and national regulations
- **Step 5: Transmission to Aggregator**
  - CAP message is sent to CAP Aggregator, MNOs, or Government Alerting Systems
- **Step 6: Multi-Channel Dissemination**
  - CAP message reaches MNOs (CB…), TV, Radio, Mobile Networks, Sirens, IoT, Social Media, etc.
- **Step 7: Feedback and statistics**
  - The decision maker has an immediate view of the ongoing campaign. It also provides a way of managing technical errors on disseminators and acting accordingly.

All-Hazards, All-Media Message Format



Early Warning System and CAP

CAP Aggregator

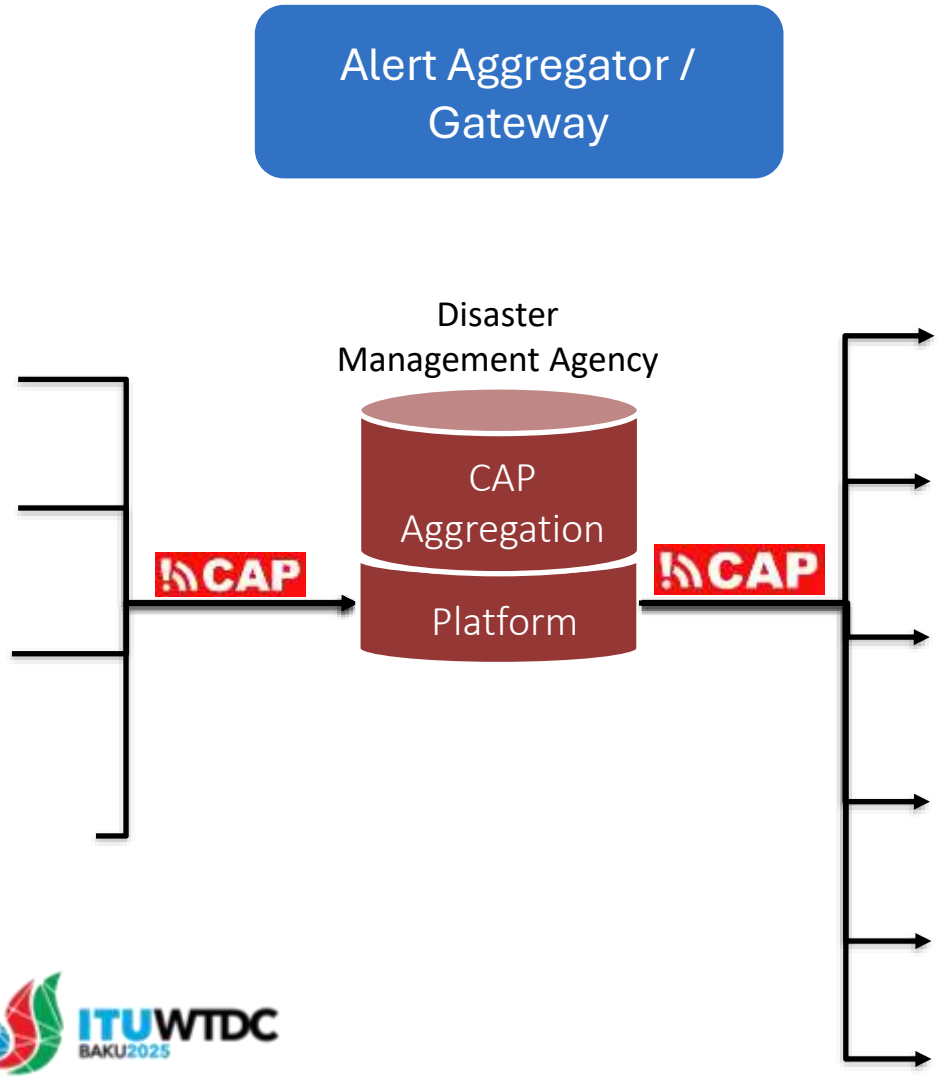


Centralizing and streamlining alert dissemination

A CAP Aggregator is a central component in an early warning system that collects, standardizes, and redistributes alerts from multiple sources to ensure uniform, multi-channel dissemination.

Early Warning System and CAP

CAP Aggregator



Why is a CAP Aggregator important?

Interoperability – Ensures seamless communication between different alerting authorities and technologies.

Efficiency – Automates alert distribution, reducing delays in critical situations.

Scalability – Supports national and regional alerting needs across various hazard types and disseminators.

Reliability – Provides redundancy and fallback mechanisms in case of infrastructure failures.

Early Warning System and CAP

CAP Alert Dissemination – matching the right disseminator to the right purpose

1. **Speed of Dissemination**: How quickly the message reaches the audience.
2. **Mass Notification Ability**: Ability to notify large audiences simultaneously.
3. **Content Capacity (Poor to Rich)**: Maximum message richness (e.g., text size, multimedia).
4. **Feedback Capacity**: Whether recipients can respond or acknowledge the alert.
5. **Automation Effectiveness**: refers to the ability of a system to efficiently execute tasks with minimal human intervention, ensuring speed, accuracy, adaptability, and reliability in dynamic or emergency environments.
6. **Geo-Targeting Effectiveness**: Precision in reaching specific groups or areas.
7. **Alignment with Alert Constraints**: Compliance with CAP format and dissemination requirements.

Typical CAP-based Alerting System

Phone operator Networks

MNOs Cell Broadcast
MNOs SMS
Voice Messages
Fax

Infrastructure

Digital Roads Signs
Digital Billboards
Sirens

Internet

Public Feeds
Government Websites
Apps/Instant Messaging Apps
Social Media
Online Gaming
IoT
E-mails

Radio

Analog Radio
Radio Display RDS
DAB+
Bipers

Television

Analog TV
Digital TV (ATSC 3.0)

Satellite

Multiple technologies

Early Warning System and CAP

CAP Alert Dissemination – matching the right disseminator to the right purpose

	Disseminator	Speed of Dissemination			Mass Notification Ability	Content Capacity (Text)	Feedback Capacity	Automation Effectiveness	Geo Targeting Effectiveness	Alignment with Alert Constraints
		Speed	Metric scale	Certainty						
Phone Operator Networks	MNOs Cell Broadcast	Very High	10000 to 10000000 MPS*	High	Very High	**Short Text** (93 char. GSM 7 bits, 70 char. UCS-2 to 1395 char. max)	**Low** (One-way)	High	High	Very High
	MNOs SMS (LB-SMS/National)	Moderate	100 to 10000 MPS	Very High	Moderate	Medium Text (160 GSM 7 bits, 70 char. UCS-2 or more)	High	Moderate	Very High	Moderate
	Voice Messages	Slow	10 to 1500 MPS	Very High	Moderate	1mn message equiv. Max 1000 chars	High	Low	Moderate	Moderate
	Fax	Very Slow	1 to 200 MPS	Moderate	Low	1 page limitation for mass	None	Low	Low	Low
Satellite	Multiple technologies	Very High	10000 to 10000000 MPS*	High	High	Low (but based on indexes)	None	Moderate	Very high	Very High

Phone Operator Networks: Mobile and landlines

* : No limits in the protocol

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Early Warning System and CAP

CAP Alert Dissemination – matching the right disseminator to the right purpose

	Disseminator	Speed of Dissemination			Mass Notification Ability	Content Capacity (Text)	Feedback Capacity	Automation Effectiveness	Geo Targeting Effectiveness	Alignment with Alert Constraints
		Speed	Metric scale	Certainty						
Radio	Analog Radio	Very High	near-instantaneous to any receiver	Moderate	Very High	N/A	None	High	Low	Moderate
	Radio Display RDS	Very High	near-instantaneous to any receiver	Moderate	Moderate	Short Text (64 chars)	None	Moderate	Low	Moderate
	DAB+	Very High	near-instantaneous to any receiver	Moderate	Moderate	15000 chars	None	Moderate	Low	Moderate
	Bipers	Moderate	near-instantaneous to any receiver	Moderate	Low	80 chars to 240 chars	None	Low	Low	Low
Television	Analog TV	Very High	near-instantaneous to any receiver	Moderate	High	Poor text capacity to Rich (Visual)	None	Moderate	Low	High
	Digital TV (ATSC 3,0)	Very High	near-instantaneous to any receiver	Moderate	High	Poor text capacity to Rich (Visual)	High	Very High	High	Very High

Early Warning System and CAP

CAP Alert Dissemination – matching the right disseminator to the right purpose

	Disseminator	Speed of Dissemination			Mass Notification Ability	Content Capacity (Text)	Feedback Capacity	Automation Effectiveness	Geo Targeting Effectiveness	Alignment with Alert Constraints
		Speed	Metric scale	Certainty						
Infrastructure Networks	Digital Road Signs	Moderate	N/A	Moderate	Low	Short Text (50-80 chars)	None	Moderate	Moderate	Moderate
	Digital Billboards	Moderate	N/A	Moderate	Low	Visuals and long texts	None	Moderate	Moderate	Moderate
	Sirens	Moderate	N/A	Moderate	High	None (Sound Only) to Poor (audio)	None	Low to High	Low	High
Internet	Public Feeds	**High**	**N/A**	**Low**	**Low**	**Rich**	**Moderate**	**High**	**Low**	**Low**
	Government Websites	Moderate	N/A	Low	Moderate	Rich	Moderate	Moderate	Low	Moderate
	Apps/Instant Messaging Apps	**Slow**	**Slow due to private network management**	**Very Low**	**Low**	**Poor to Rich (Platform dependency)**	**Moderate**	**High**	**Moderate**	**Low**
	Social Media	**Very High**	N/A	Low (unless specific protocol)	High	Poor to Rich (Platform dependency)	Moderate	High	Low	Moderate
	Online Gaming	Moderate	N/A	Low	Moderate	Rich (Game Interface)	Low	Moderate	Low	Low
	IoT	Unknown	Unknown	Unknown	Moderate	Poor to Rich (Sensor-driven)	Low	Moderate	**Very High**	Moderate
	E-mails	**Moderate**	**1 to 10000 MPS**	**Moderate**	**Low (Spam)**	**Rich**	**Moderate**	**Moderate**	**Low**	**Low**

Early Warning System and CAP

CAP Alert Dissemination – Social Media

- On social media such as Facebook, X (was Twitter), WhatsApp... simply post a link to the CAP alert, or to the CAP alert feed
- CEN, the European standards agency, requires
  "To ensure consistency, clarity and completeness of the messages disseminated simultaneously across different channels, the social media early warning messages and related notifications shall refer to the persistent unique
  URL of the CAP message."

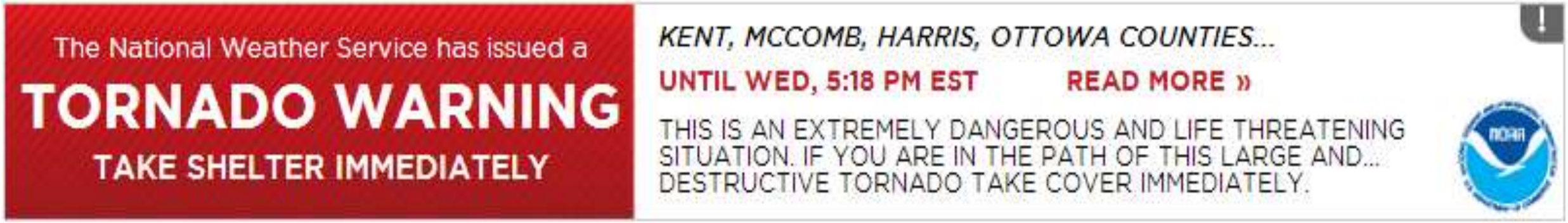
Early Warning System and CAP

CAP Alert Dissemination – Mobile app

Early Warning System and CAP

CAP Alert Dissemination – Online Ad Overlay

- The Federation for Internet Alerts exploits advertising technology to help alerting authorities send warnings
  to people using the Internet, at no charge
- Example: tornado warning from U.S. National Weather Service overrides Web advertisements in alerting area



Early Warning System and CAP

CAP Alert Dissemination – Sirens

- A designated official subscribed to the CAP News Feed can manually trigger the sirens or the campus or building alarms
- Recently purchased sirens and alarms might be programmable to process alerts received from a specific CAP alert feed

CAP Profile vs CAP Policy

- All messages must be tailored to the constraints of each dissemination channel. Each channel may also require specific adaptations based on its technology, limitations and regulatory or geographic context.

- CAP Profile: A **CAP Profile** is a **technical specification** that defines constraints and extensions to the CAP standard to meet the needs of a specific country, region, or system. It ensures **interoperability** and adherence to local requirements while maintaining CAP's core structure.

- CAP Policy: A **CAP Policy** refers to the **operational rules, governance, and best practices** for **how CAP messages are created, distributed, and managed**. Policies ensure that CAP messages are used correctly, effectively, and securely.

CAP Profile FEMA (Federal Emergency Management Agency)

Flexibility	Highly flexible usage	The FEMA CAP Profile explicitly adds restrictions that are not present in CAP 1.2.

Feature	CAP 1.2 (Common Standard)	FEMA CAP Profile (USA-Specific)
Scope	Global	U.S.-specific
Event Codes	Customizable	Pre-defined FEMA event codes
Geo-Targeting	Recommended but optional	Mandatory
Authentication	Not required in general use	Required via IPAWS
Compatible Networks	Any CAP-compliant system	IPAWS-integrated networks
Use Cases	Any country or system	U.S. emergency alerting (WEA, EAS, NOAA, etc.)

https://docs.oasis-open.org/emergency/cap/v1.2/ipaws-profile/v1.0/cap-v1.2-ipaws-profile-v1.0.pdf

Google Public Alert Policy

Receiver

`<status>`	REQUIRED	`AlertStatus`	Google only publishes publicly available alerts that have a **`<status>`** element value of **`Actual`**. ★ **Caution:** Google might suspend publishers who send test messages as **`<status>`** **`Actual`**.
`<scope>`	REQUIRED	`AlertScope`	The **`<scope>`** element denotes the intended distribution of the alert message. ★ **Note:** Google only publishes alerts with a **`Public`** **`<scope>`** value.
`<code>`	OPTIONAL	`string`	The `<code>` element denotes special handling of the alert message. ★ **Note:** Usually, Google doesn't support the `<code>` element.
`<info>`	REQUIRED*	`info`	At least one `<info>` element must be present. Multiple `<info>` blocks must all have the same `<category>` and `<event>` element values.

* Google requires elements that have a bold and red **REQUIRED** optionality, but those elements are optional in the CAP standard.

https://developers.google.com/public-alerts/guides/cap-requirements/overview

EWSS CAMF (satellite) 1/3

Receiver

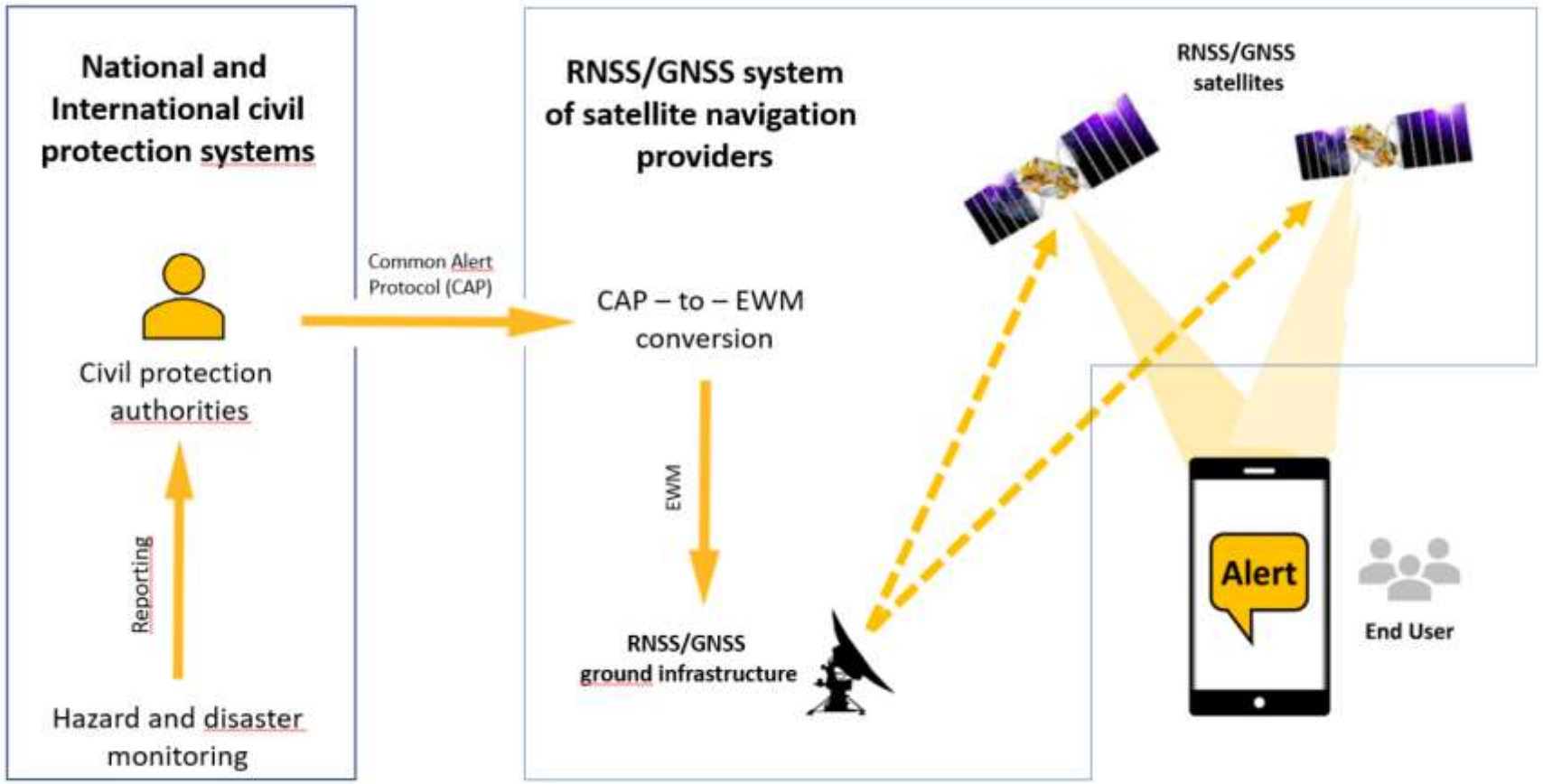


Figure 1: EWSS Overview

https://www.gsc-europa.eu/

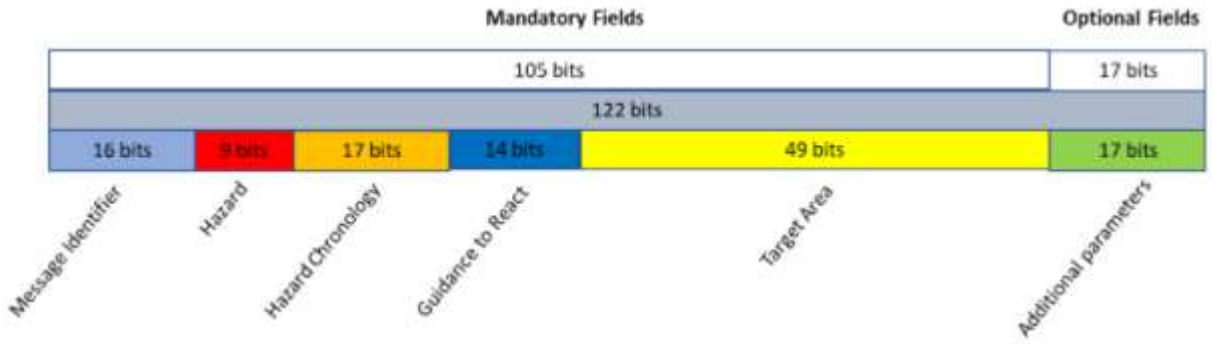
"Source: Common Alert Message Format Specification. © European Union/Japan Cabinet Office, 2023"

EWSS CAMF (satellite) 2/3

Receiver

CAMF codes the following information:

- **Message identifier**
  1. Message type (A1)
  2. Country / Region ID (A2)
  3. Provider identifier (A3)
- **Hazard**
  4. Hazard category & type (A4)
  5. Severity (A5)
- **Hazard chronology**
  6. Hazard onset: week number (A6)
  7. Hazard onset: time of the week (A7)
  8. Hazard duration (A8)
- **Guidance to react**
  9. Guidance library selection (A9)
  10. Guidance library version (A10)
  11. Guidance instructions (A11)
- **Target area**
  12. Ellipse centre latitude (A12)
  13. Ellipse centre longitude (A13)
  14. Ellipse semi-major axis length (A14)
  15. Ellipse semi-minor axis length (A15)
  16. Ellipse azimuth angle (A16)
- **Additional parameters**
  17. Main subject (A17)
  18. Specific settings (A18)



"Source: Common Alert Message Format Specification. © European Union/Japan Cabinet Office, 2023"

https://www.gsc-europa.eu/

EWSS CAMF (satellite) 3/3

Receiver

A11 – Guidance to react – International library (list A)	
Code [5 bits]	**Instructions**
00000	[*empty*]
00001	You are in the danger zone, leave the area immediately. Listen to radio or media for directions and information.
00010	You are in the danger zone, leave the area immediately and reach the evacuation point indicated by the area plotted in yellow. Listen to radio or media for directions and information.
00011	Seek shelter in a building immediately. Stay under cover and stay informed.
…	…
11111	Conditions have improved and are no longer expected to meet alert criteria.

"Source: Common Alert Message Format Specification. © European Union/Japan Cabinet Office, 2023"

https://www.gsc-europa.eu/

Receiver

CAP for Cell Broadcast (Profile/Policy)

What is ETSI TS 102 900?

- **ETSI TS 102 900** is a technical specification published by the **European Telecommunications Standards Institute (ETSI)**.
- It defines the **Common Alerting Protocol (CAP)** for use in **European Public Warning Systems (EU-Alert)**.
- CAP is an XML-based data format for exchanging emergency alerts and public warnings.
- ETSI TS 102 900 specifies how CAP messages should be formatted, transmitted, and processed in the context of mobile networks.

https://www.etsi.org/deliver/etsi_ts/102900_102999/102900/01.03.01_60/ts_102900v010301p.pdf

Mobile Alerting Practices Version 1.0 (https://docs.oasis-open.org/emergency/mapcn/v1.0/mapcn-v1.0.html)

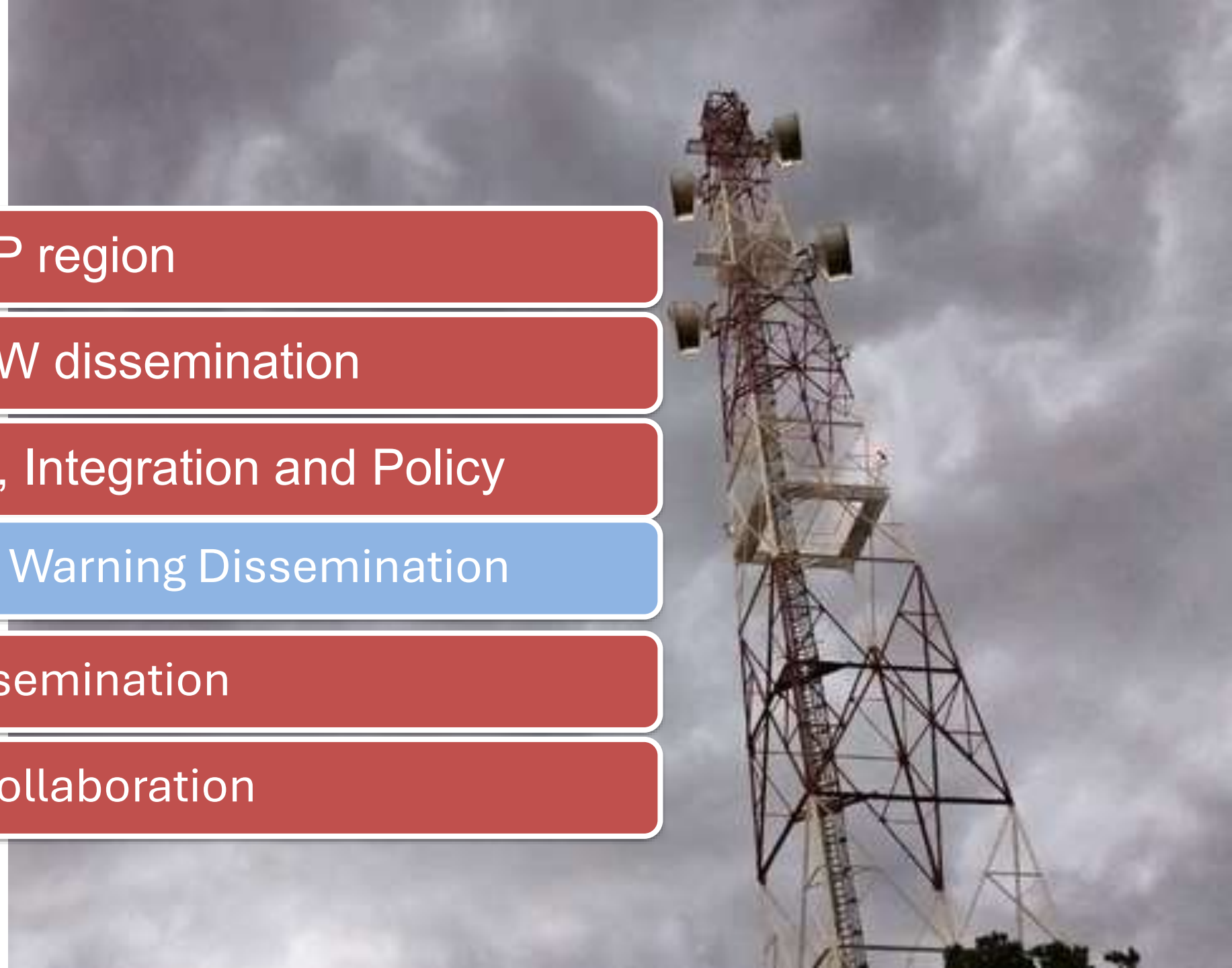
Receiver

CAP for Cell Broadcast (Profile/Policy)

Parameter	Description	Recommended Policy Setting
Message Length	Maximum size of alert message text.	- **GSM 7-bit:** Up to 1395 characters (Cell Broadcast), preferred less than 160 characters for device compatibility - **UCS2:** Up to 615 characters (for non-Latin scripts)
Encoding	Text encoding format for message content.	- **GSM 7-bit** preferred; **UCS2** for non-Latin languages.
TTL (Time-to-Live)	Duration for which the alert remains active.	- **Emergency Alerts:** 10-30 minutes - **Severe Alerts:** 1-2 hours - **Public Info Alerts:** Up to 6 hours
Geo-targeting	Method for defining the alert area.	- Use **<circle>** for most cases; limit **polygons** to <10 vertices. **MANDATORY**
Priority Levels	Alert urgency and importance.	- Follow 3GPP CBS classes: **Presidential, Extreme, Severe, Amber**.
Event Codes	Standardized codes for alert types.	- Use **SAME, CAP-CP, EU-Alert codes** based on region/system.
Digital Signature	Authentication for CAP message integrity.	- Implement **XML Digital Signature** for all alerts.
Alert Repetition	Frequency of repeated broadcasts.	- **Emergency:** Every 2-5 minutes until TTL expires.
Testing Alerts	Rules for test messages.	- Include **<msgType>Test**; limit to **authorized networks**.
Feedback Mechanism	System for receiving feedback from recipients.	- Enable **CAP acknowledgments (<msgType>Ack)** where possible.
Multimedia Inclusion	Use of images, audio, or video in alerts.	- **Exclude for Cell Broadcast**; optional for web/app feeds.

Scope

- EW for DRR in ASP region
- Need for CAP in EW dissemination
- CAP Infrastructure, Integration and Policy
- Mobile-based Early Warning Dissemination
- Use of AI in EW Dissemination
- Partnerships and Collaboration



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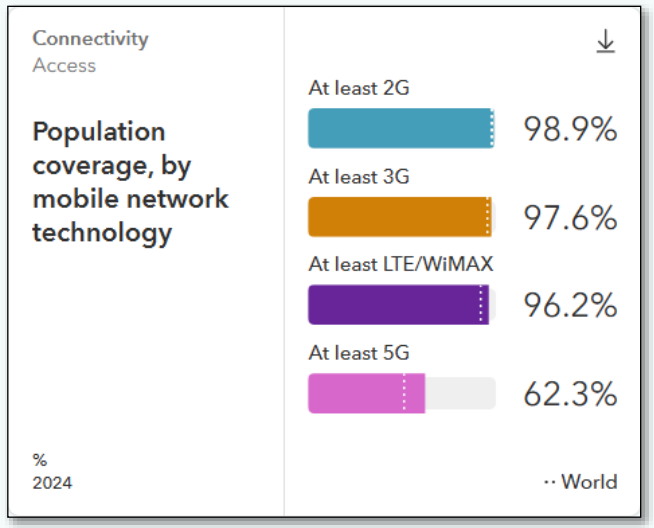
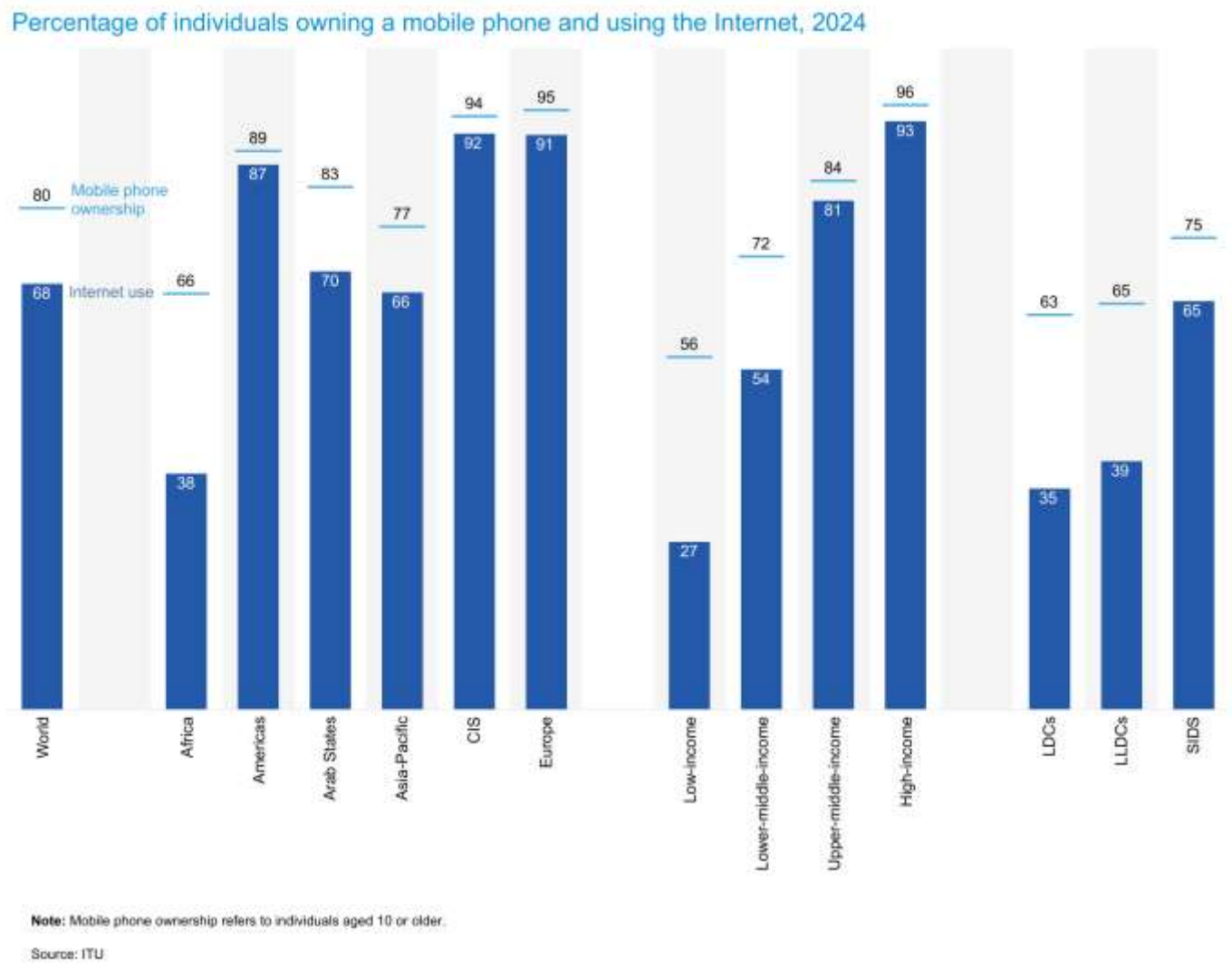
Mobile-based early warning services

97.9% of the world population is covered by mobile network

4 out of 5 people in the world own a mobile phone



Mobile Connectivity Statistics - ASP



…making mobile network an effective channel to reach people!

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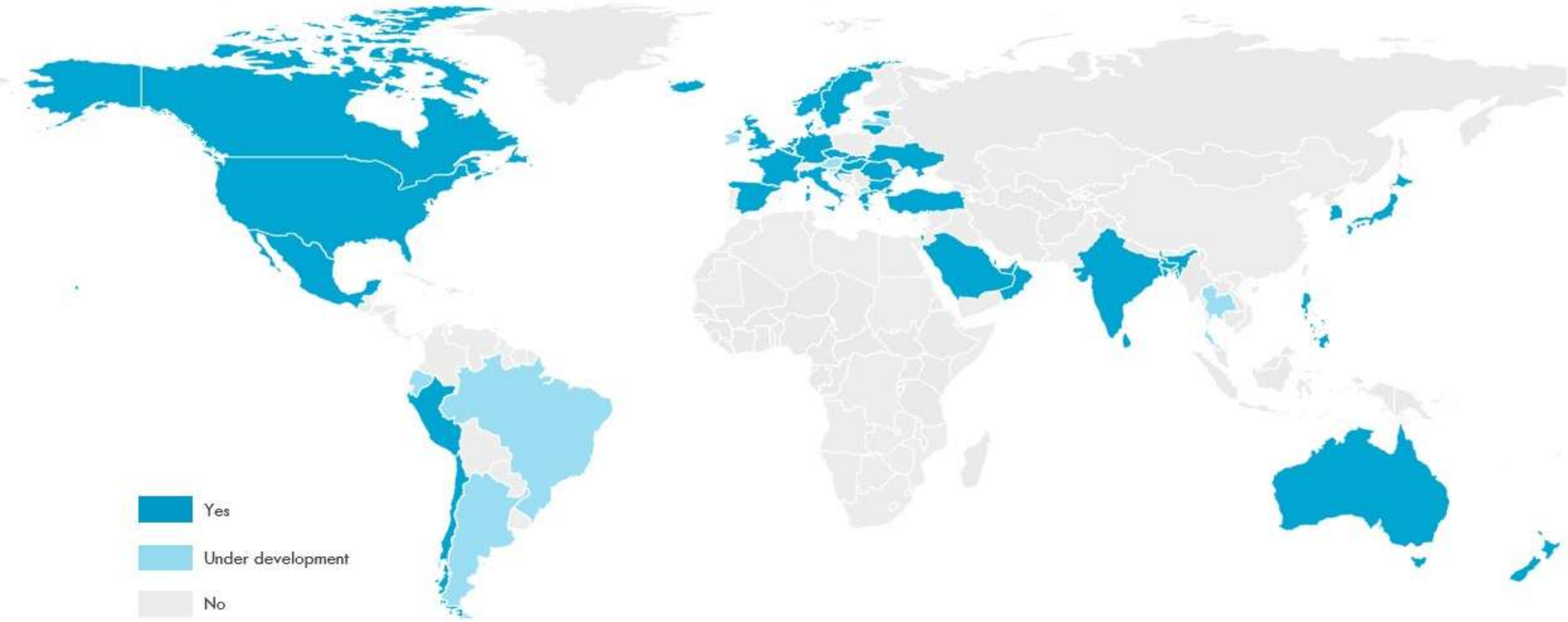
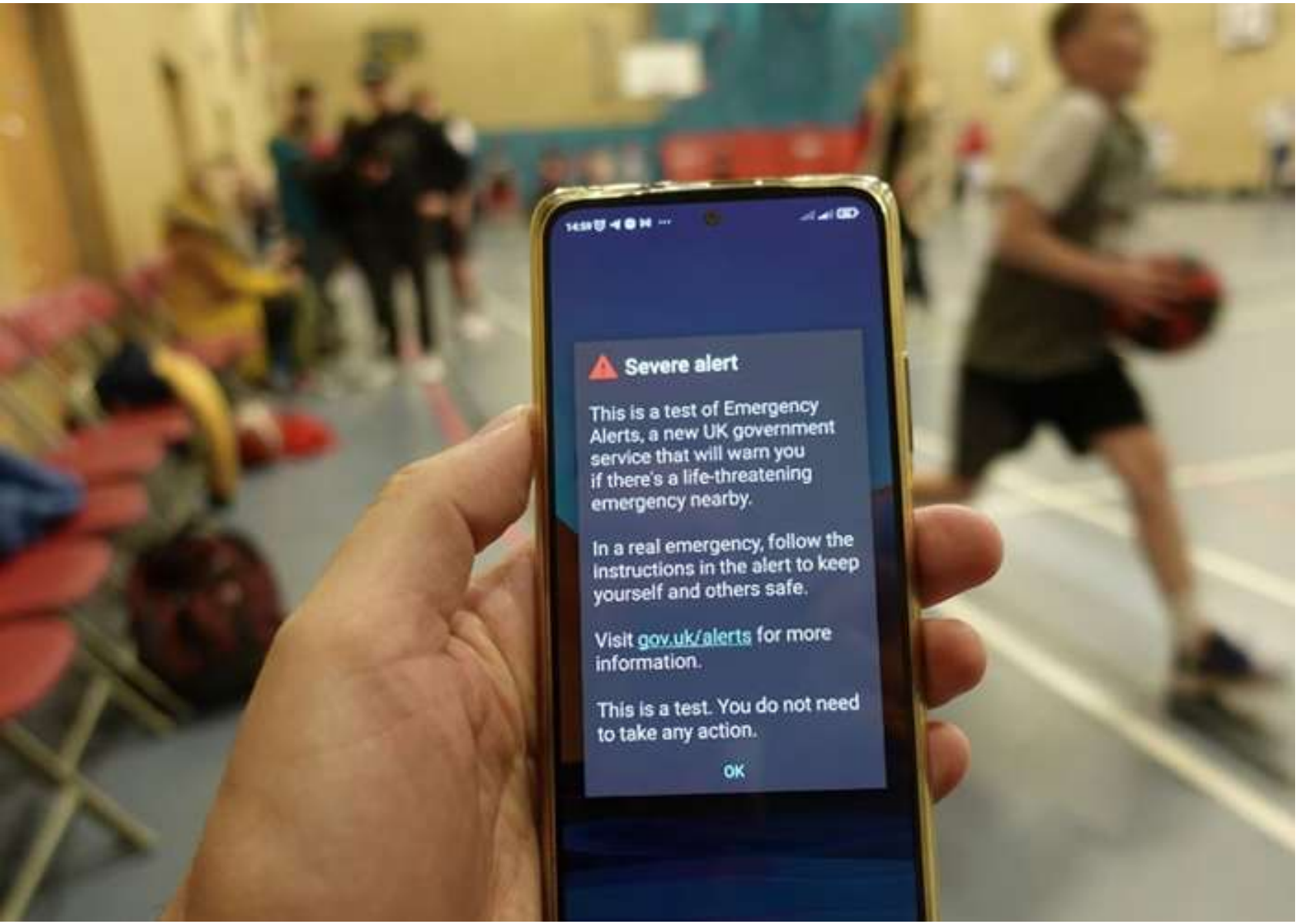
Countries with mobile EWS in place

using cell broadcast and/or location-based SMS*



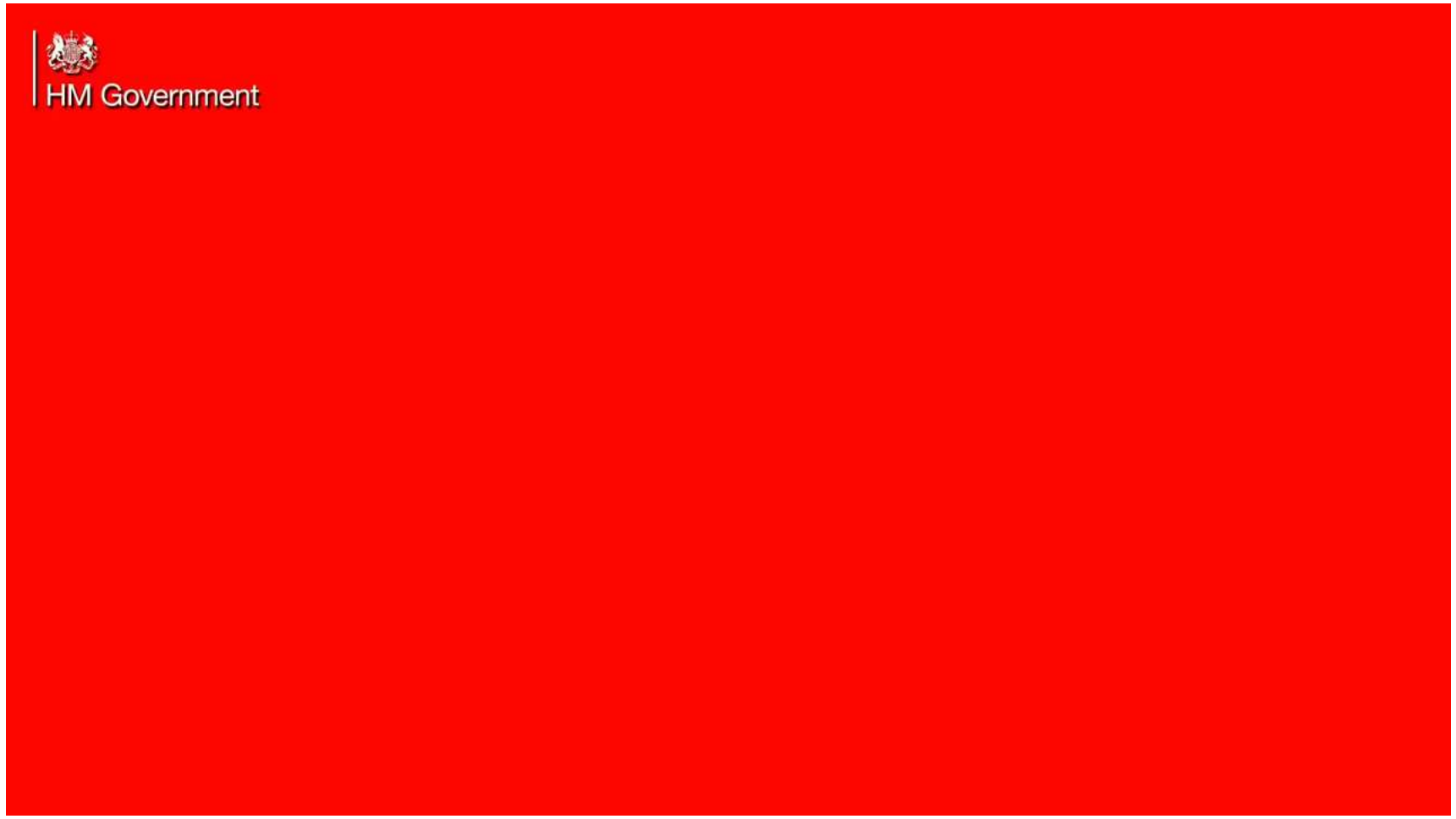
* work in progress, based on ITU research

www.itu.int



Cell Broadcast

Emergency Alerts via Cell Broadcast



Cell Broadcast: Fast, Reliable Emergency Alerts Straight to User's Phones

✅ **Instant Delivery**: Alerts reach phones in seconds, even during network congestion

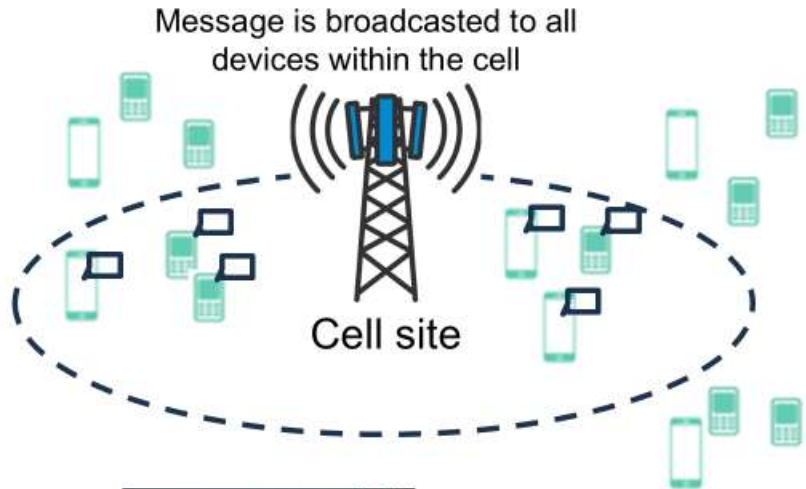
📡 **One-to-Many Technology**: Sends alerts to all devices in a targeted area (local, regional, or national)

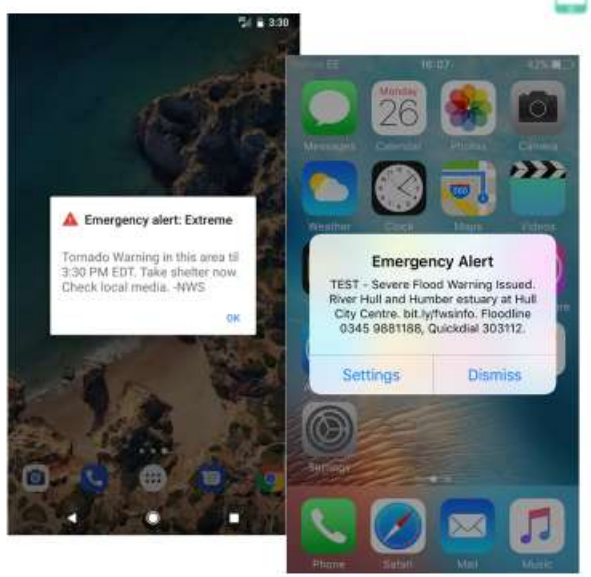
📶 **Works on All Networks**: Compatible with 2G, 3G, 4G, 5G & beyond

🔔 **Grabs Attention:** Loud alert + vibration, even if phone is on silent

📲 **Unmissable**: Appears directly on your screen, overriding other apps

🌎 **In Personalised Language:** Emergency messages are delivered in the user's preferred language

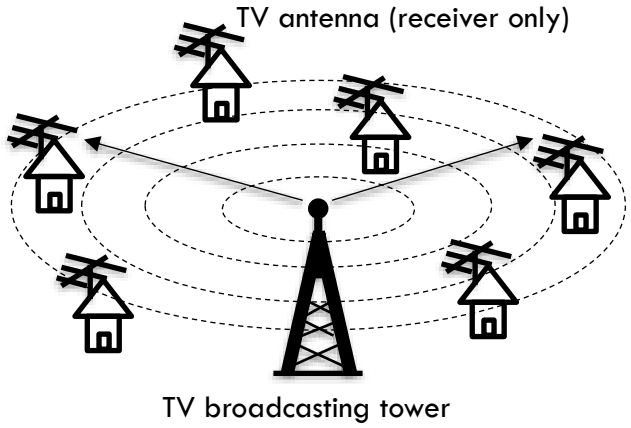




Introduction to Cell Broadcast Service (CBS)

What is broadcast?

- Commonly associated with TV or radio broadcasting: “to send out programs on television or radio”
- Other definition: “to spread information to a lot of people”

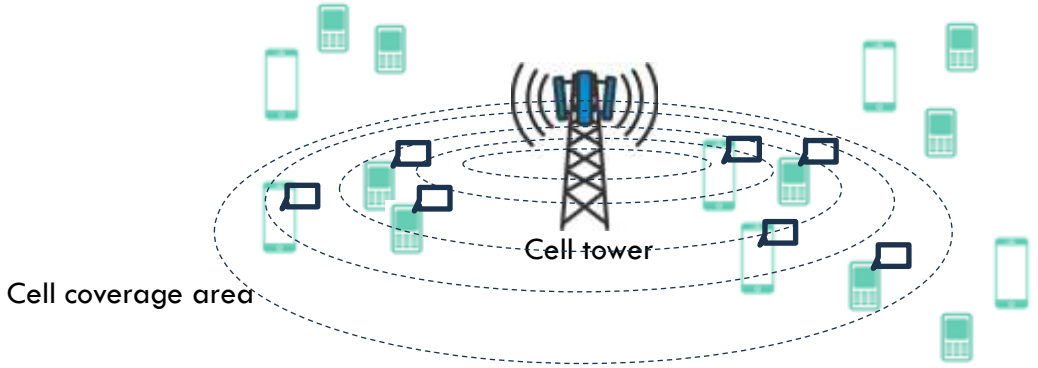


- One-way communication
- One-to-many communication (or point-to-area)
- Same TV or radio program broadcasted within the coverage area

Cell Broadcast Service

- Technology that simultaneously delivers a text message to multiple devices in a specified geographic area
- Example: one cell site

Cell Broadcast message delivered (broadcasted) to all devices in the cell site coverage area

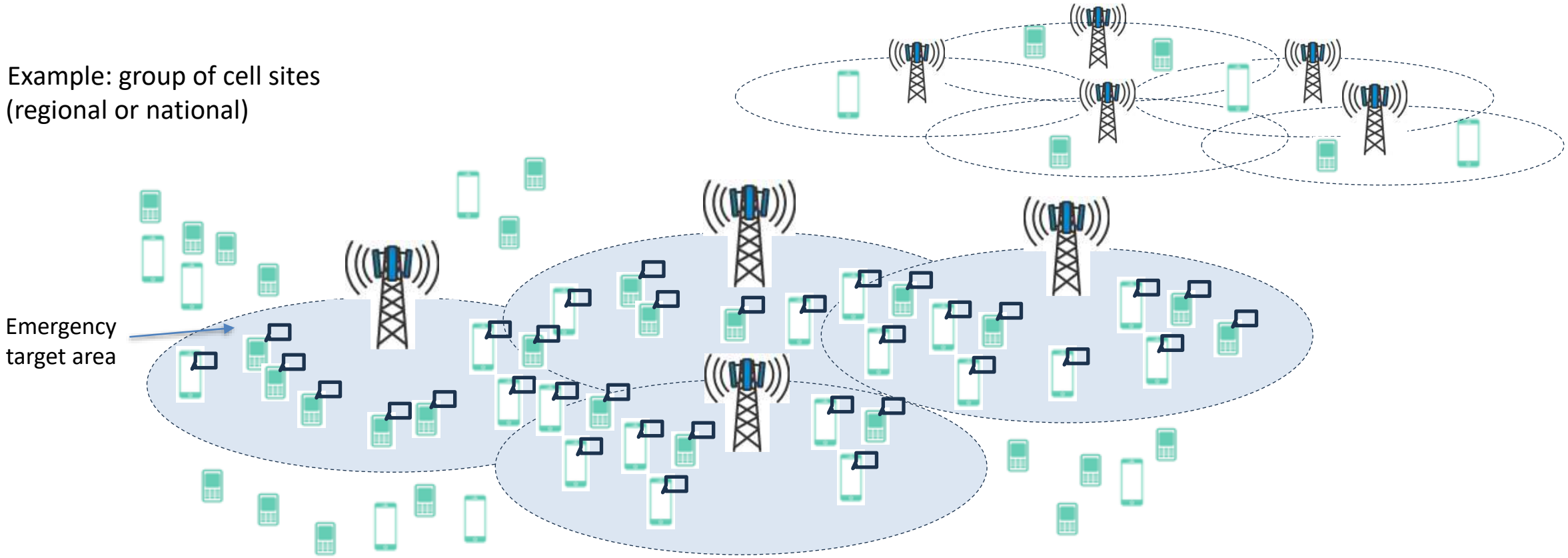


- One-way communication (cell tower to mobile device)
- One-to-many communication (or point-to-area)
- Same text message broadcasted to all devices within the coverage area

Introduction to Cell Broadcast Service (CBS)

Cell broadcast service

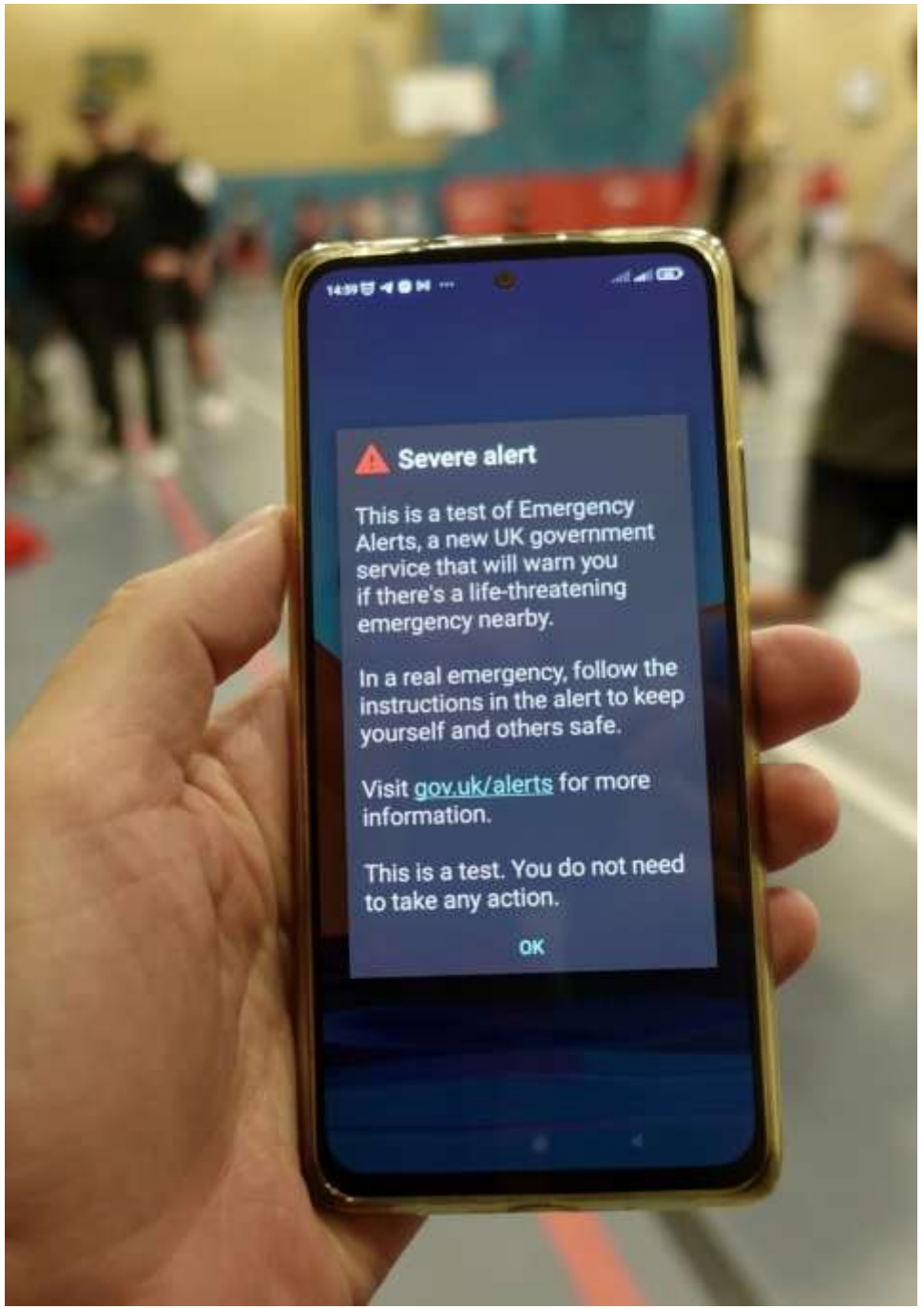
- Example: group of cell sites (regional or national)



- One-to-many communication (or point-to-area)
- Same text message broadcast to all devices within the coverage area (group of cell sites)

How and why alerting via mobile-cellular networks work?

Cell-Broadcast (CB)	Location-based SMS (LB-SMS)
Send geo-located messages to users within risk areas, including roamers/tourists	Roaming agreement might be needed for roamers/tourists
Supports multi-language alerts	Supports multi-language alerts
Not affected by congestion	Affected by congestion
No subscription needed	Subscription needed (SIM)
Compatible on most devices	Compatible in all devices
A “blind technology” that does not allow 2-way communication	2-way communication to provide information such as number of users in risk areas



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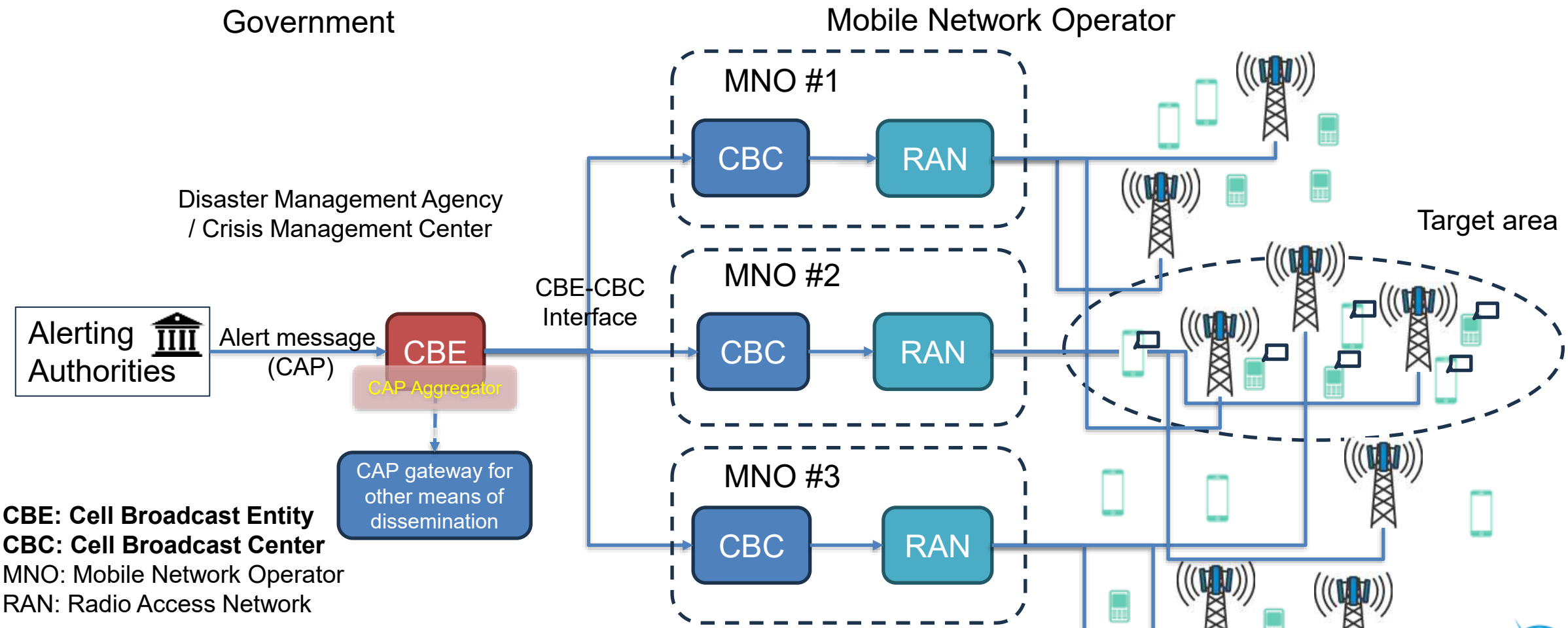
Key elements of Cell Broadcast technology



CBE: Cell Broadcast Entity
CBC: Cell Broadcast Center
MNO: Mobile Network Operator
RAN: Radio Access Network

Source: Cellular Tower Vector Images (VectorStock.com) / Getty Images/iStockphoto

Key elements of Cell Broadcast technology

Cell Broadcast Entity (CBE):

- Application connected to the Cell Broadcast Center (CBC), responsible for creating and formatting CB messages (emergency alerts).
- CBE can also receive alert messages from alerting authorities.
- CB messages, including information such as **target locations, message identifier, start time/end time, and repetitions** of the message to be delivered, should be provided by the CBE to the CBC.
- Instead of investing in physical infrastructure (hardware-server, maintenance, space, etc.), CBE can be hosted in the cloud.

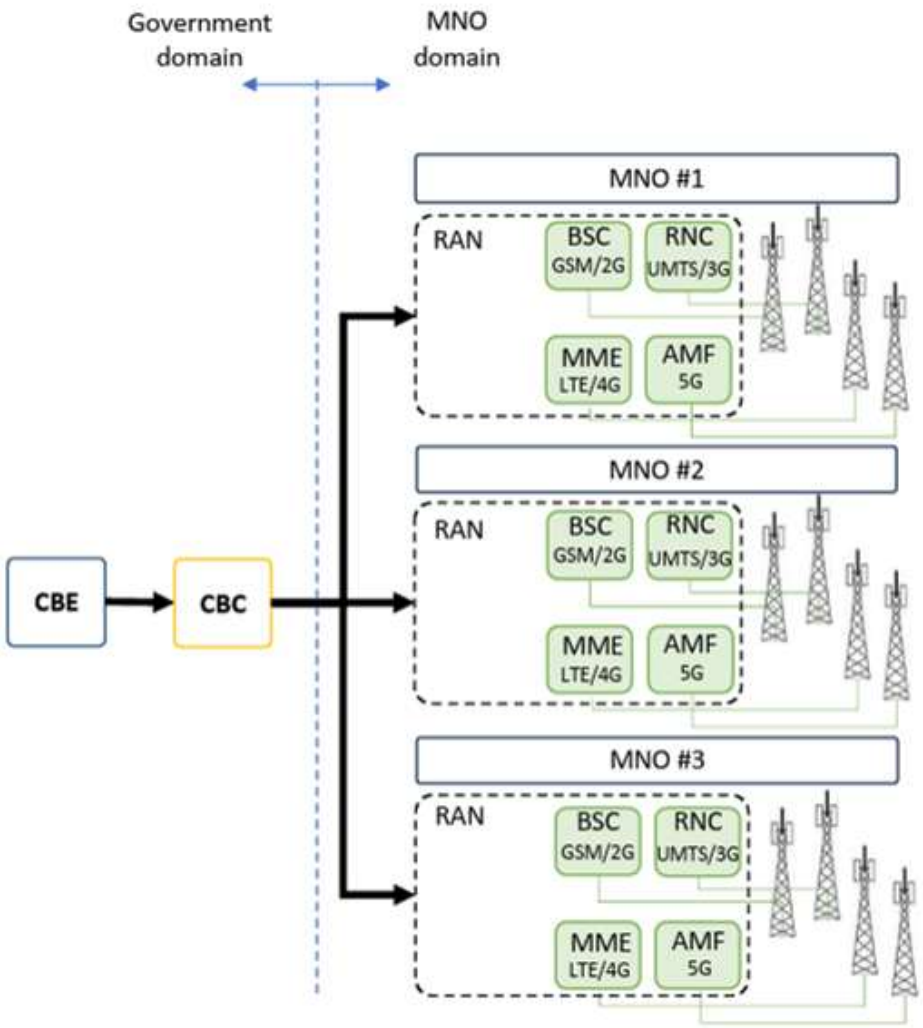
Key elements of Cell Broadcast technology

Cell Broadcast Center (CBC):

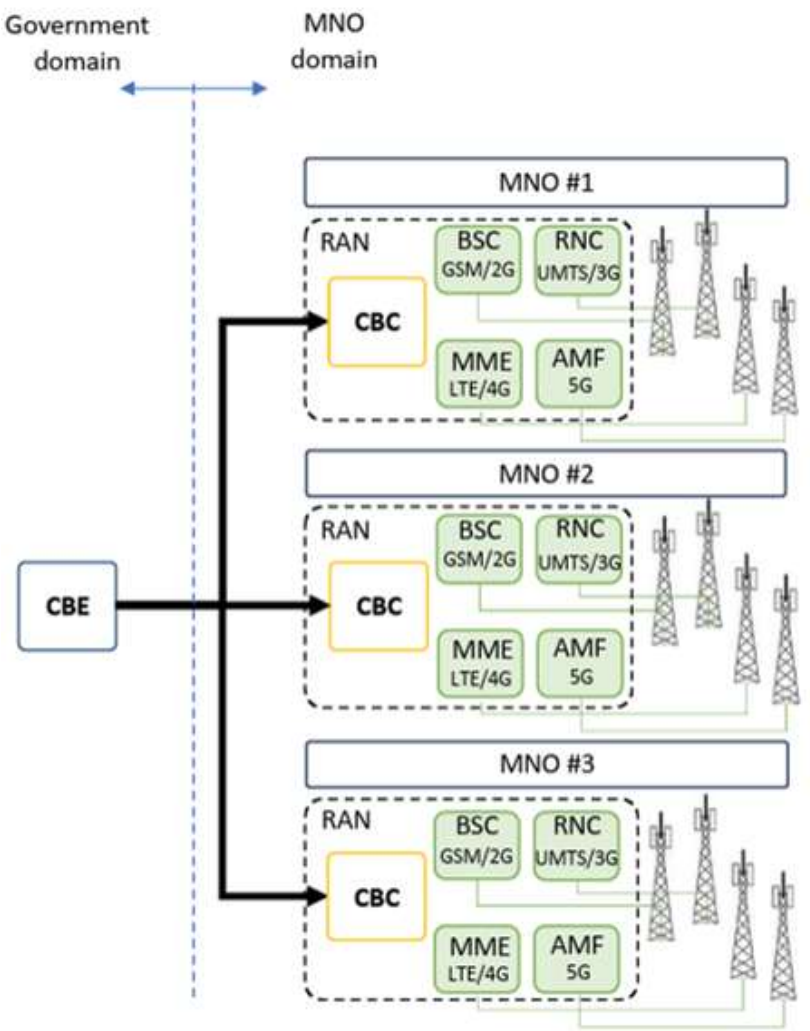
- Mobile network element that delivers Cell Broadcast messages to the Radio Access Network (RAN).
- CBC receives the Cell Broadcast message from the Cell Broadcast Entity (CBE).
- CBC is located within the mobile operator domain.
- CBC determines which cell towers from the mobile operator need to broadcast the Cell Broadcast message within the target area.

Centralized vs. Distributed architecture

Centralized architecture:



Distributed architecture:



Source: Cellular Tower Vector Images (VectorStock.com)

Centralized vs. Distributed architecture

Advantages

Centralized CBC

- Single CBC to purchase, lower capex and operational expenditure costs and quicker installation time.
- Government can take control of whole Cell Broadcast functionality across all networks in the whole country in case of national emergency.
- Only one team of qualified expert technicians needed to maintain the facility.

Distributed CBC

- Network takes full control of the CB channel and all its capabilities as the CBC can control access and utilisation of the facility.
- Confidential cell data base does not leave the firewall of the network.
- Network can exploit any commercial applications of CB (although not recommended).
- Network can choose a favoured CBC vendor who supports their system technology and RAN vendor.

Disadvantages

Centralized CBC

- Government must bear the costs of installation and maintenance of the CBC (although same could apply for a distributed CBC).
- Government must identify and train technicians with the skills and knowledge to maintain the CBC to a high state of readiness and availability.
- Government needs to choose a vendor which can support all RAN vendors and system technologies applicable across all networks in the country.
- Government needs to arrange for the cell data files to be updated in near real time from the networks data centres.

Distributed CBC

- Overall cost of the project is multiplied by the number of different operators all needing their own CBC, higher capex.
- Networks need to identify and train suitable maintenance staff to maintain the CBC and ensure high availability as a matter of high priority particularly in times of national emergency.

Roaming Users

- Roaming users (e.g., tourist) receive the CB alert message as long as Message Identifiers (MI) are the same (home country and visiting country)
- Message identifiers help mobile devices recognize and filter the types of messages they receive over the broadcast channel
- Message identifiers indicate the source and type of message – devices can be configured to receive only specific types of messages based on the MI

EU-Alert and US CMAS types and message identifiers

Message identifier	Type	Similar CMAS message type	Comment
4370	EU-Alert level 1	National Alert	Broadcasting of level 1 alerts where opt-out is not allowed.
4371, 4372, 4384, 4385	EU-Alert level 2	Extreme Alert	Broadcasting of level 2 alerts where opt-out is allowed.
4373-4378, 4386-4391	EU-Alert level 3	Severe Alert	Broadcasting of level 3 alerts where opt-out is allowed.
4396, 4397	EU-Alert level 4	Public Safety Alert	Broadcasting of advisory messages. Users should be able to opt-out from these messages.
6400	EU-Info	none	Broadcasting of advisory messages. Users should be able to opt-out from these messages.
4379	EU-Amber	Child Abduction Alert	Allocated for Amber (child abduction) alerts. Users should be able to opt-in to these messages.
4380	EU-Monthly Test	Required Monthly Test	Allocated for monthly test messages that may or may not involve the general public and may or may not require special UEs.
4398-4399	EU-Test	State/Local Test	Allocated for messages used for proficiency training and public outreach. Users may be able to opt-in to these messages.
4381	EU-Exercise	Exercise	Allocated for use during exercises. Its use is for further study.
	EU-Reserved	Reserved for CMSP use	Reserved for operator specific use. In EU-Alert this MI is reserved for national government requests to operators.
	EU-Geo-fencing trigger message	Geo-fencing trigger	Allocated for geo-fencing trigger message for Device-Based Geo-Fencing.

"Message Identifiers for EU-Alert shall be the same as their comparable CMAS message types.
Roaming on a network that offers a CMAS compliant service will provide a similar user experience as is offered by the EU-Alert service, and vice versa. Roaming individuals with a CMAS compliant user equipment (UE) should receive alert messages of similar severity levels as they may expect in their home network."

ETSI TS 102 900

Cell Broadcast Standards

EU-ALERT
ETSI TS 102 900
V1.3.1 (2019-02)

3GPP Main standards:

CBS	3GPP TS 23.041 V18.1.0 (2022-12)
BSC GSM/2G	3GPP TS 48.049 V17.0.0 (2022-03)
RNC UMTS/3G	3GPP TS 25.419 V17.0.0 (2022-04)
MME LTE/4G	3GPP TS 29.168 V17.1.0 (2021-12)
AMF 5G	3GPP TS 29.518 V18.2.0 (2023-06)

Common CB for Pacific: Study

12 Pacific Islands studied

- **Why?**
  - Make it easier for countries to implement CB (OPEX and CAPEX)

- **Key Considerations:**
  - Existing MNOs and their status (regional vs national MNOs)
  - Submarine cable connectivity
  - Population
  - Cost efficiency

- **How?**
  - Survey in Q1 2025
  - Webinar in March 2025

- **What is and has not been easy**
  - Data availability

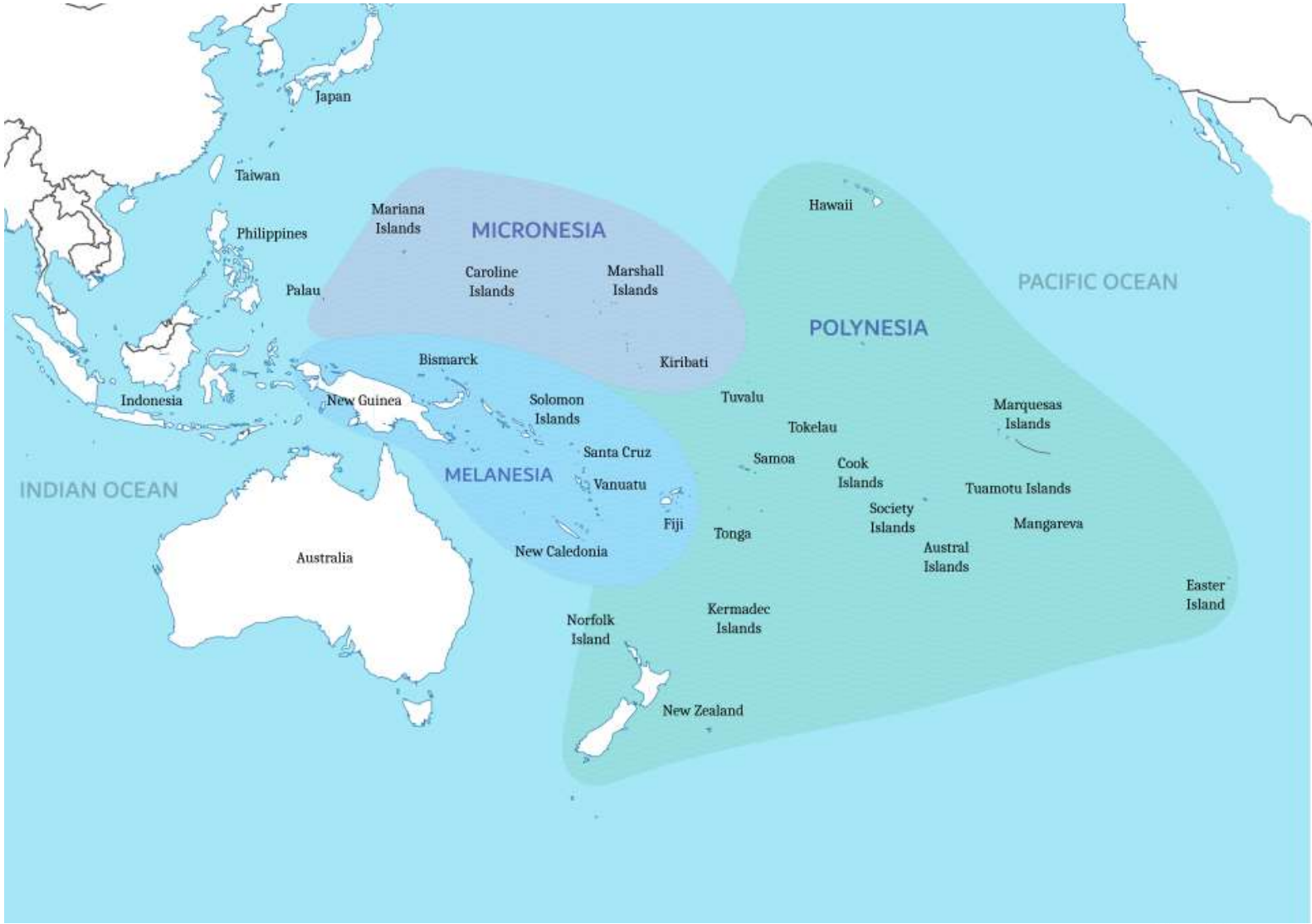


Image: Wikipedia

Common CB for Pacific: Study

➢ Trends towards recommendation

- **Group 1:** Independent CBS system for Papua New Guinea.
- **Group 2:** Independent CBS system for Solomon Islands.
- **Group 3:** Regional centralised CBS system in Fiji (or in Australia for Digicel) connecting Kiribati, Nauru, Samoa, Tonga and Vanuatu.
- **Group 4:** Regional centralised CBS system for F.S. Micronesia, Marshall Islands, Palau and Tuvalu (TBD location, cloud-based CBC is suggested).

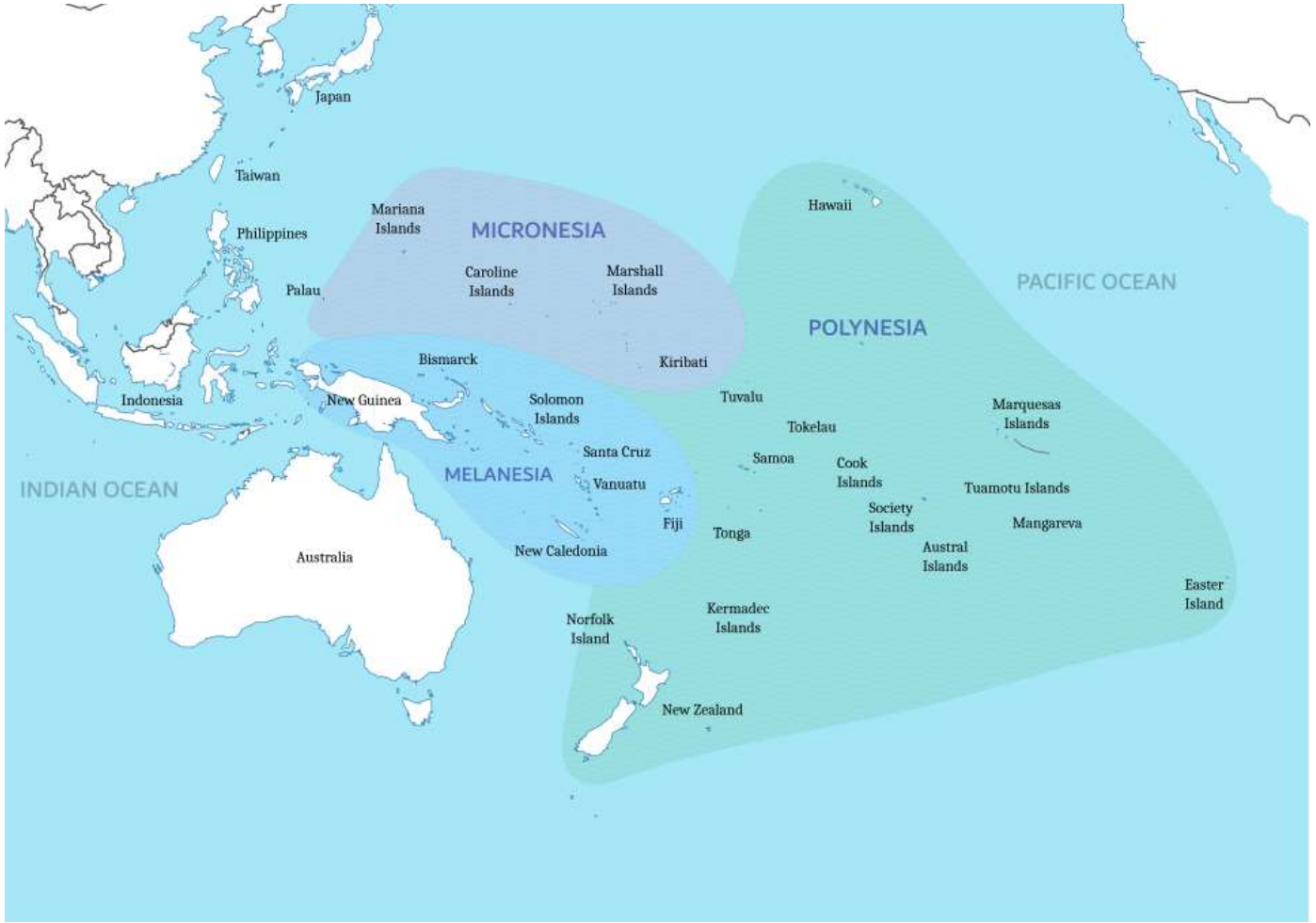
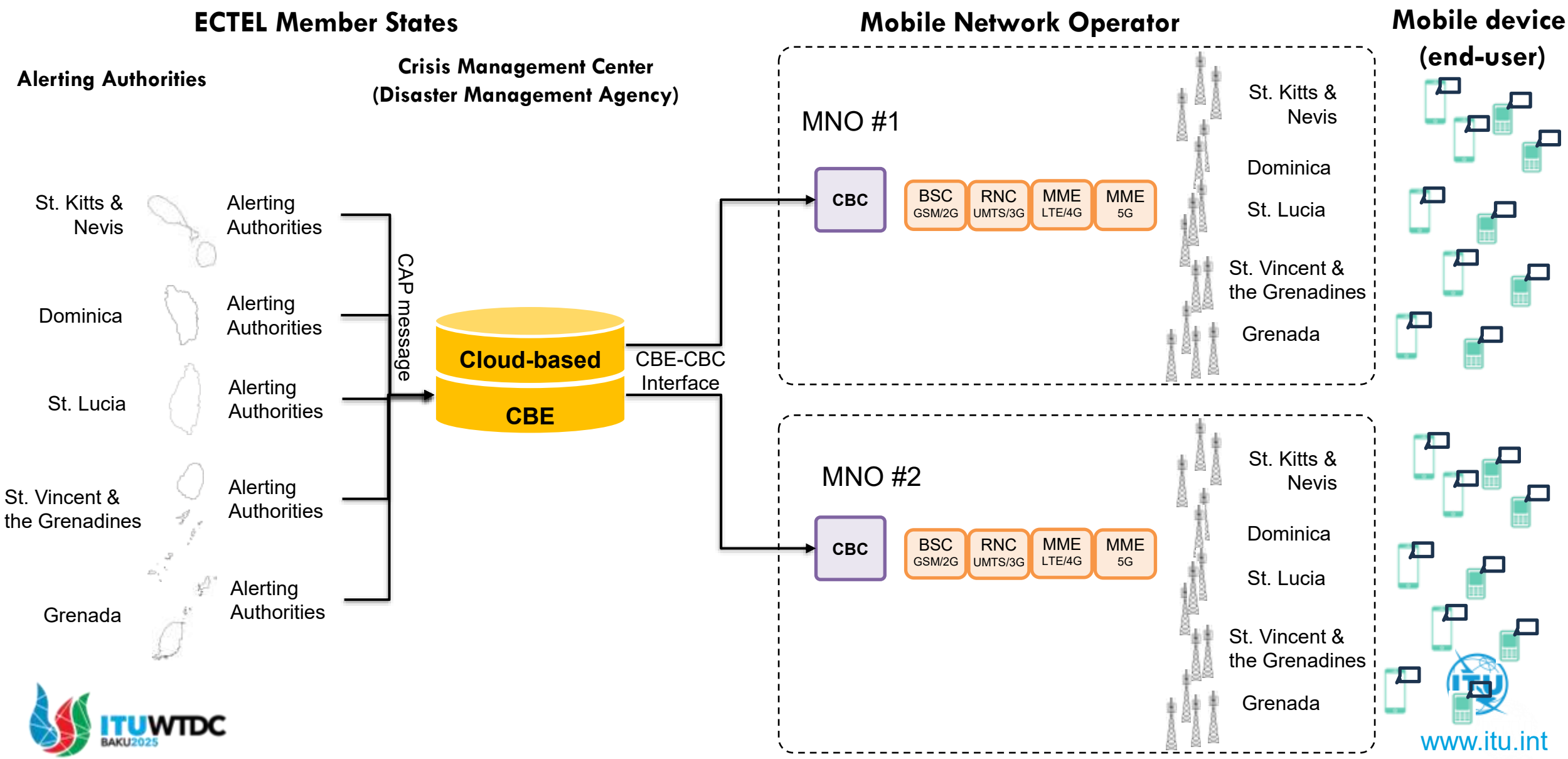


Image: Wikipedia

Cell Broadcast Service for the Caribbean (Proposal)



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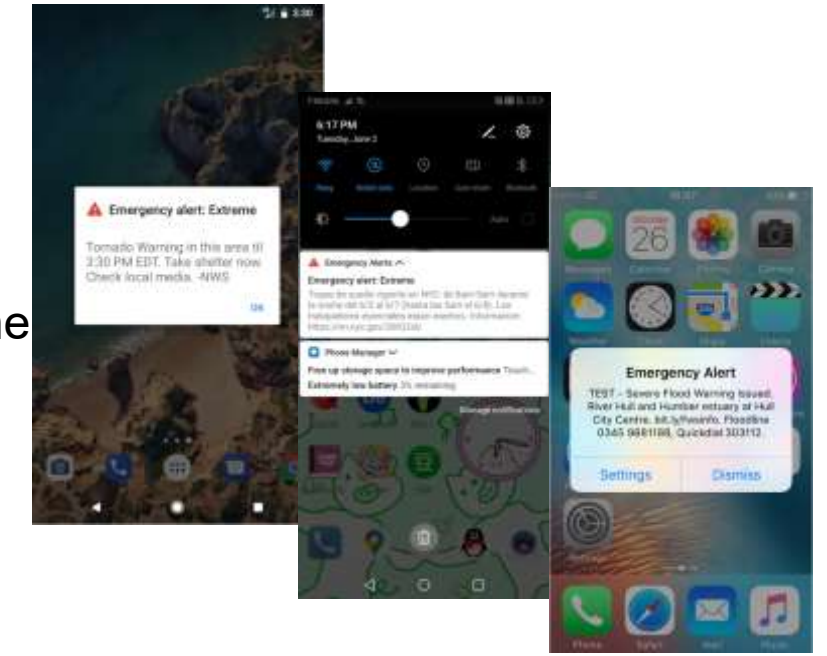
Main benefits of Cell Broadcast

- ✓ Alert messages are delivered within seconds after the alert is issued
- ✓ Alerts are geo-targeted (one cell, local, regional, national alerts)
- ✓ Standard ringtone and vibration mode
- ✓ Alert messages are shown in the screen of the device
- ✓ Hyperlinks to additional information online in the text message
- ✓ All end users receive the alert, including those with no contract with the MNO and roaming users
- ✓ Alert messages are received by end users in their own language
- ✓ Not affected by network congestion
- ✓ Privacy not an issue (end user information not required)



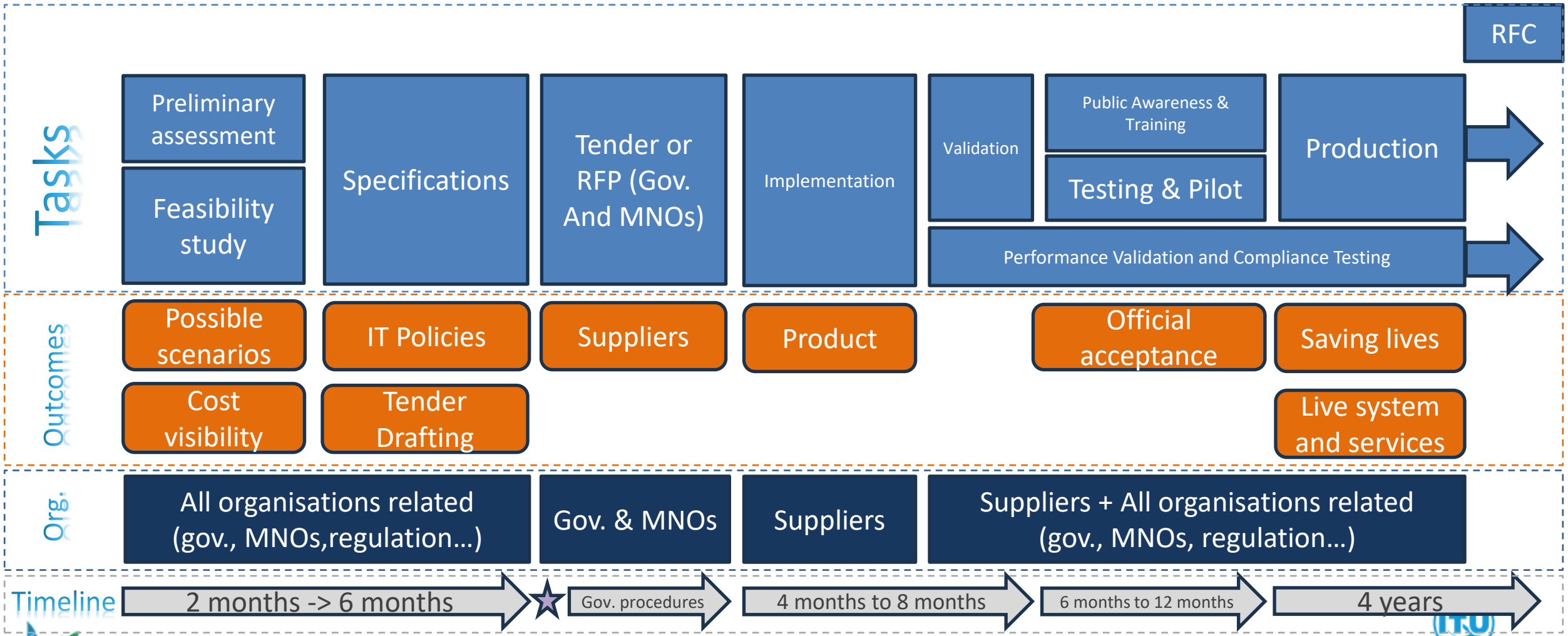
Legal & Regulatory Compliance

Funding

Stakeholder Agreement on Governance & Roles

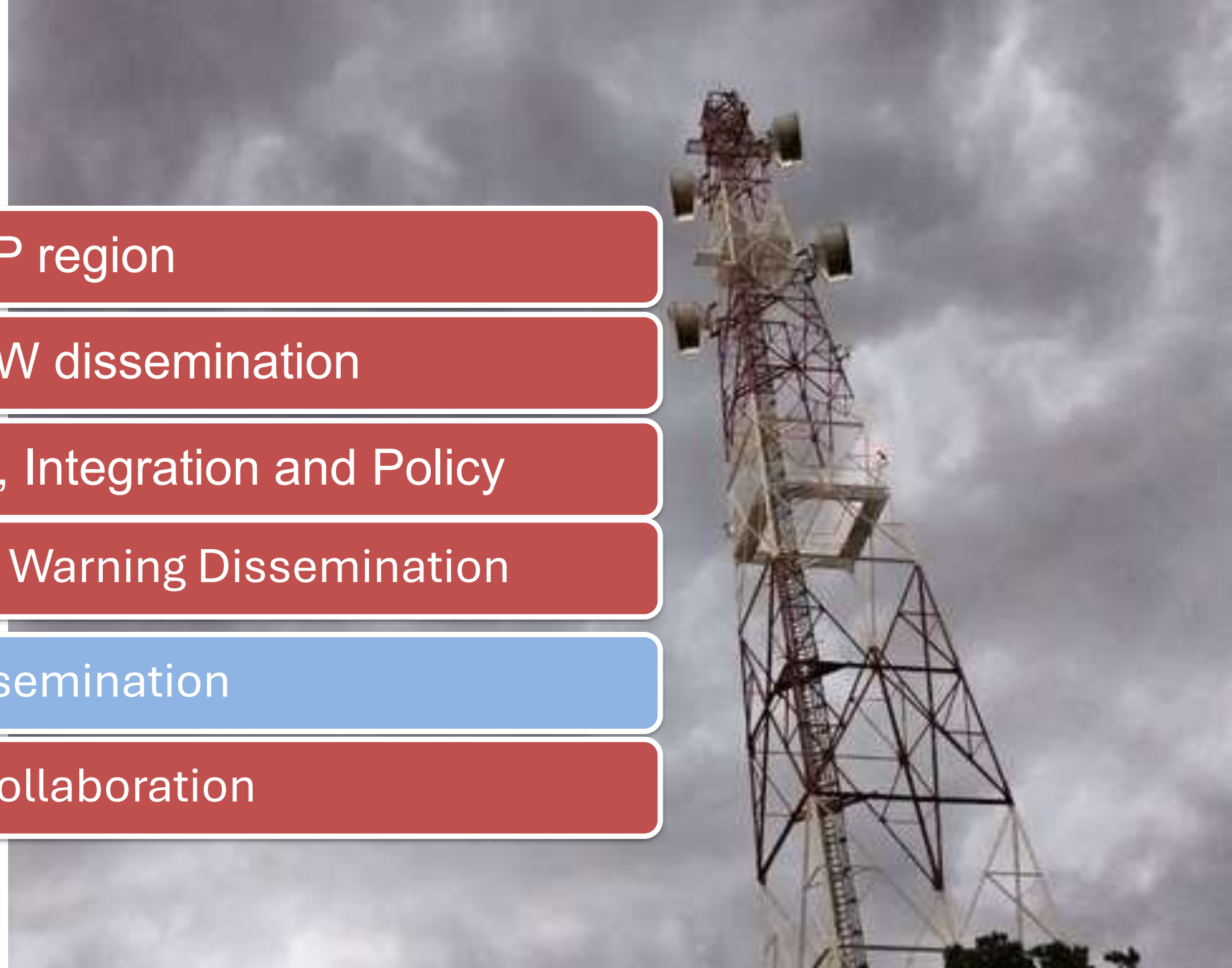
Commitment

CB Project Management Plan



Scope

- EW for DRR in ASP region
- Need for CAP in EW dissemination
- CAP Infrastructure, Integration and Policy
- Mobile-based Early Warning Dissemination
- Use of AI in EW Dissemination
- Partnerships and Collaboration



ITUWTDC BAKU2025

Georeferencing

Connecting image maps with their spatial location.

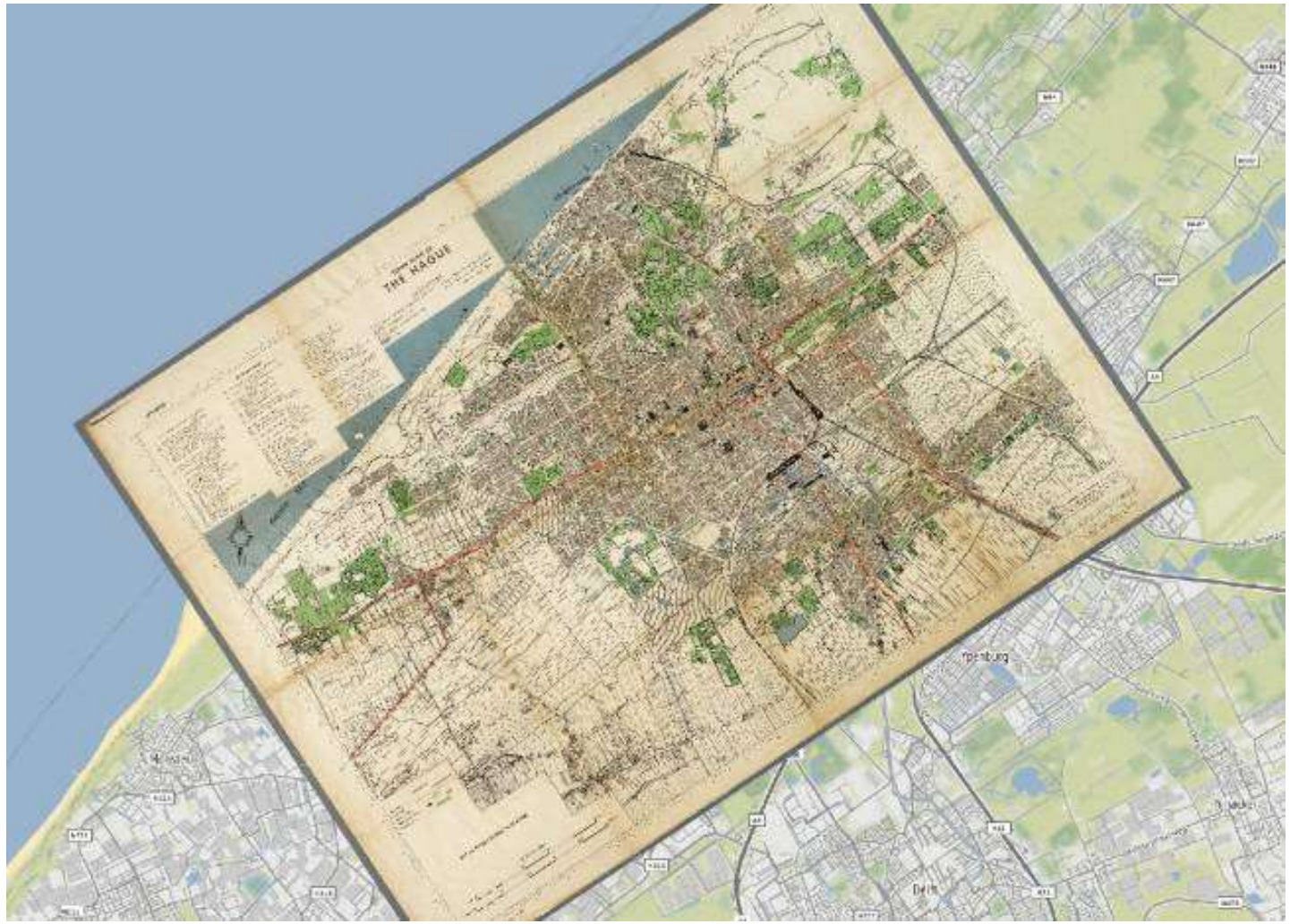


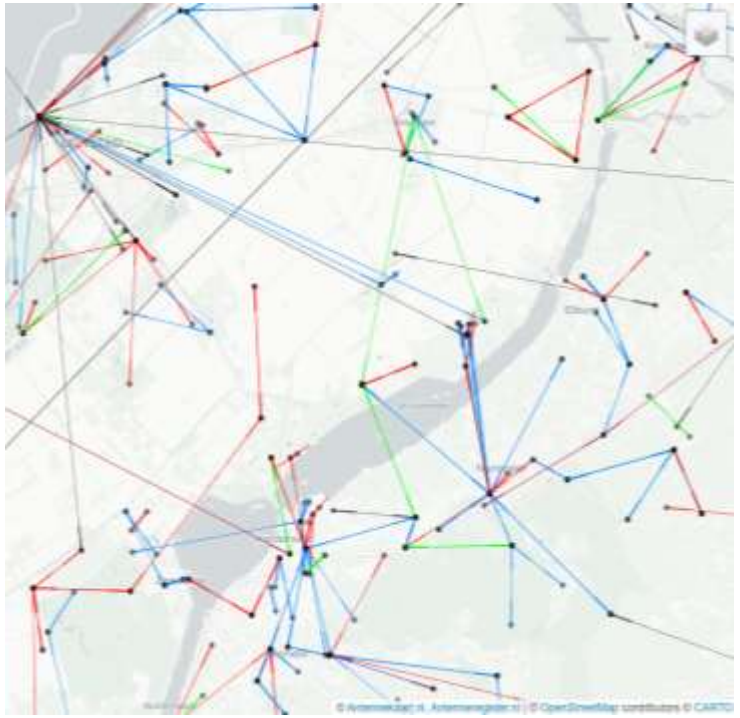
Image source: https://kokoalberti.com/articles/georeferencing-and-digitizing-old-maps-with-gdal/

ICT infrastructure representation on a map

ICT infrastructure as we would present it in a GIS: cell towers (points), radio-links (lines), mobile coverage areas ((multi-)polygons).

Cellular tower

Radio-links



Mobile coverage area

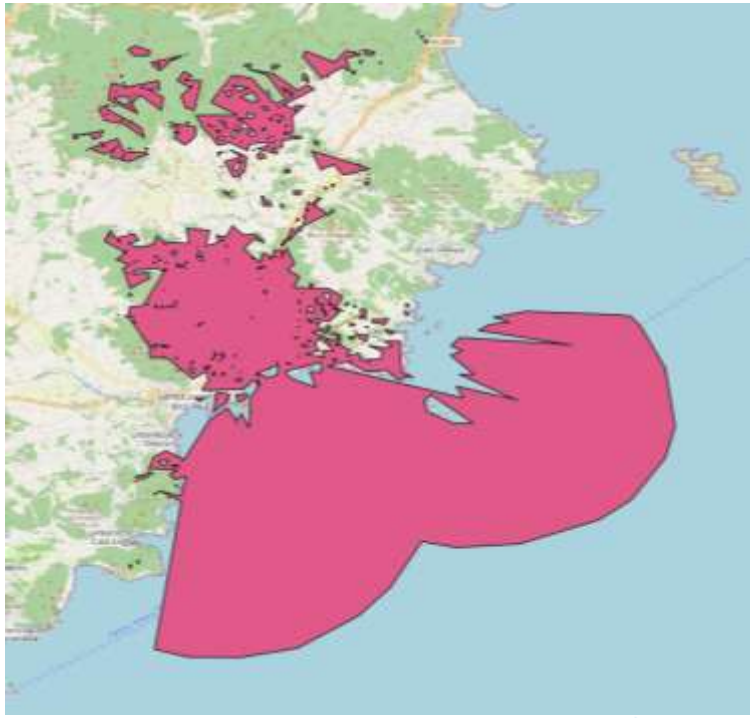


Image source: https://antennekaart.nl/

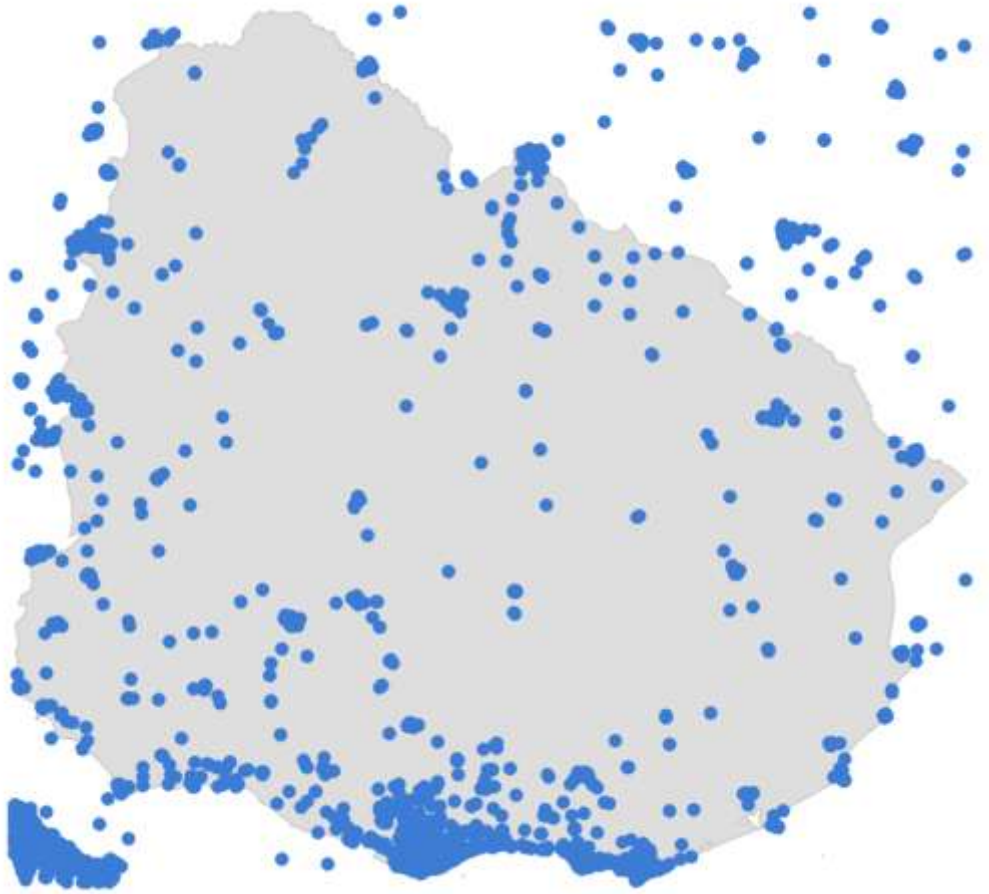
Data preprocessing

Field data is pre-processed, clarified, evaluated, corrected, and enhanced with unique IDs, correct data types, accurate geolocation, and geo-related interventions improving accuracy and consistency

Common issues

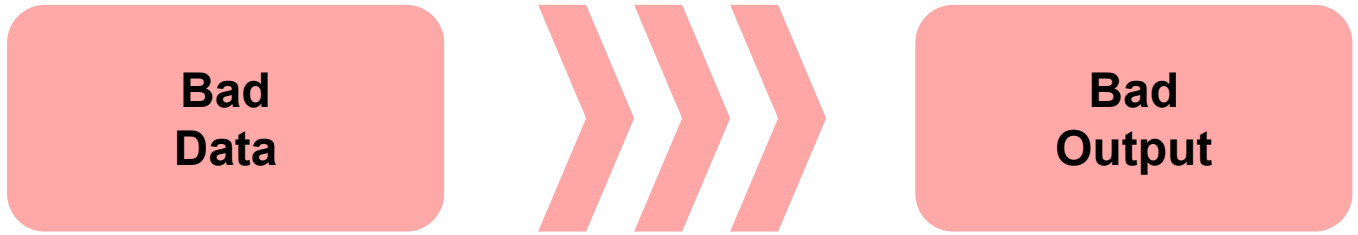
- Missing data
- Non-standard fields
- Non-standard categories
- Duplications
- Geo data outside expected areas
- Topology errors
- Scale and Resolution Issues
- Logical errors

Example of data out of expected area



Data Accuracy and Quality

High accuracy and quality data is the foundation for reliable analysis and effective decision-making

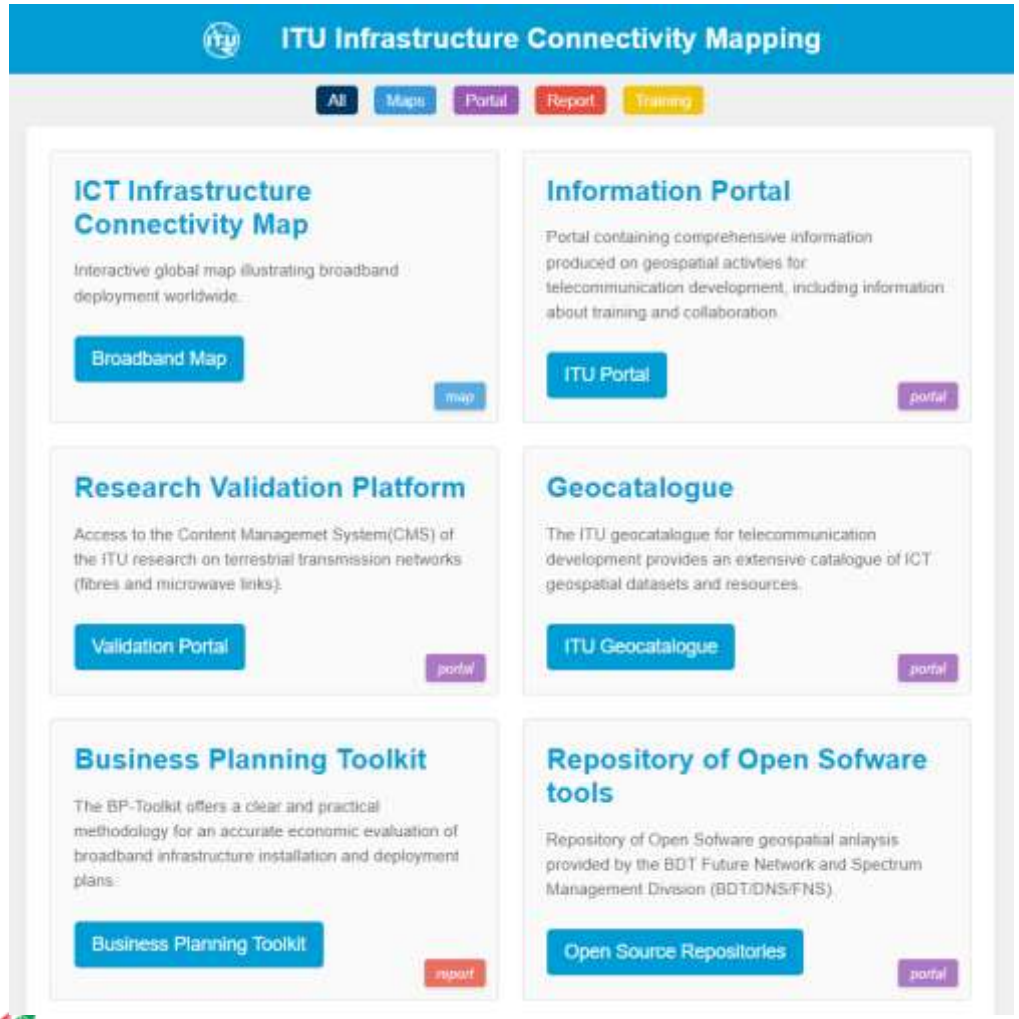


Data that does not serve the purpose, is inaccurate, inconsistent. Affects overall output and decision making

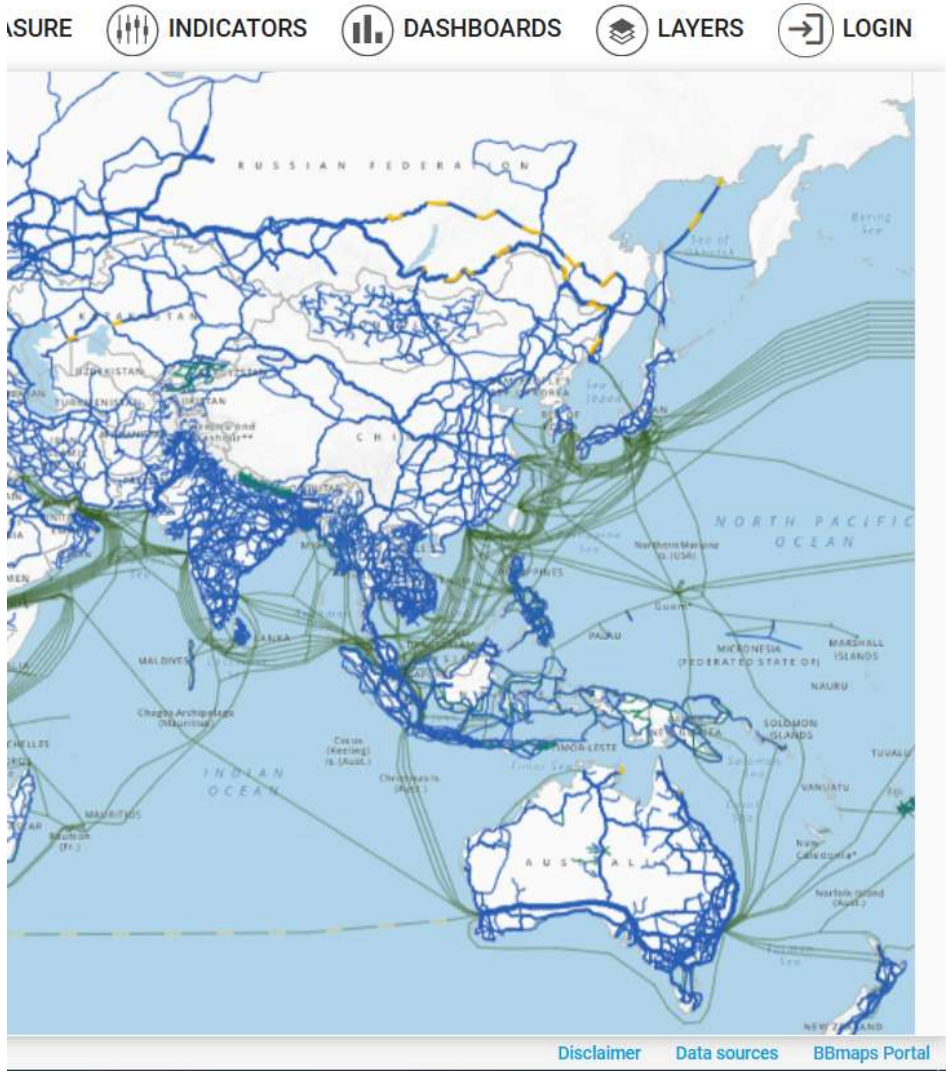
Data that serve the purpose, is accurate, consistent. Supports reliable output and aids decision making

Visualization and Mapping

ITU offer powerful tools to visualize and analyse infrastructure data, helping stakeholders to visualise infrastructure, identify connectivity gaps, and determine connectivity technology options and viability



Infrastructure mapping tools



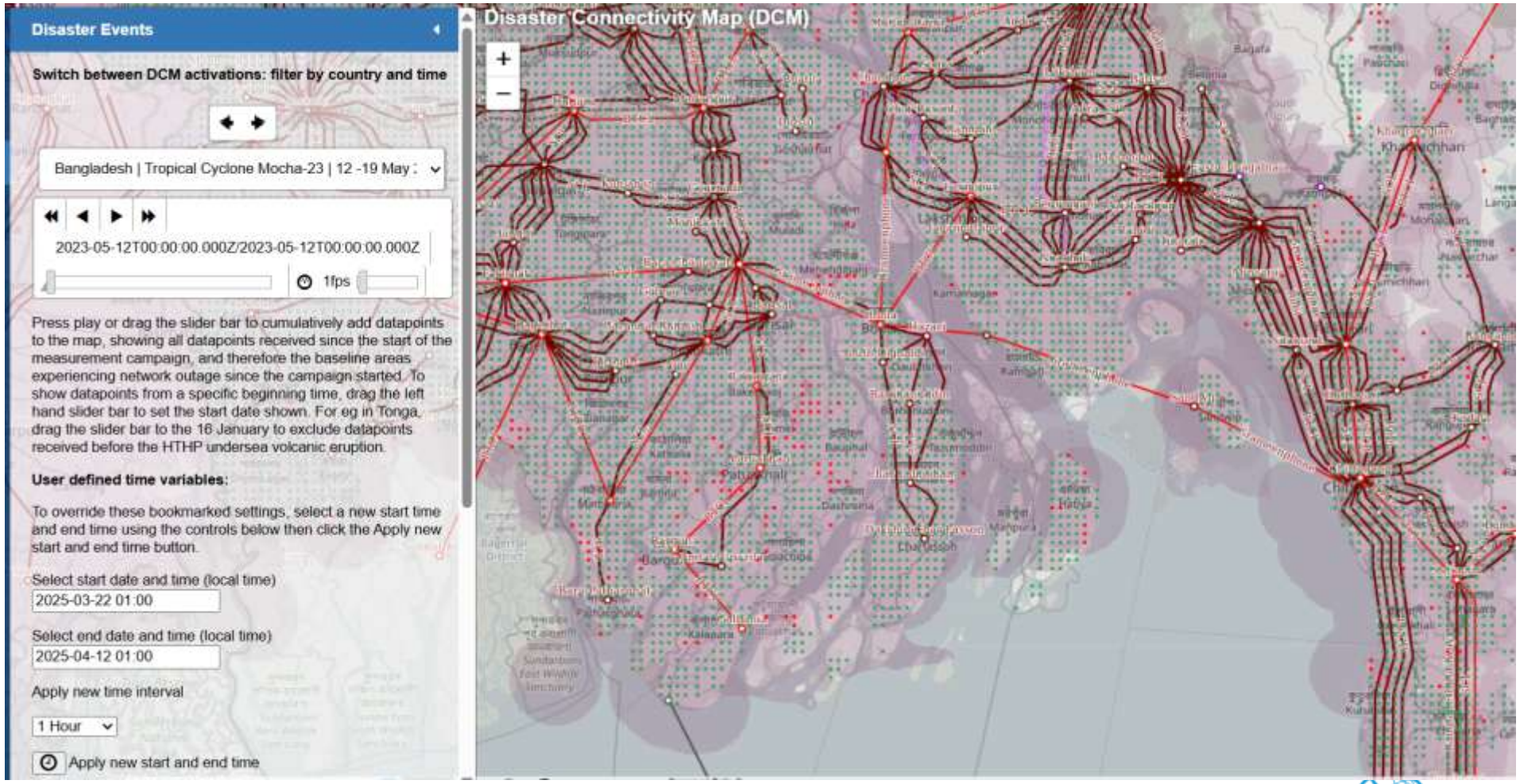
https://bbmaps.itu.int/

www.itu.int

ITU Disaster Connectivity Maps

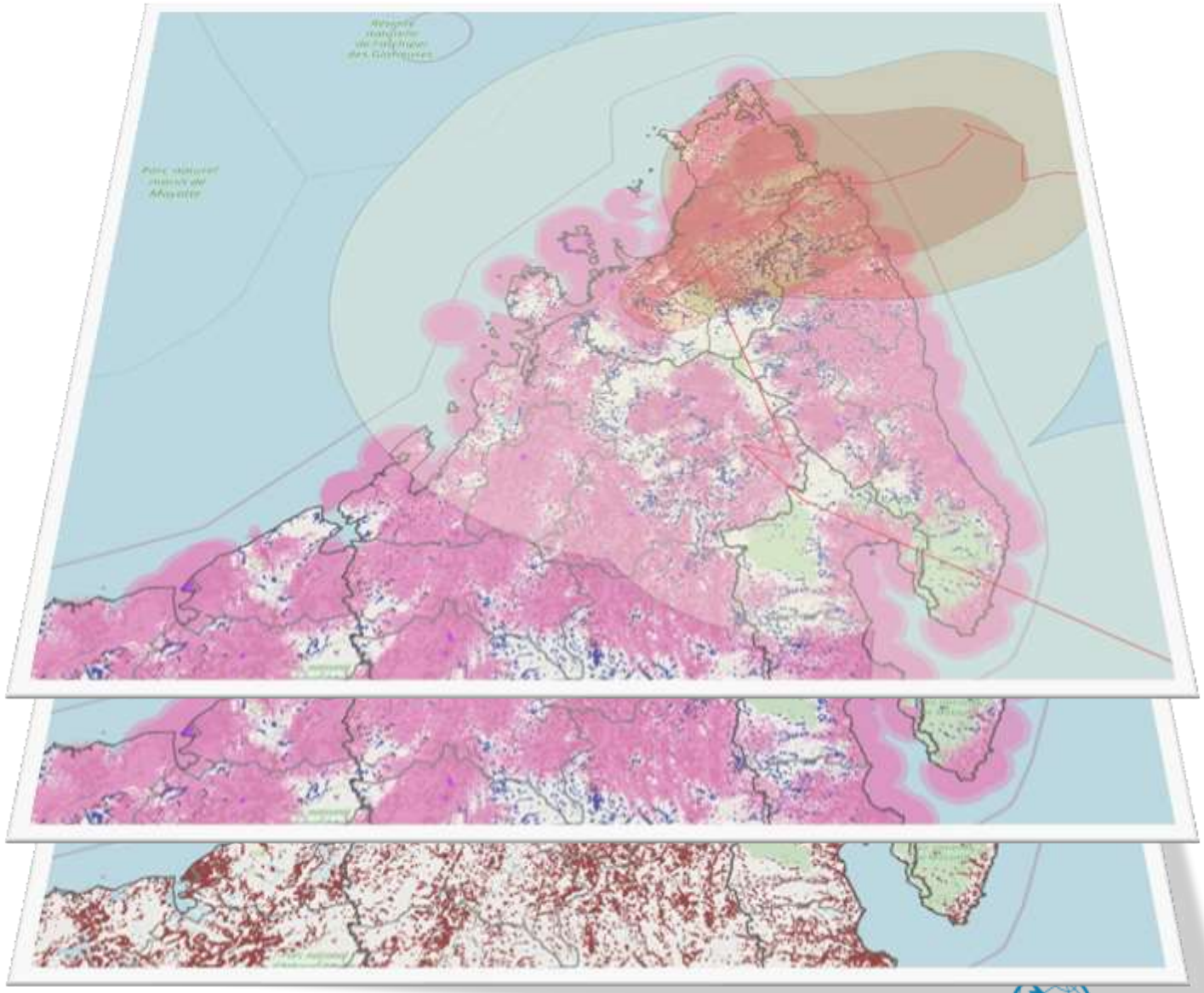
DCM: Activation Example (Bangladesh – May 2023/Cyclone Mocha)

- ✓ **Manually** activated by the ITU upon request
- ✓ **In the aftermath** of Tropical Cyclone Mocha. Green squares show where cellular network connectivity was detected, and red squares show where it was not detected, compared to the baseline.

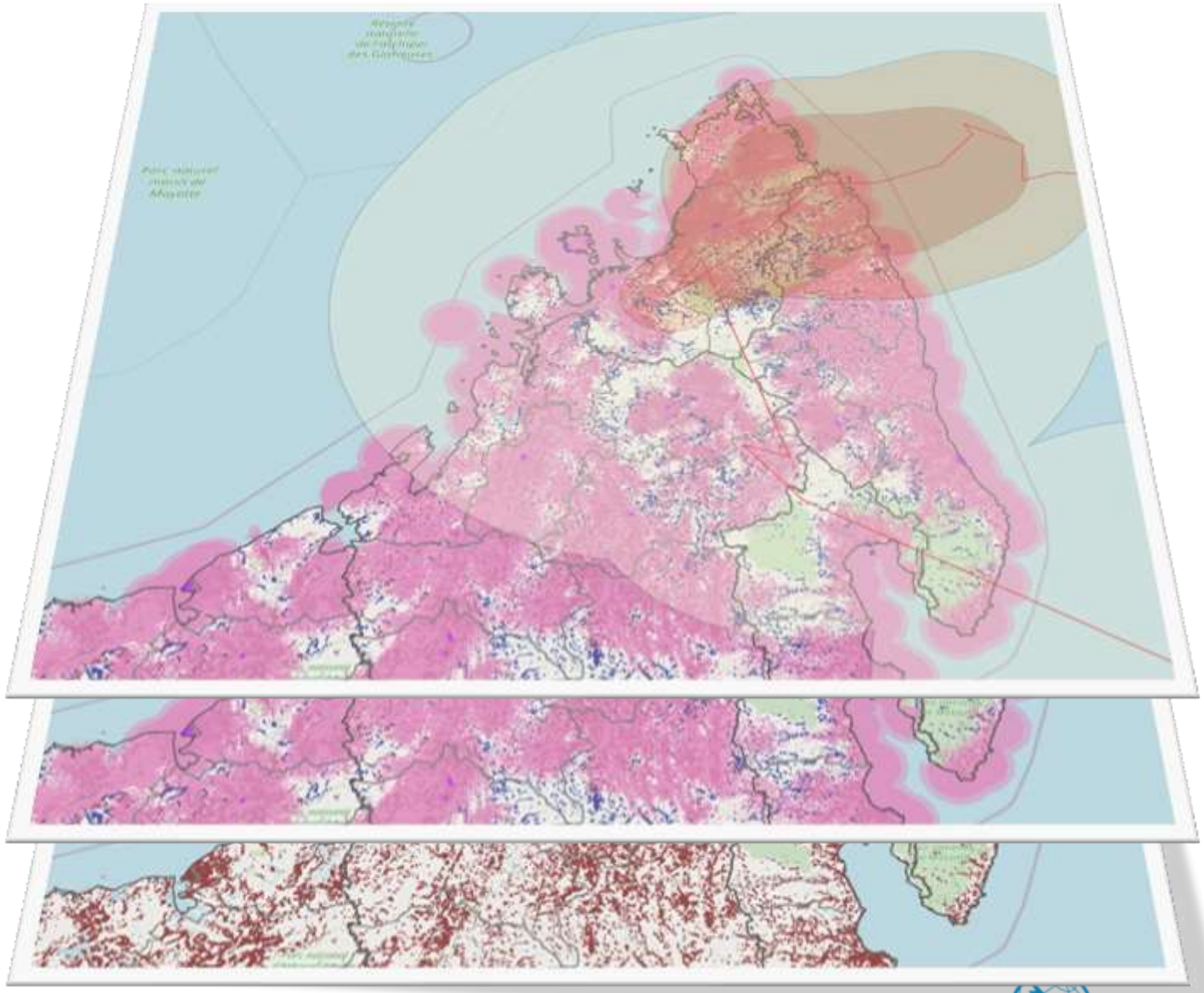


Early Warning Connectivity Map EWCM

- ITU collaborates with Microsoft AI for Good Lab, Planet, and the Institute for Health Metrics and Evaluation (IHME) at the University of Washington.
- Integrates AI with satellite imagery to create high-resolution population density maps and visualize connectivity data, to **highlight areas where people are vulnerable to natural hazards due to limited access to emergency notifications.**
- These results will guide **data-driven decisions on warning dissemination strategies** and guide mobile infrastructure investment to ensure no one is left behind.



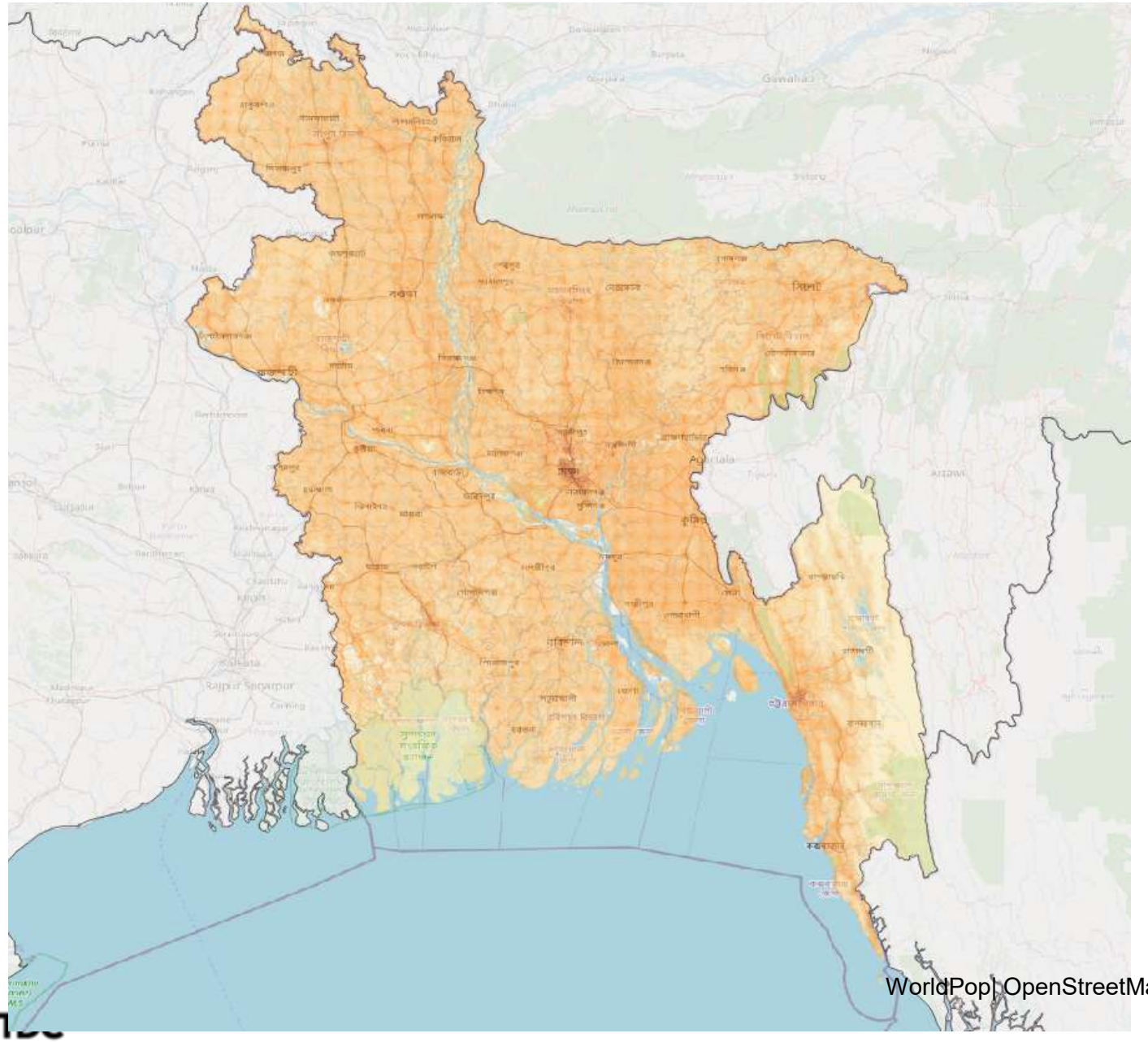
EWCM: Population beyond the reach of fixed broadband, 2G and 3G networks, Bangladesh



Population density at 1km resolution

Total population
(UNPD, Jan 2024)
172,507,468

- 1 - 50
- 50 - 100
- 100 - 500
- 500 - 1000
- 1000 - 5000
- 5000 - 10000
- 10000 - 25000
- 25000 - 50000
- 50000 - 100000
- 100000 - 201786



Coldspot map of offline population.

- What is the extent of fixed and mobile telecom coverage, and therefore, which channels can be used to send early warning notifications?
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Fixed broadband datapoints

Total population (UNPD, Jan 2024) 172,507,468

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- 50 - 100
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- 5000 - 10000
- 10000 - 25000
- 25000 - 50000
- 50000 - 100000
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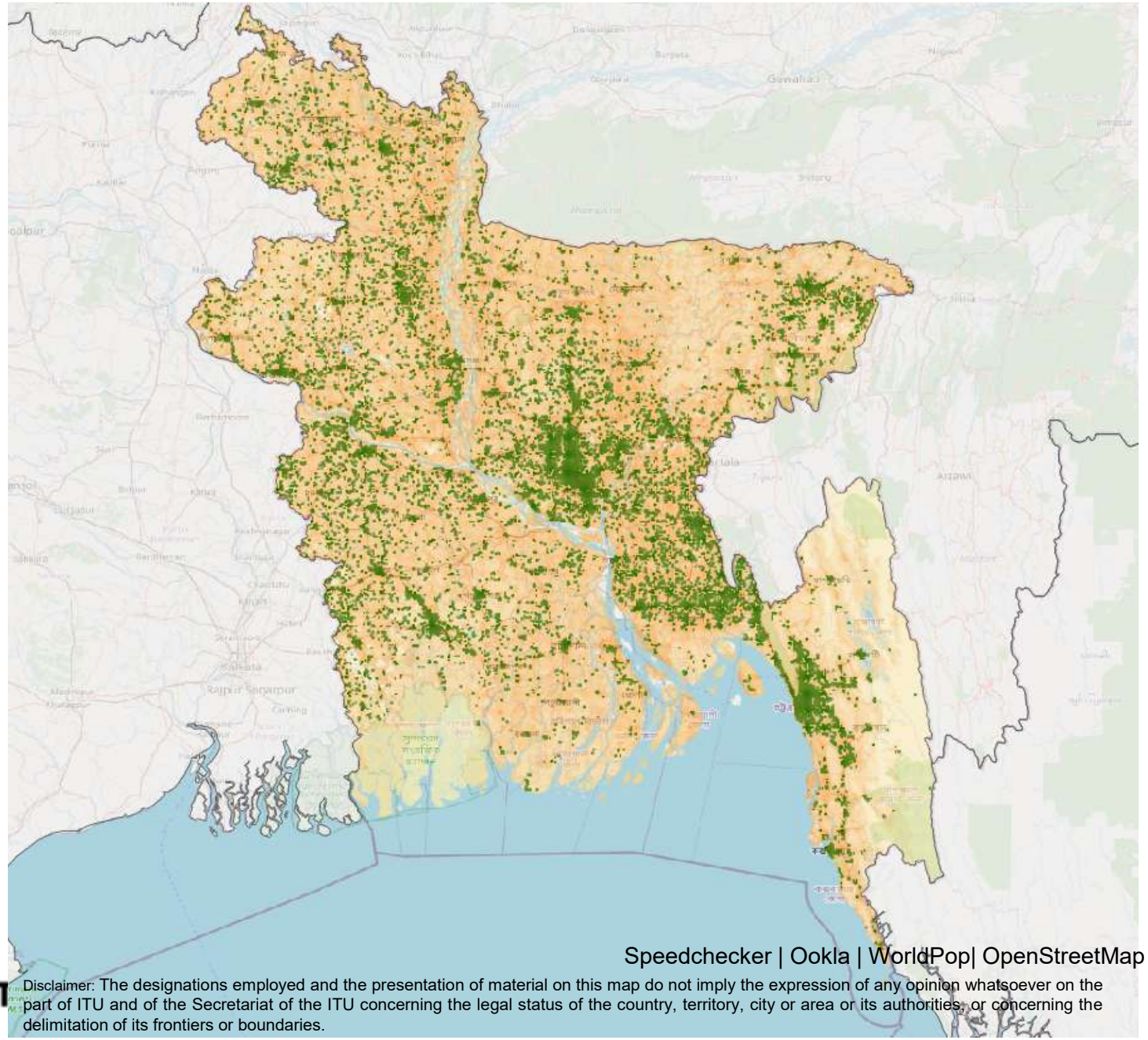

Speedchecker | Ookla | WorldPop| OpenStreetMap

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2G cellular coverage

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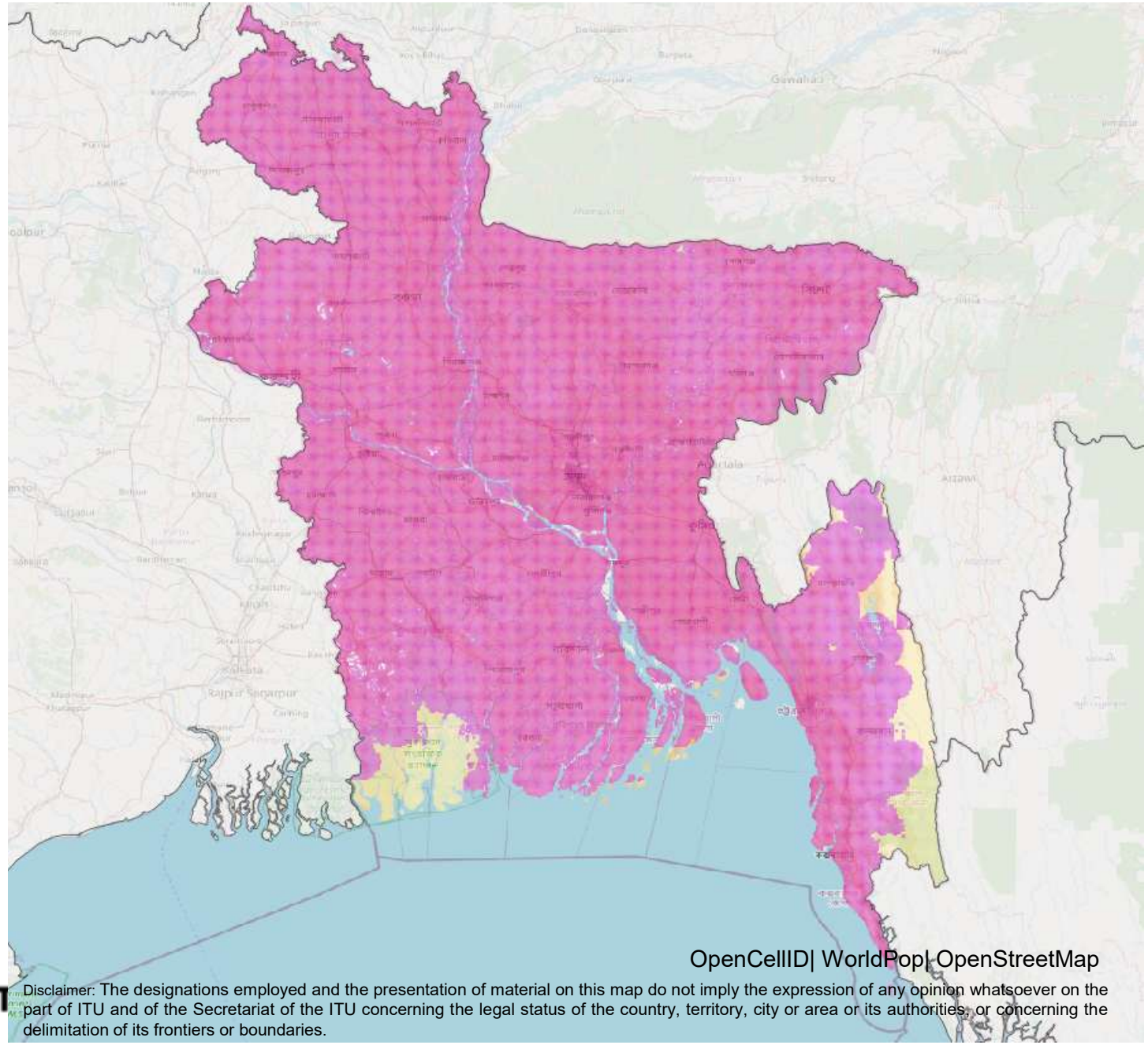
- 1 - 50
- 50 - 100
- 100 - 500
- 500 - 1000
- 1000 - 5000
- 5000 - 10000
- 10000 - 25000
- 25000 - 50000
- 50000 - 100000
- 100000 - 201786



OpenCellID| WorldPop| OpenStreetMap

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3G+ cellular coverage

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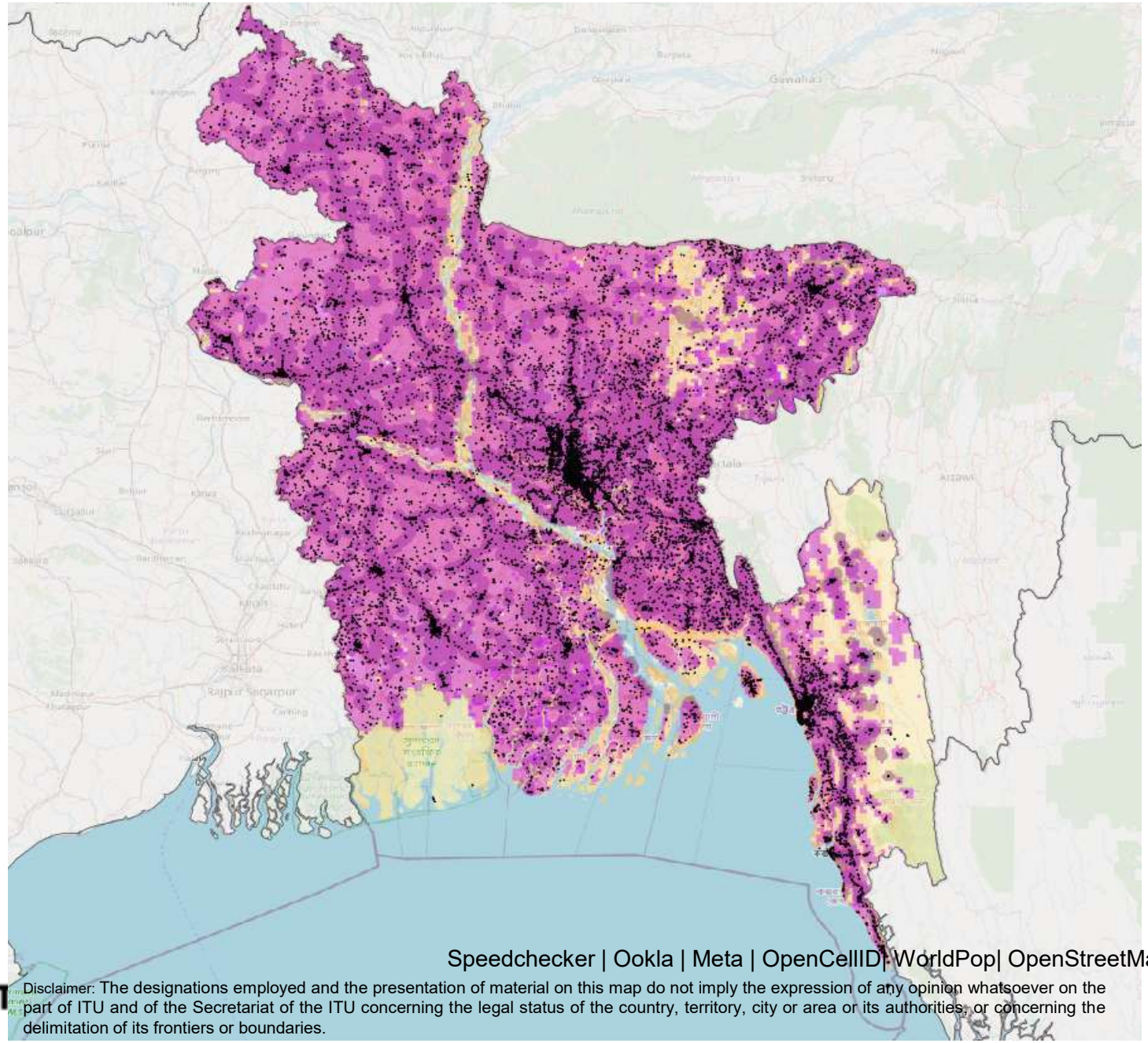
- 1 - 50
- 50 - 100
- 100 - 500
- 500 - 1000
- 1000 - 5000
- 5000 - 10000
- 10000 - 25000
- 25000 - 50000
- 50000 - 100000
- 100000 - 201786



Speedchecker | Ookla | Meta | OpenCellID | WorldPop| OpenStreetMap

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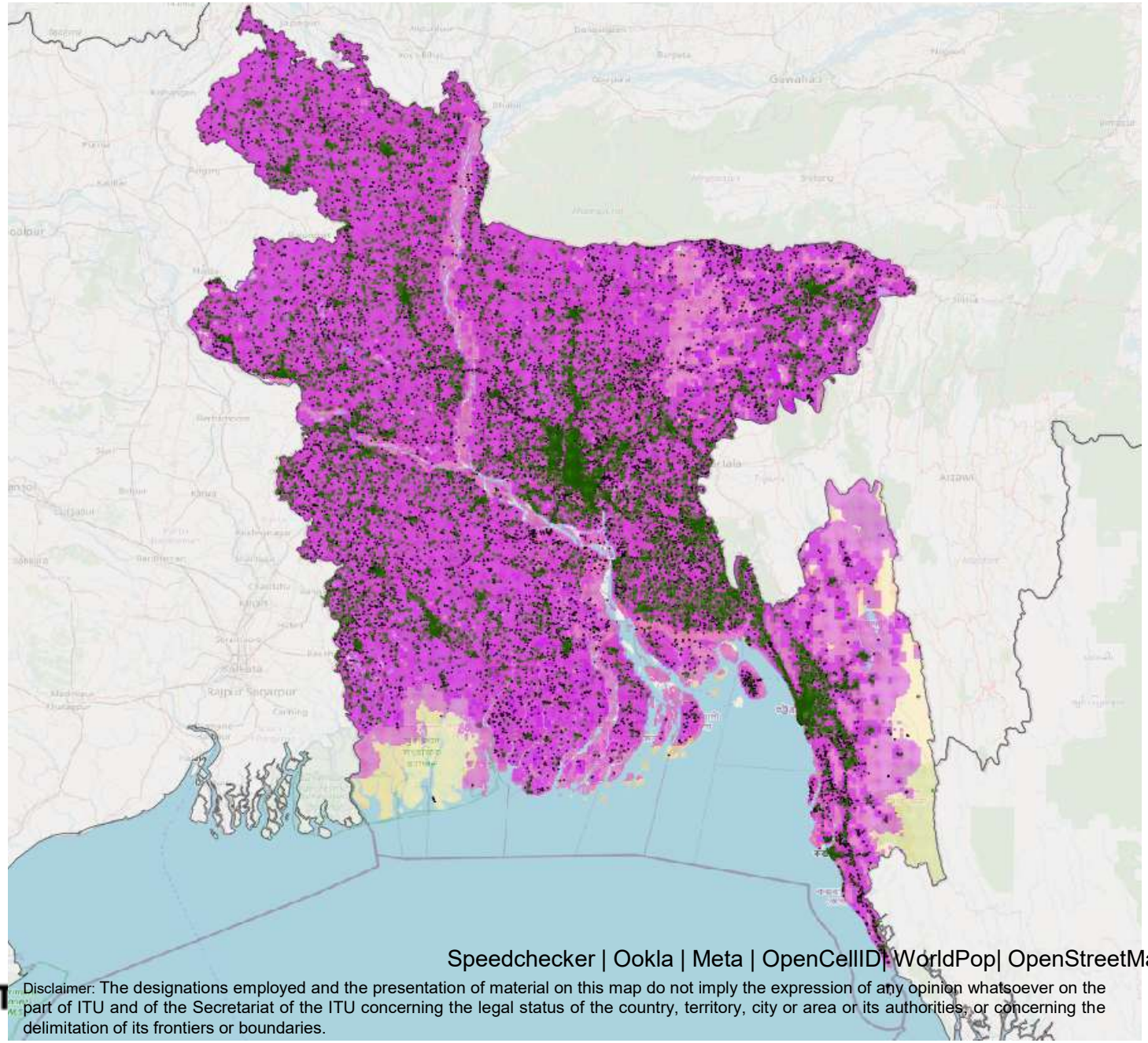
Fixed broadband, 2G, and 3G+ cellular coverage

Total population (UNPD, Jan 2024) 172,507,468

- 1 - 50
- 50 - 100
- 100 - 500
- 500 - 1000
- 1000 - 5000
- 5000 - 10000
- 10000 - 25000
- 25000 - 50000
- 50000 - 100000
- 100000 - 201786



Speedchecker | Ookla | Meta | OpenCellID| WorldPop| OpenStreetMap

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Offline population

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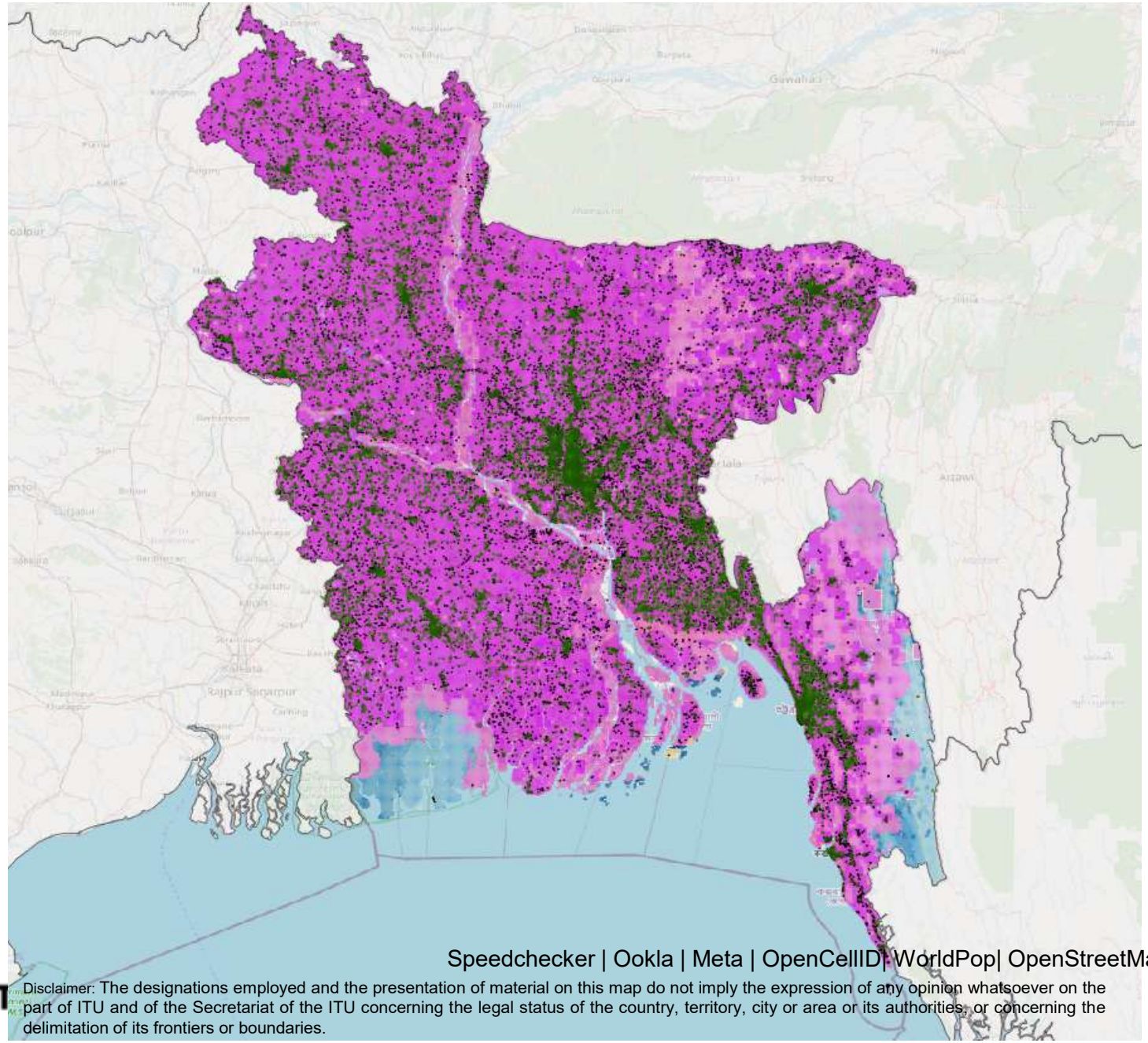
- 50 - 100
- 100 - 500
- 500 - 1000
- 1000 - 5000
- 5000 - 10000
- 10000 - 25000
- 25000 - 50000
- 50000 - 100000
- 100000 - 201786

Population beyond network reach 418,458 (0.2%)

- 1 - 2
- 2 - 5
- 5 - 10
- 10 - 25
- 25 - 50
- 50 - 75
- 75 - 100
- 100 - 250
- 250 - 500
- 500 - 1180.6



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- Geographical areas beyond the network reach

Offline population

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- 50 - 100
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- 500 - 1000
- 1000 - 5000
- 5000 - 10000
- 10000 - 25000
- 25000 - 50000
- 50000 - 100000
- 100000 - 201786

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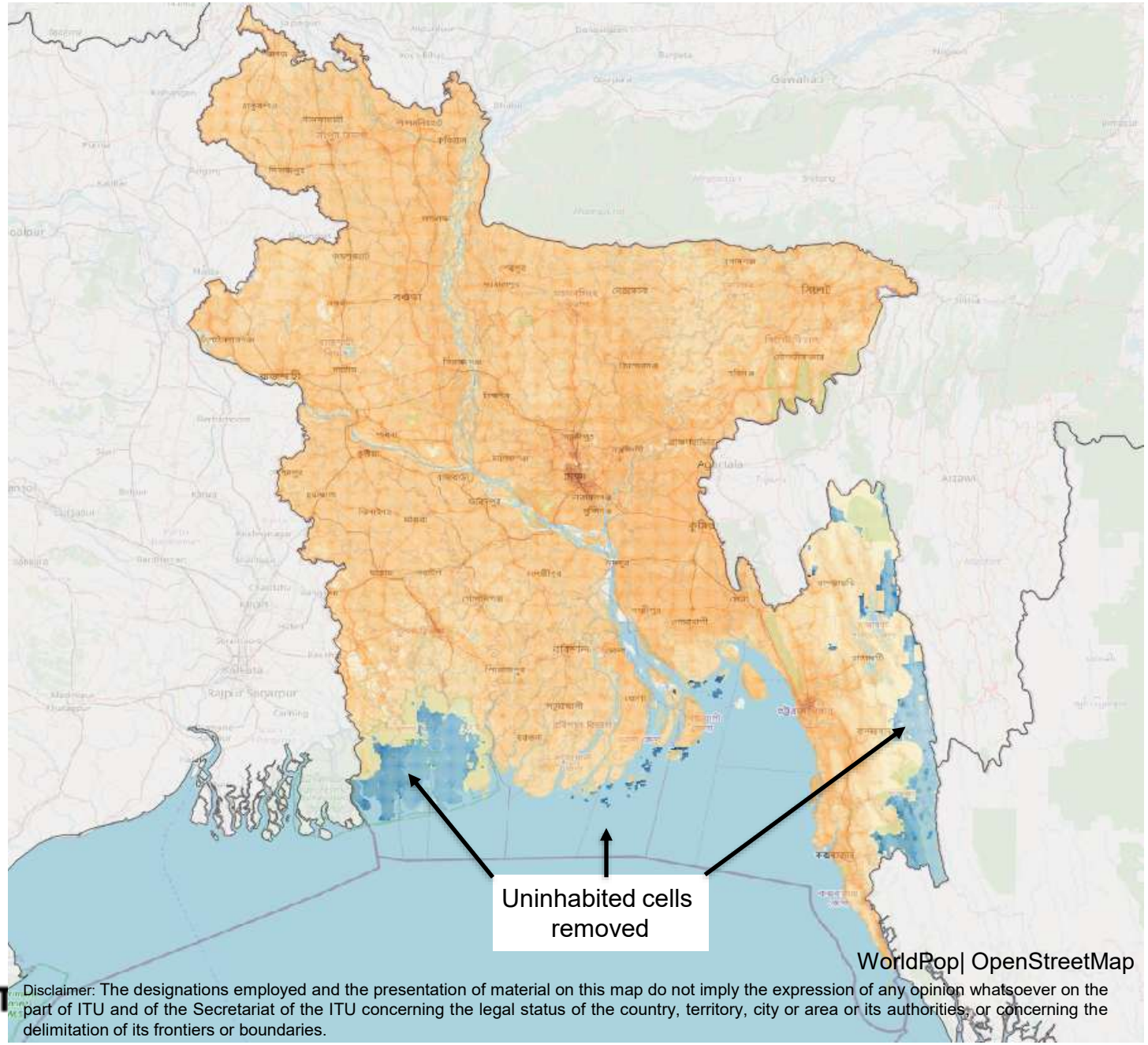
- 2 - 5
- 5 - 10
- 10 - 25
- 25 - 50
- 50 - 75
- 75 - 100
- 100 - 250
- 250 - 500
- 500 - 1180.6



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Offline population, filtering out uninhabited grid cells

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- 1 - 50
- 50 - 100
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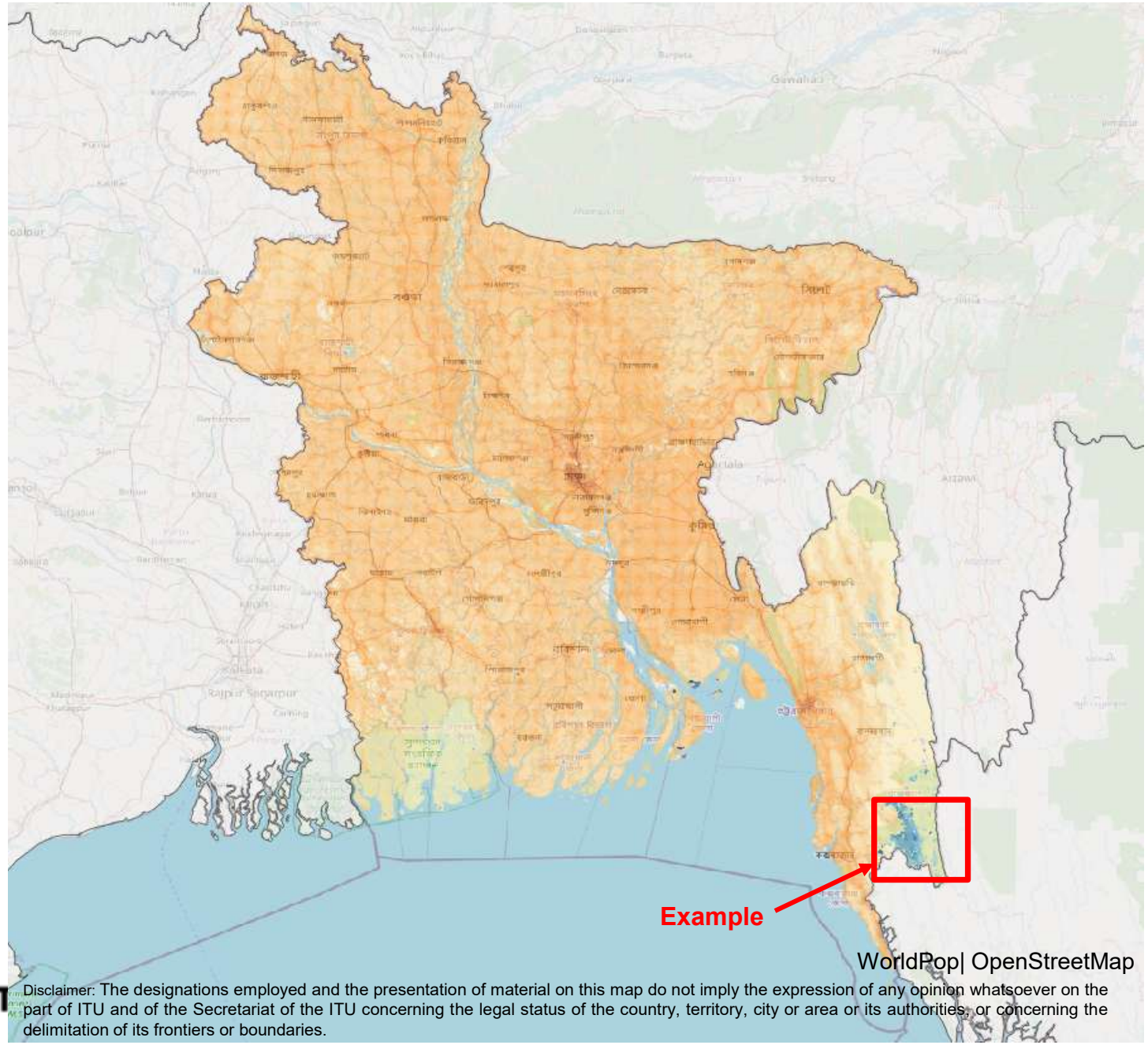
- 5000 - 10000
- 10000 - 25000
- 25000 - 50000
- 50000 - 100000
- 100000 - 201786

Population beyond network reach 113,047 (0.1%)

- 1 - 2
- 2 - 5
- 5 - 10
- 10 - 25
- 25 - 50
- 50 - 75
- 75 - 100
- 100 - 250
- 250 - 500
- 500 - 1180.6



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- 10 - 25
- 25 - 50
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- 75 - 100
- 100 - 250
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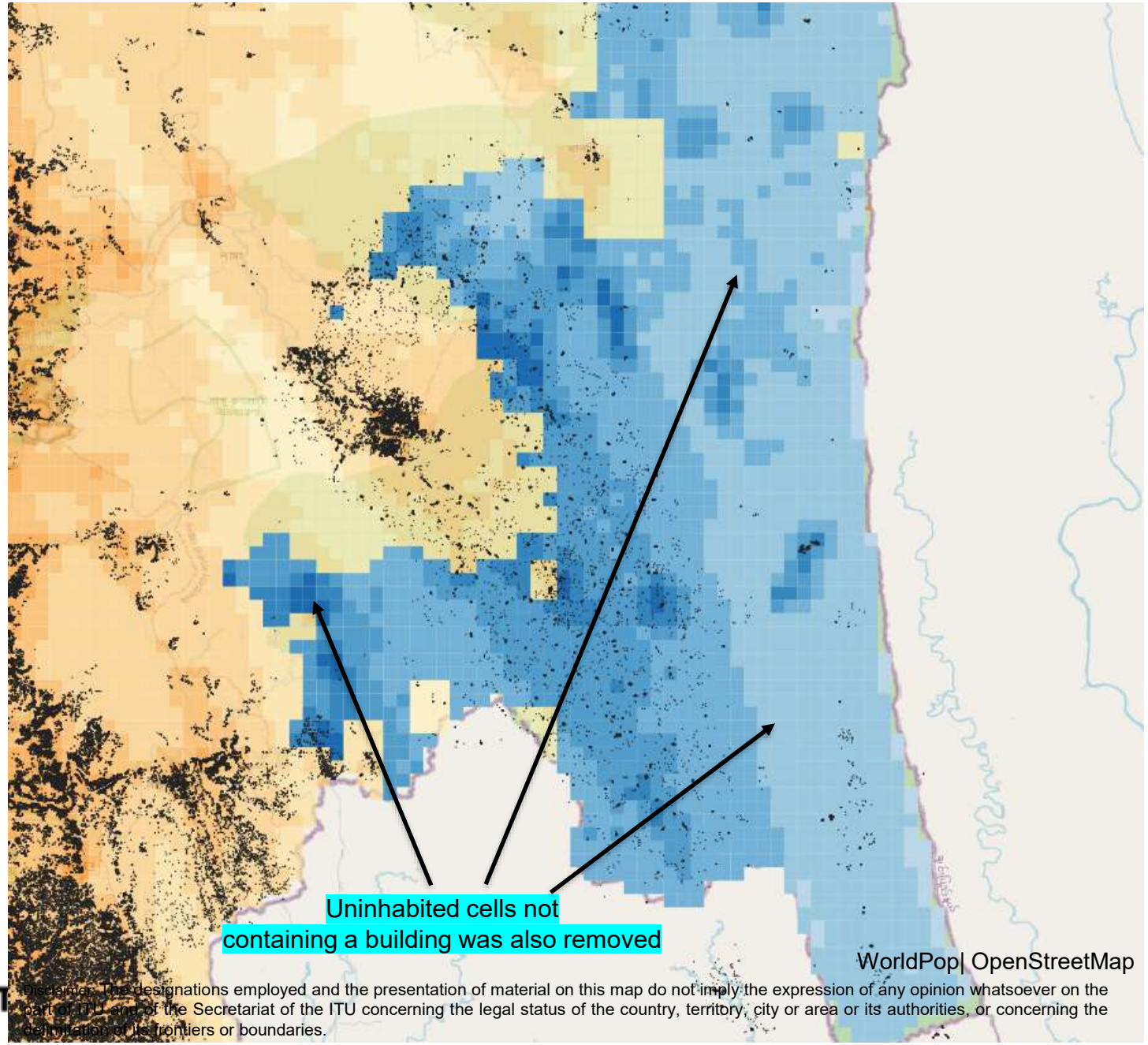

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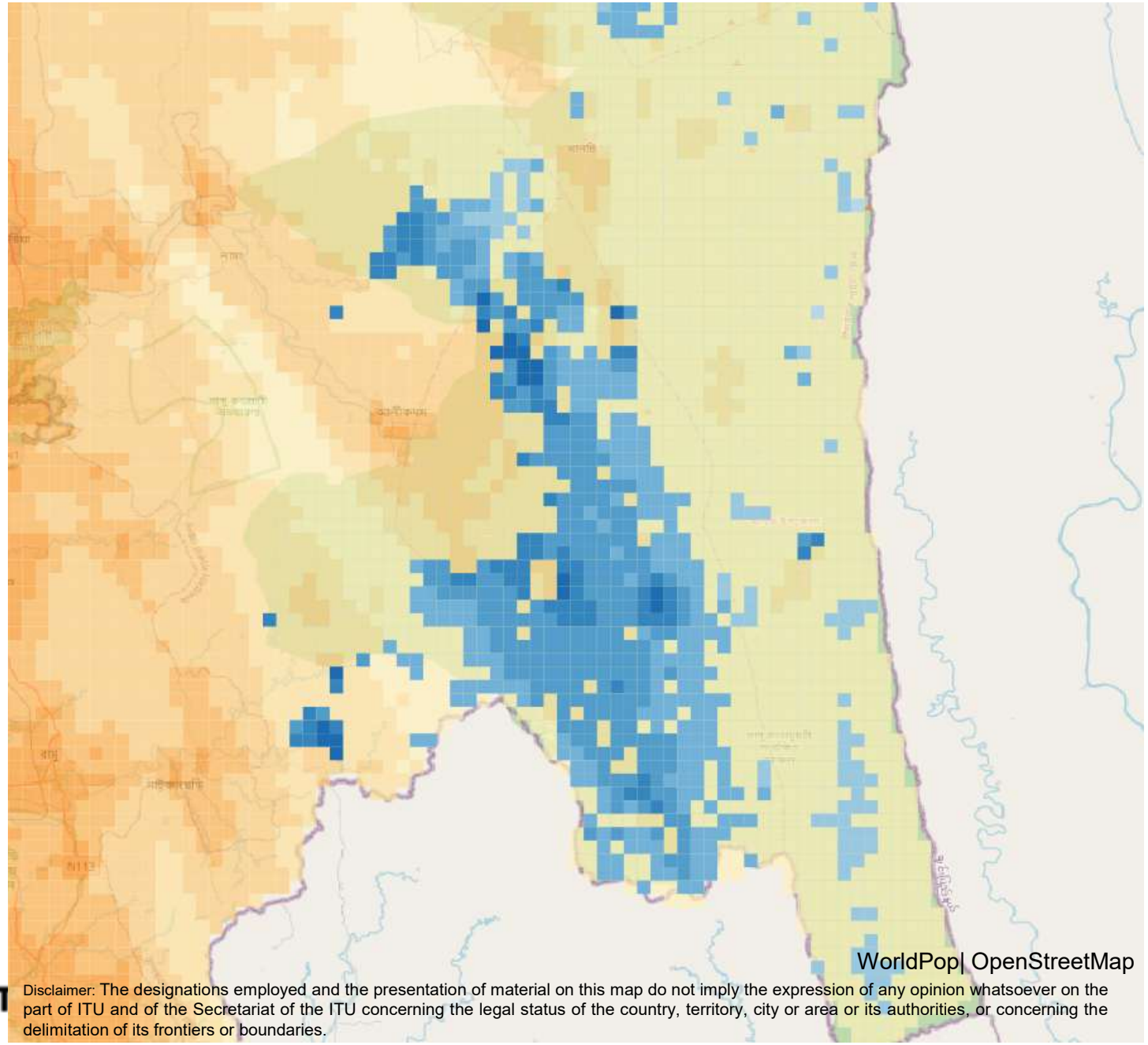

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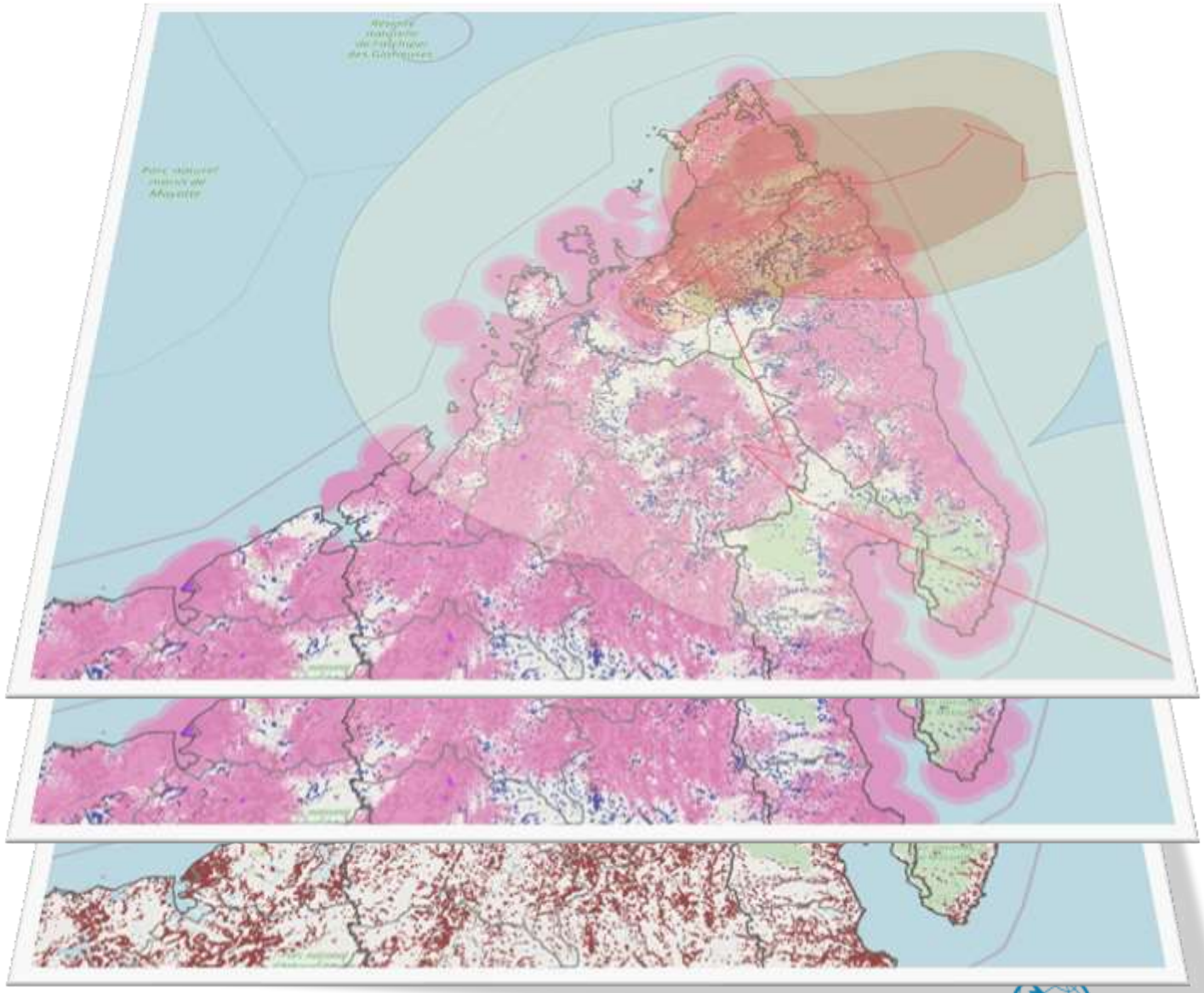
EWCM: Population beyond the reach of fixed broadband, 2G and 3G networks, Nepal



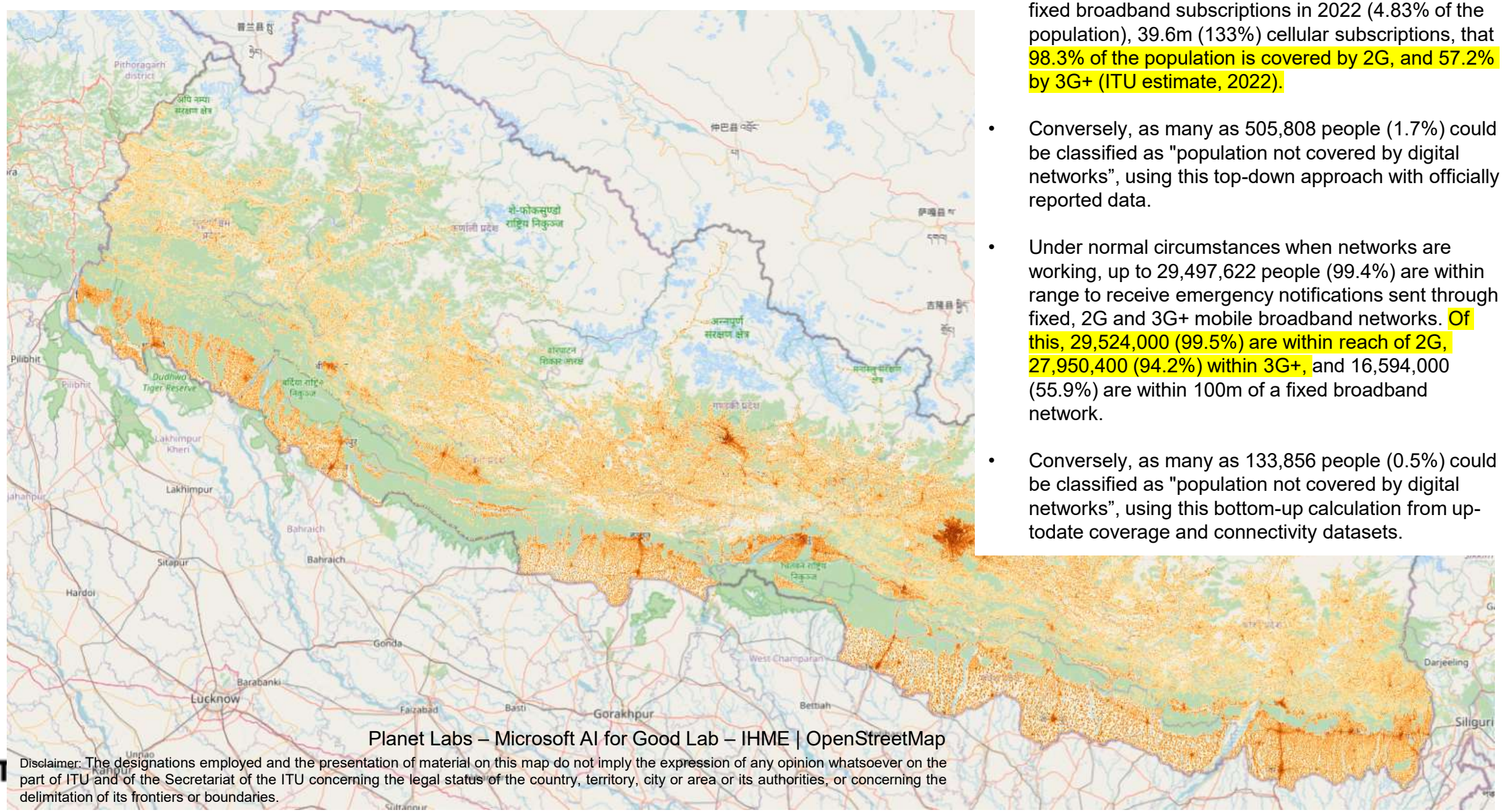
Population beyond the reach of fixed broadband, 2G and 3G networks, Nepal

Population density at 100m resolution
Planet Labs – Microsoft AI for Good Lab – IHME

Total population (IHME, Q4 2023) 29,662,599

Population density (people/ 100 sq.m.)

- 0 - 5
- 5 - 10
- 10 - 50
- 50 - 100
- 100 - 252



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Coldspot map of population not covered by digital networks.

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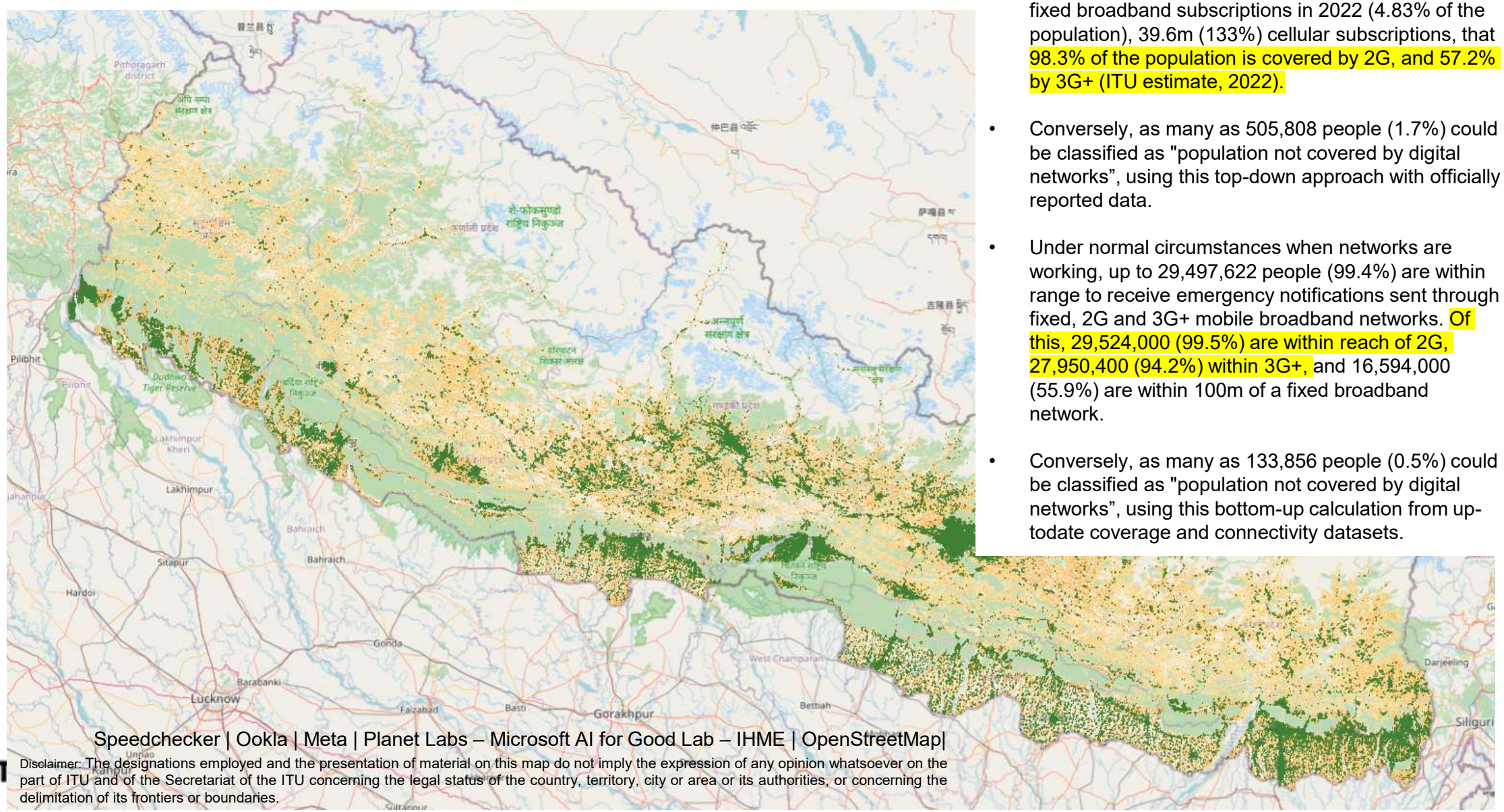
Fixed broadband datapoints

Coldspot map of population not covered by digital networks.



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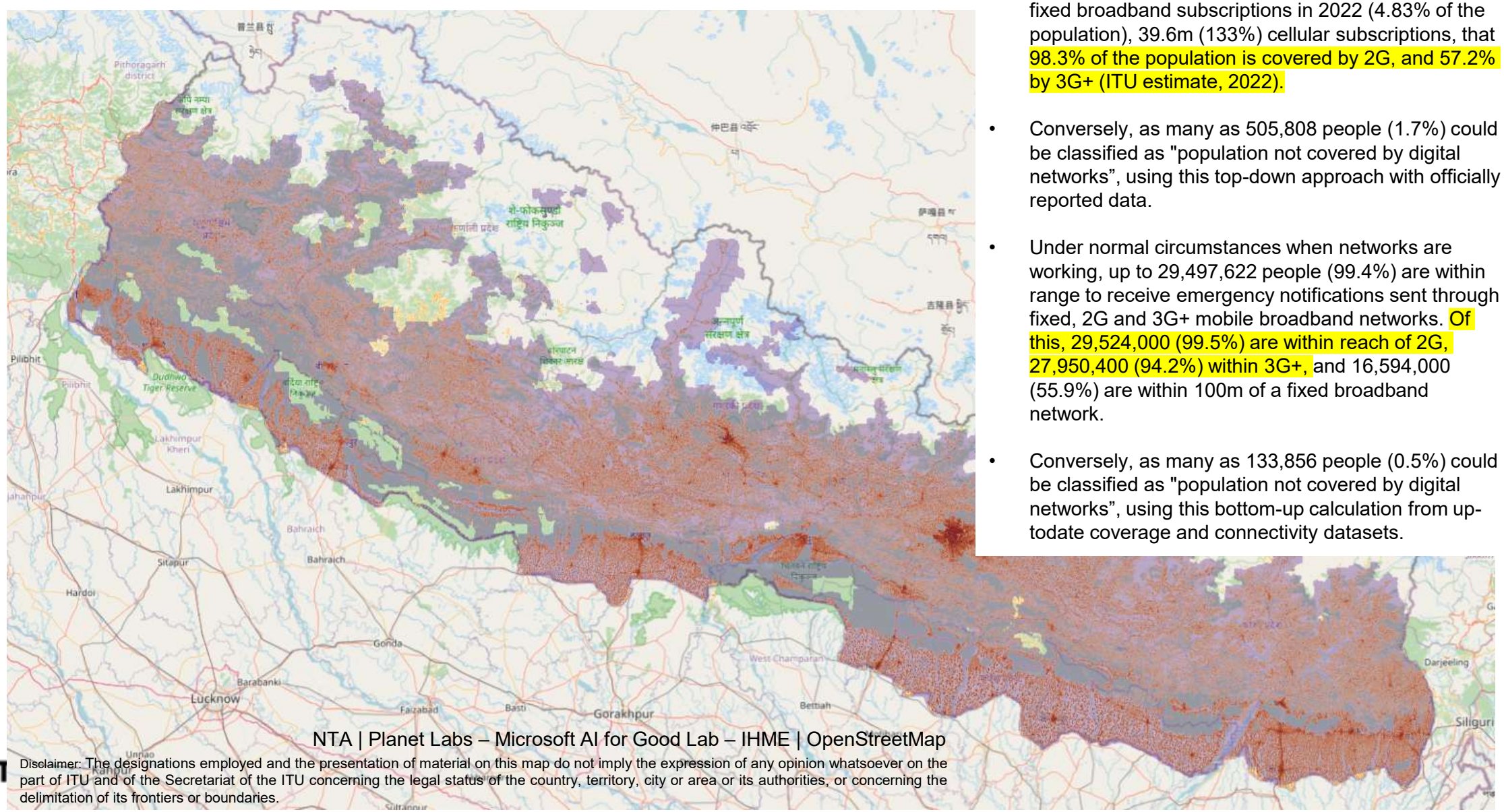
2G cellular coverage
99.5%



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Population beyond the reach of fixed broadband, 2G and 3G networks, Nepal

3G+ cellular coverage
94.7%

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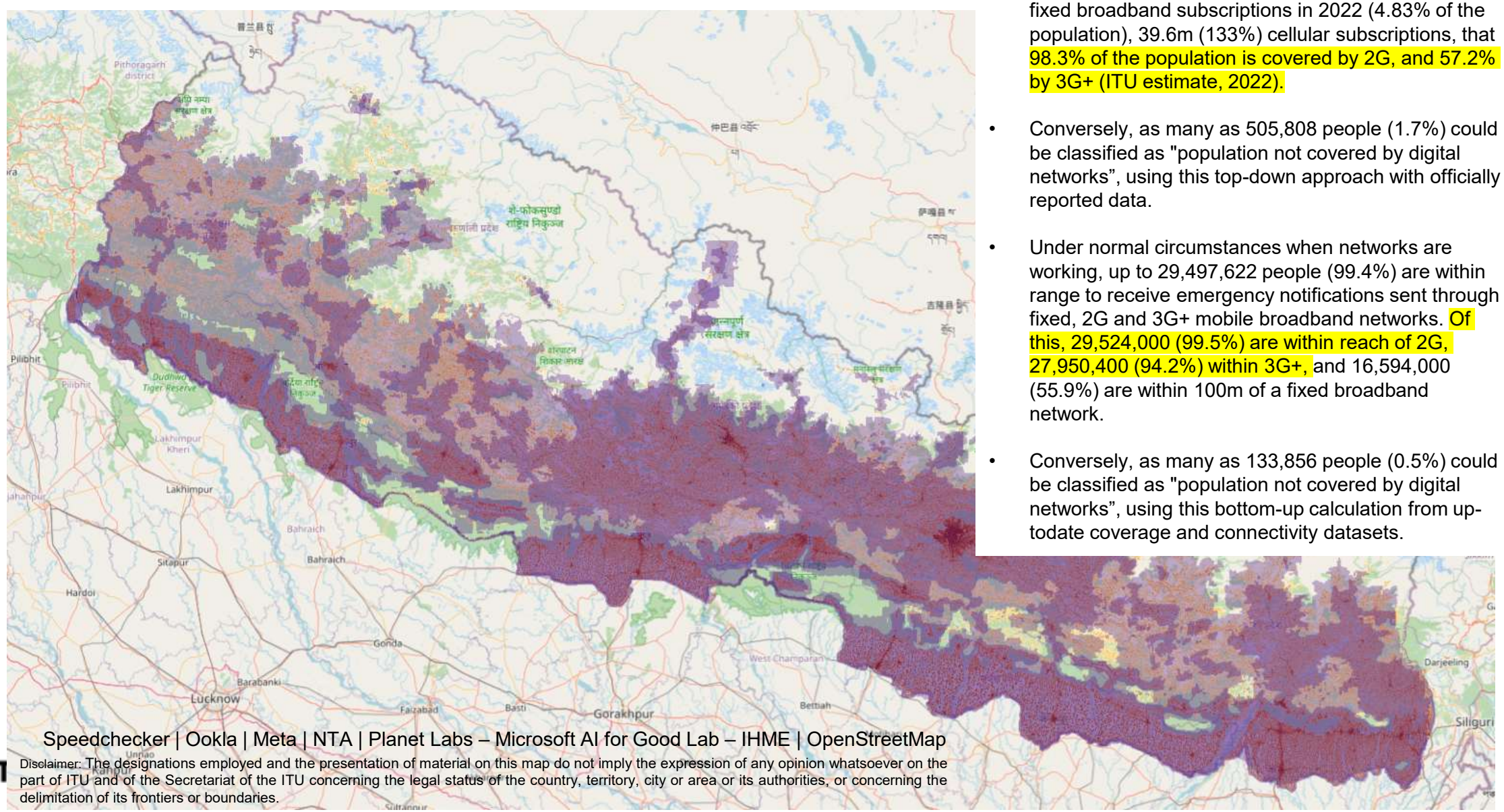

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Population beyond the reach of fixed broadband, 2G and 3G networks, Nepal

Fixed bb, 2G, 3G+ cellular coverage
99.4%

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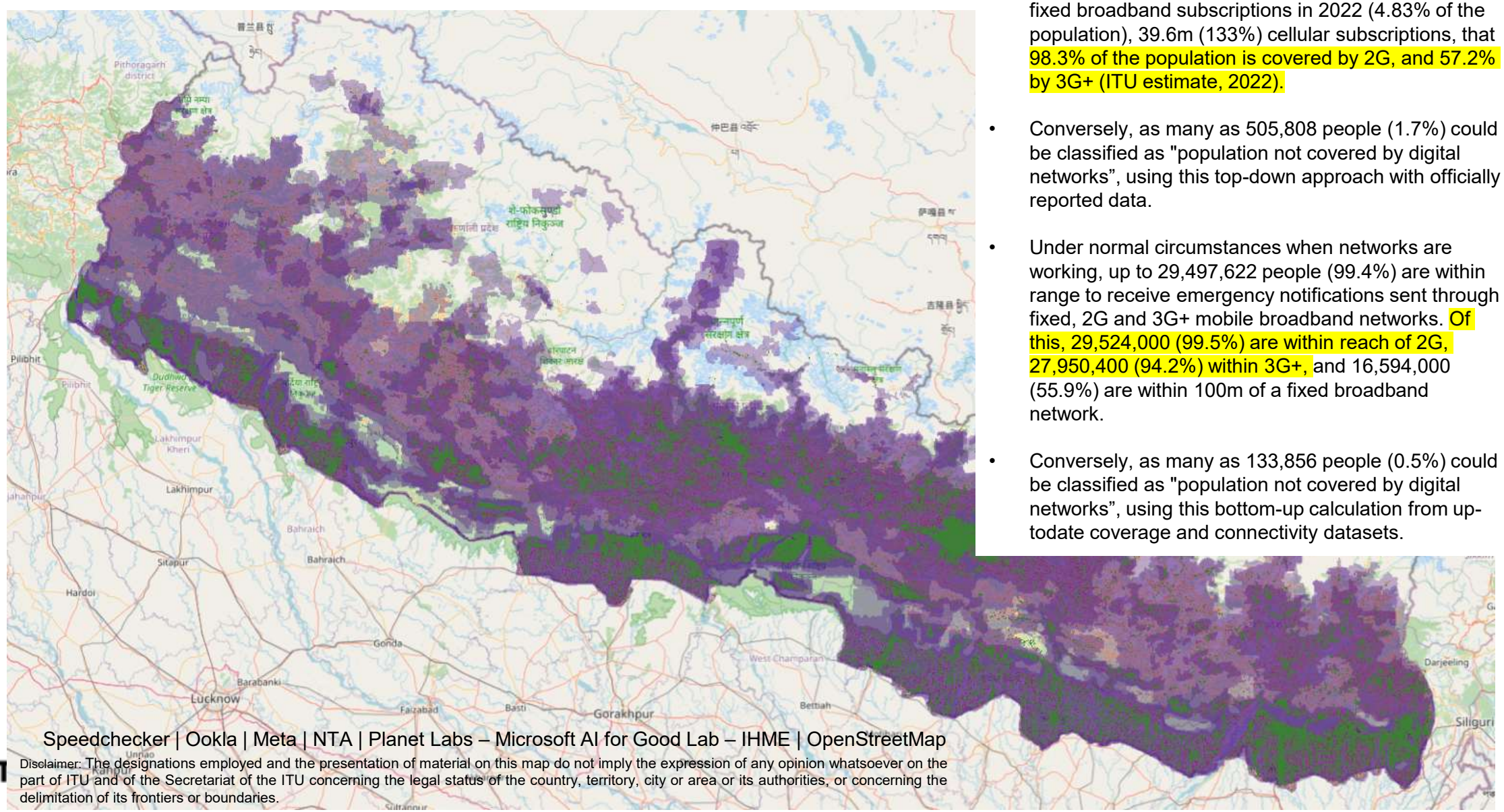

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Offline population at 100m resolution
Planet Labs – Microsoft AI for Good Lab – IHME
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Population beyond network reach 133,856 (0.5%)

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- Connected 0 - 5
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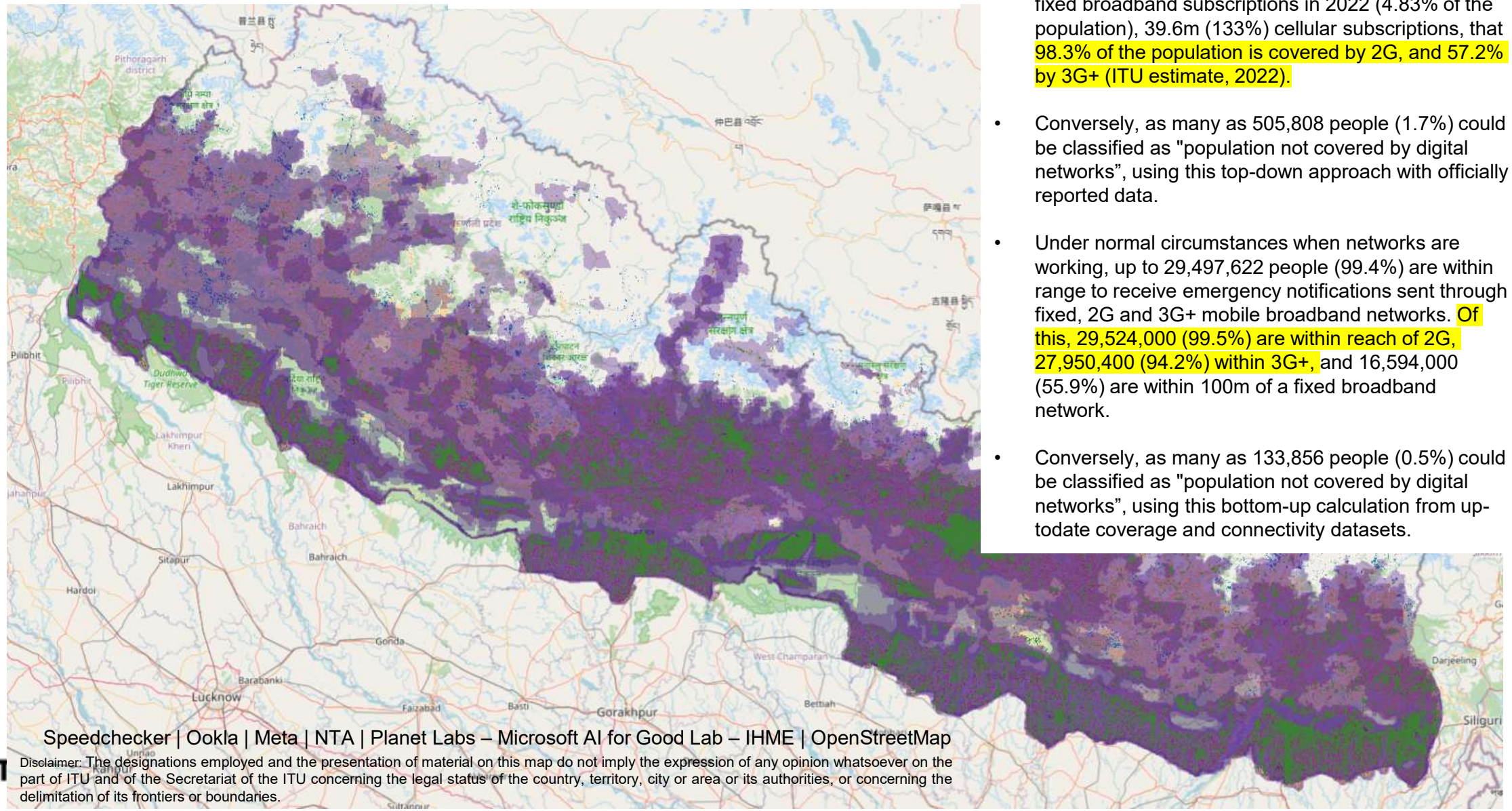

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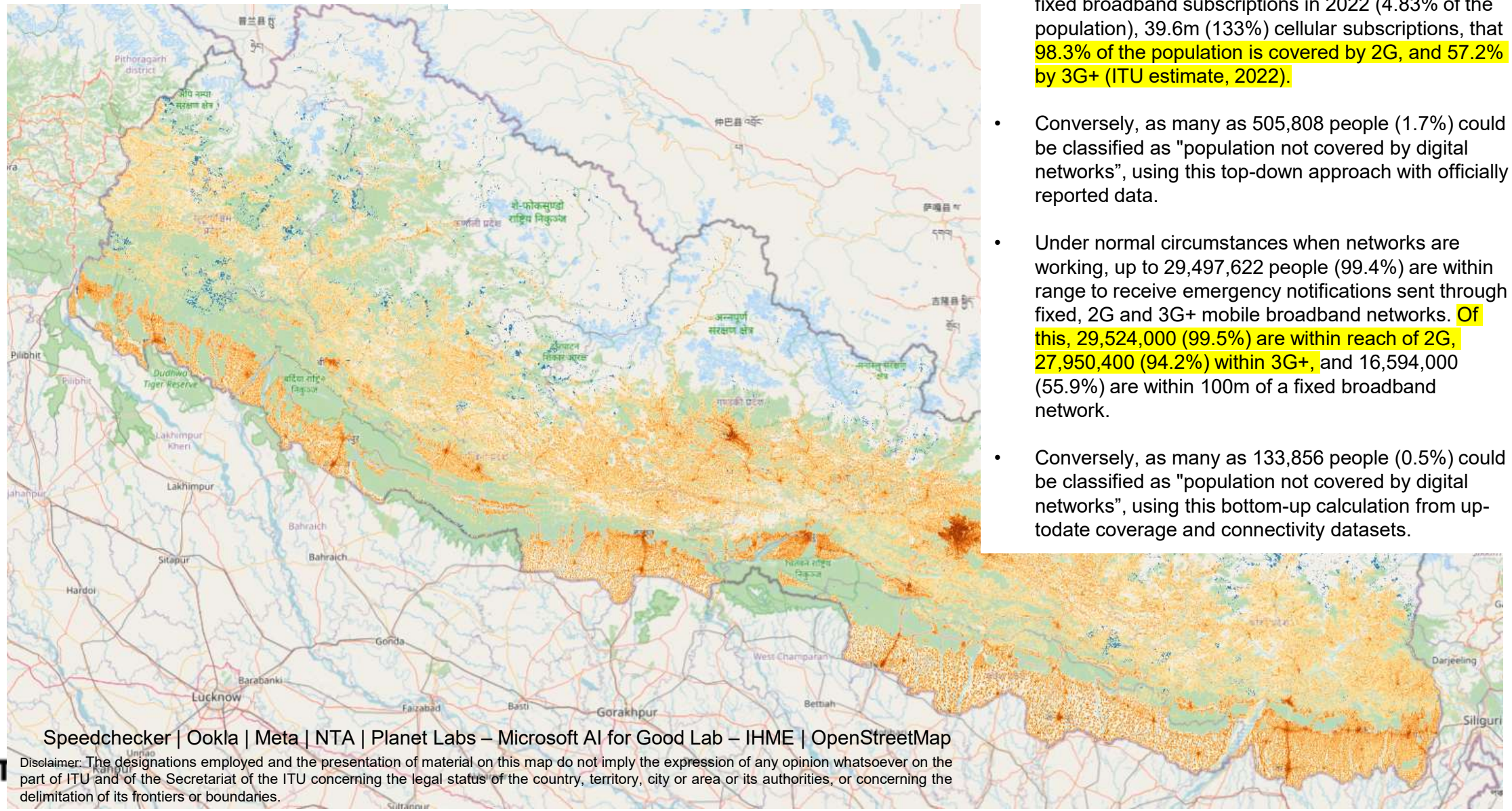

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Leveraging AI in Pillar 3

- The EW4All Action Plan recognizes the need for accelerating innovation and technology - references private sector and AI.
- AI transforms disaster management practices e.g. enhances monitoring, analysis, and forecasting of hazards.
- Optimises information delivery to communities at risk, ensuring timely response to warnings.
- Establishment of the AI Sub-Group for EW4All to cultivate partnerships to further leverage AI – Microsoft is a key partner.

AI for EW4All: Advancing AI Across All 4 Pillars

Role of the AI Sub-group of EW4All

- Coordinated by the ITU, the sub-group drives the integration of AI across all four pillars of the EW4All initiative.
- Unites global experts in AI & data science, disaster risk management, climate & environmental sciences.
- Aims to bridge the gap between cutting-edge AI research and the practical needs of early warning practitioners and communities worldwide.

Integrating AI solutions across all four pillars

Linking Country Needs with AI Solutions

Key Activities of the AI Sub-group of EW4All

1. Gap Analysis and Matchmaking

- Assessing existing early warning systems to pinpoint significant gaps where AI can make a crucial difference.
- Link these identified needs with suitable AI technologies and expertise through a 'matchmaking' approach.

2. AI Solutions Catalogue:

- Developing an online catalogue of AI models and tools relevant to early warnings - classified by hazard type, maturity, and EW4All priorities - encouraging peer validation.

3. Implementation of Pilot Initiatives:

- Launching targeted pilot projects in selected countries, supported by working groups that bring together local stakeholders and technical experts.

4. Resource Mobilization:

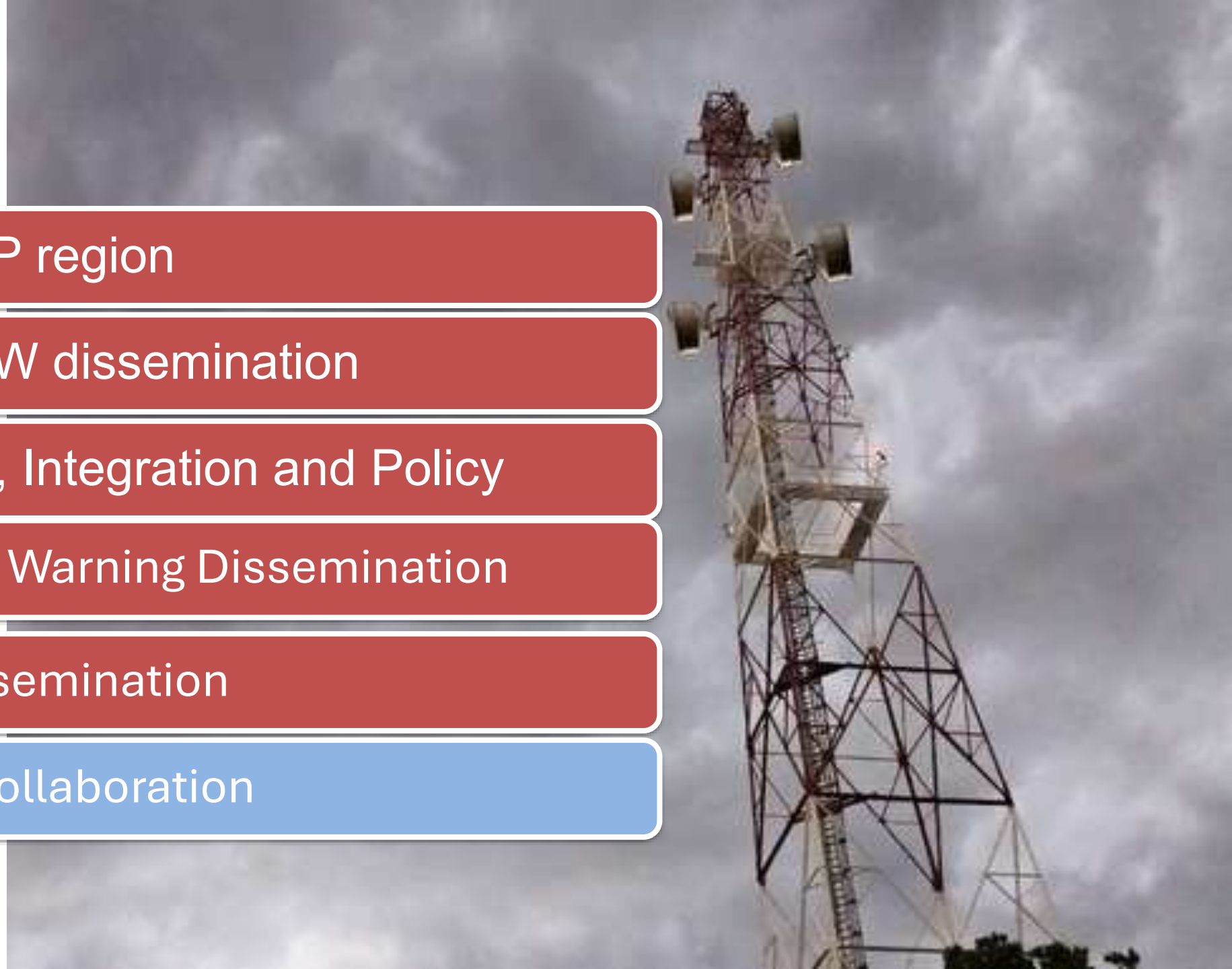
- Seeking funding and partnerships to support the development, piloting, and scale-up of AI solutions that enhance early warning capabilities.

How Engagement Works

1. **Share Your Solution:** Present your AI solution at the monthly Solutions Spotlight.
2. **Initial Assessment:** The group evaluates the solutions relevance to EW4All goals, potential impact, and whether it addresses identified gaps.
3. **Matchmaking & Working Group Formation:** If aligned with the EW4All, a Pilot Working Group with relevant stakeholders and country partners will be formed.
4. **Proposal Development:** Co-creation process of a detailed pilot proposal.
5. **Implementation & Evaluation:** Pilots are deployed, evaluated, and scaled, with learnings shared across the EW4All community.

Contact:
eetmail@itu.int

Scope



- EW for DRR in ASP region
- Need for CAP in EW dissemination
- CAP Infrastructure, Integration and Policy
- Mobile-based Early Warning Dissemination
- Use of AI in EW Dissemination
- Partnerships and Collaboration

ITUWTDC BAKU2025

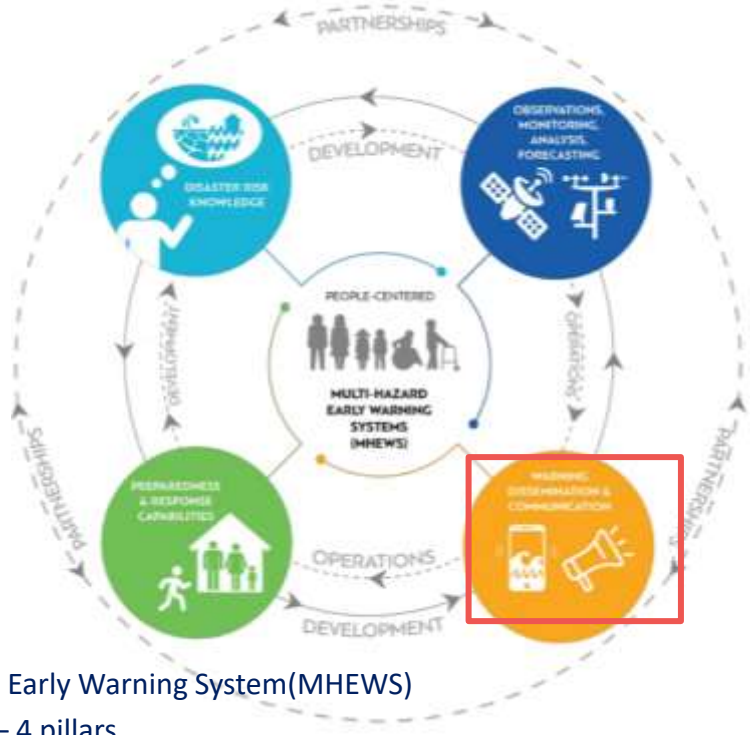
ITU Mandate on Early Warning Systems

- ITU's Membership has provided the Union with a clear mandate to support countries in implementing early warning systems, including:

- **PP Resolution 136 (Rev. Bucharest, 2022)** : the use of telecommunications/information and communication technologies for humanitarian assistance and for monitoring and management in emergency and disaster situations, including health-related emergencies, for early warning, prevention, mitigation, and relief."
- **ITU World Telecommunication Development Conference (WTDC) Resolution 34 (Rev. Kigali, 2022)** : on "the role of telecommunications/information and communication technology in disaster preparedness, early warning, rescue, mitigation, relief and response."

Early Warning for All Initiative Action Plan: launched during COP27

Pillar 3: Warning dissemination and communication



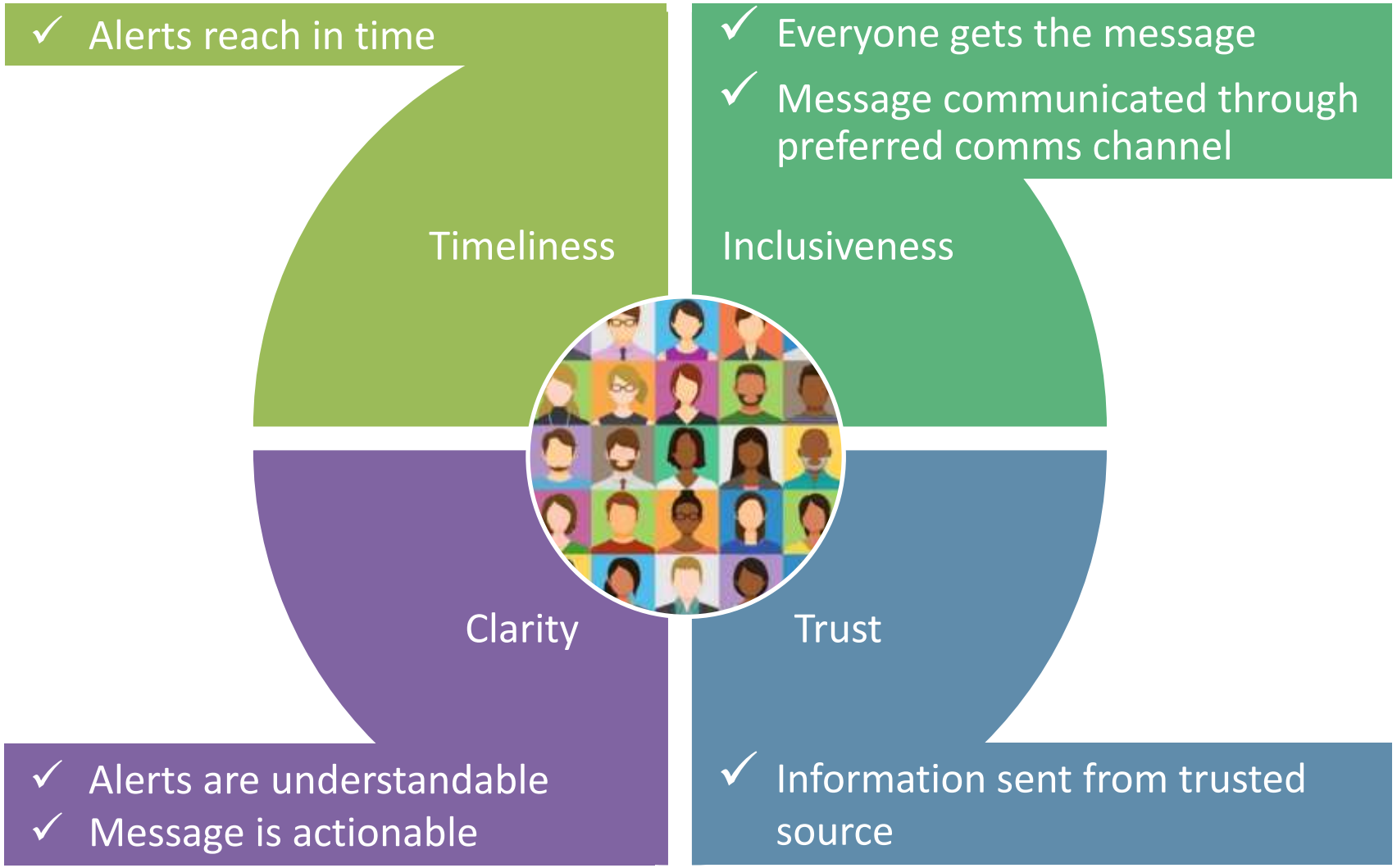
Multi-Hazard Early Warning System(MHEWS) Value Cycle – 4 pillars

EW4ALL Country Roll Out

Joint roll-out activities in a first cohort of 30 countries, including 10 countries in Asia and the Pacific region

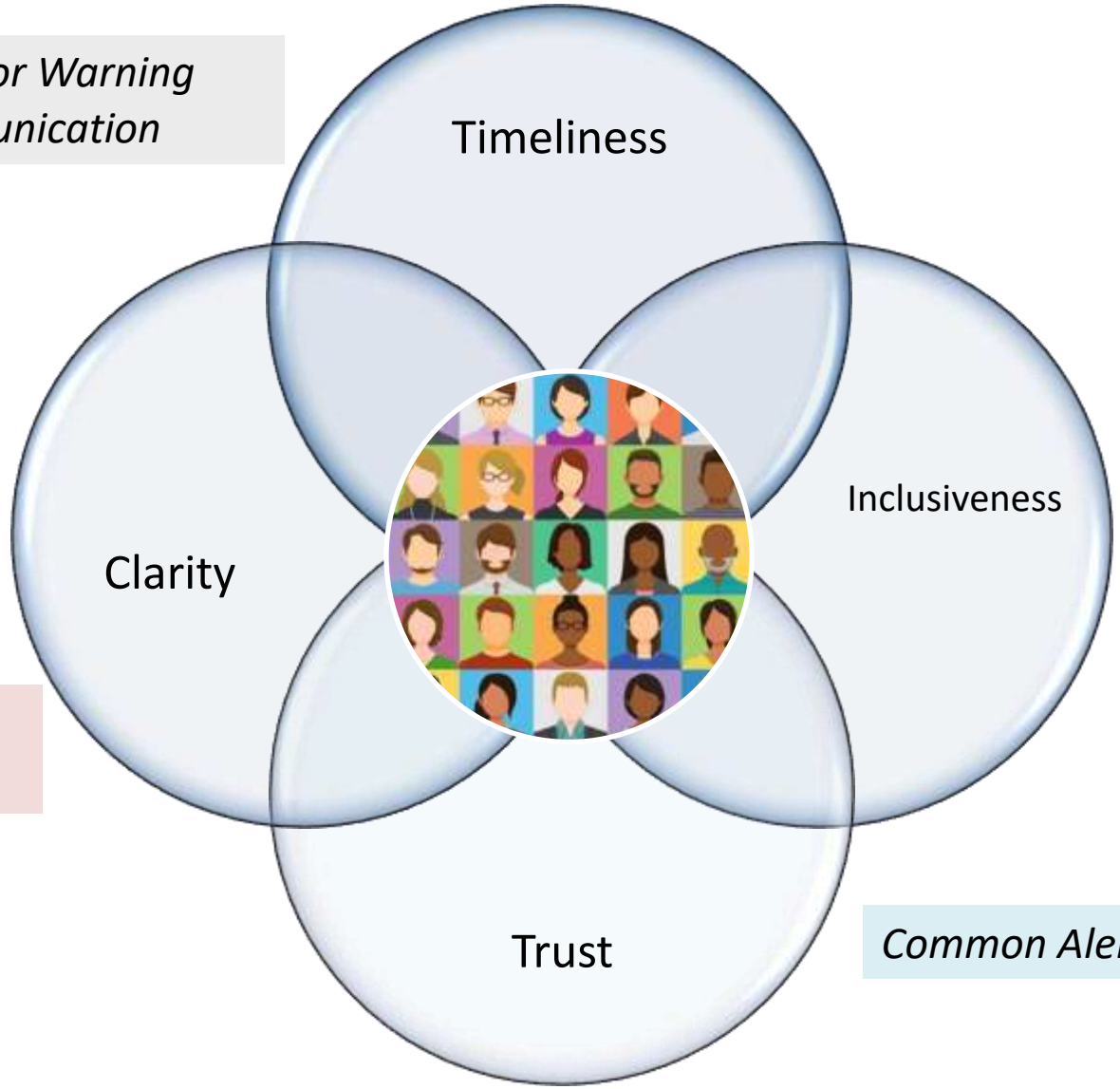
Bangladesh	Maldives
Cambodia	Nepal
Fiji	Samoa
Kiribati	Solomon Islands
Lao PDR	Tonga

People Centric Approach - Design requirements



People Centric Approach - Solutions

Multi-channel Approach for Warning Dissemination and Communication



- *Last mile connectivity*
- *Cell Broadcast*

Using AI

National Emergency Telecommunication Plan

Common Alerting Protocol (CAP)

Behavior - Need of Information

Information

In disaster situations, members of the public seek at first not to communicate, but to be informed, so that they may understand what is happening (or about to happen), and to assess whether and how they and their family and friends may be affected.

Personal Communication

Following the initial need for information, personal communication is then attempted as citizens seek rapid contact with family members and friends.

EW4A Pillar 3 technical assistance

1. Assessment and technical advice:

- Assess current use of different warning dissemination channels (e.g., mobile, TV, broadcast, siren, etc)
- Analyze necessary steps to be taken to implement most appropriate dissemination channels
- Support countries develop bidding document
- Advice on Common Alerting Protocol
- National Gap Analysis on Digital Infrastructure Resilience, Preparedness and ICT service affordability
- Last Mile Connectivity planning
- Disaster Connectivity Maps (DCM)

2. Economic scope

- Cost estimation of the roll-out of mobile EWS, and community-level last mile warnings targeting specific vulnerable groups
- Identify possible funding opportunities

3. Regulatory scope

- NETP preparation
- Review and assess the current legislation and SOPs, if appropriate and necessary, propose modifications to the regulatory framework

Early Warnings for All Initiative

Opportunities to get involved

1 Provide a **financial contribution** to support the implementation of the initiative:

- ✓ Fund the development and deployment of EWS, ensuring alerts reach at-risk communities.
- ✓ Provide flexible funding to enable ITU to respond to member states, adapt to changes, and plan strategically.
- ✓ Support multi-year agreements for predictable funding.

2 Provide **(in-kind) expertise as a knowledge partner** in specific country implementation:

- ✓ Offer expertise, technology, and a tender for CB infrastructure to enhance EWS, especially in vulnerable regions.
- ✓ Support the development of mobile EWS, leveraging widespread mobile phone usage.
- ✓ Share experiences and best practices from countries with mobile EWS to raise awareness.
- ✓ Provide technical expertise in cell-broadcast and the common alerting protocol (CAP) for resilient warning systems.

3 **Pledge commitments** to cooperate and support the initiative from mobile and satellite industry:

- ✓ Pledge support from the mobile and satellite industries to disseminate warnings quickly and widely.
- ✓ Engage mobile network operators and the satellite industry through COP pledges.

Early Warnings for All Initiative

Who can work with us?

1 **Governments:** We urge national leadership from countries needing better EWS. Governments must show political support and engage stakeholders to build resilient systems. Endorse the EW4All initiative and seek donor support.

2 **Private Sector:** The private sector should provide data and infrastructure support to identify digital network coverage in risk areas. We need partners to contribute anonymized data to improve global connectivity maps for better disaster management.

3 **ITU Membership:** Members working on AI and EW4All should join our AI for EW4All group to explore AI use cases and address gaps in EWS.

Conclusion

- **Full CAP and EWS adoption is required through a policy intervention at national level**

- **Harness technologies together for benefit of ALL.**

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