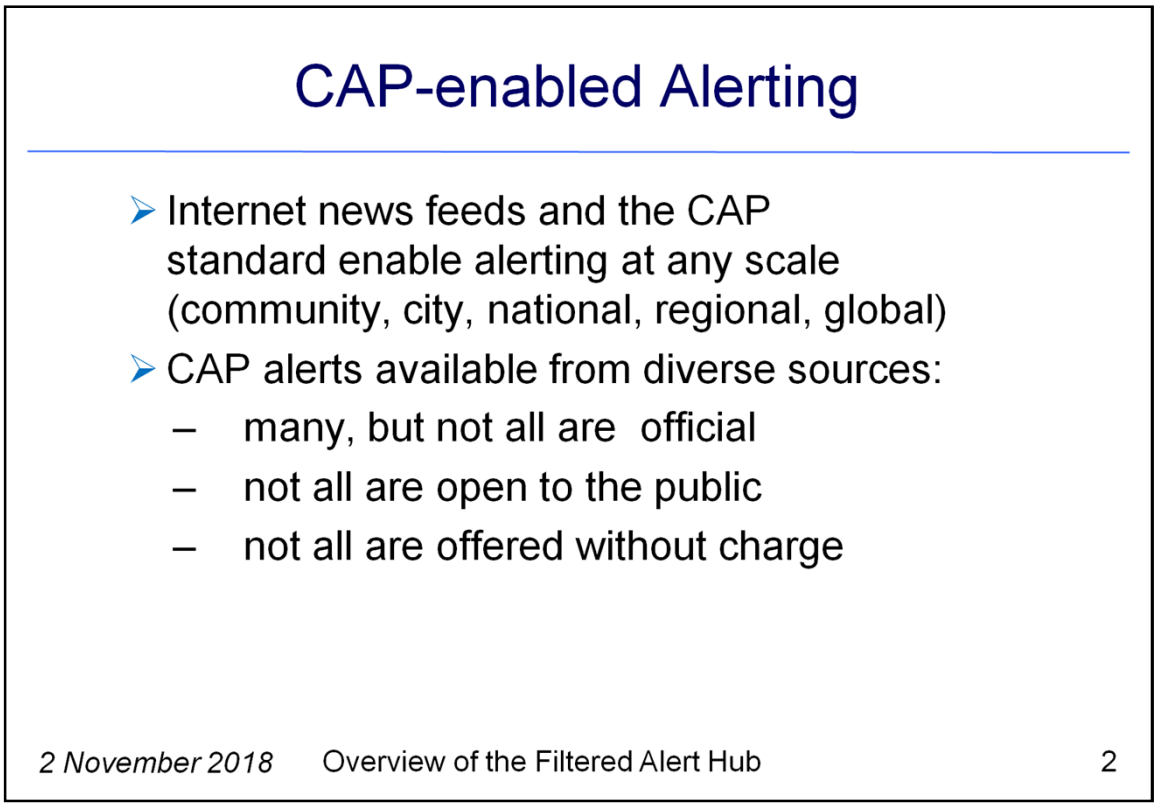
Overview of the Filtered Alert Hub

presented 2 November 2018
by Eliot Christian <eliot.j.christian@gmail.com>
at the Filtered Alert Hub Workshop
Hong Kong, China

My presentation topic is an Overview of the Filtered Alert Hub.



First, I want to highlight certain aspects of CAP-enabled alerting in general.

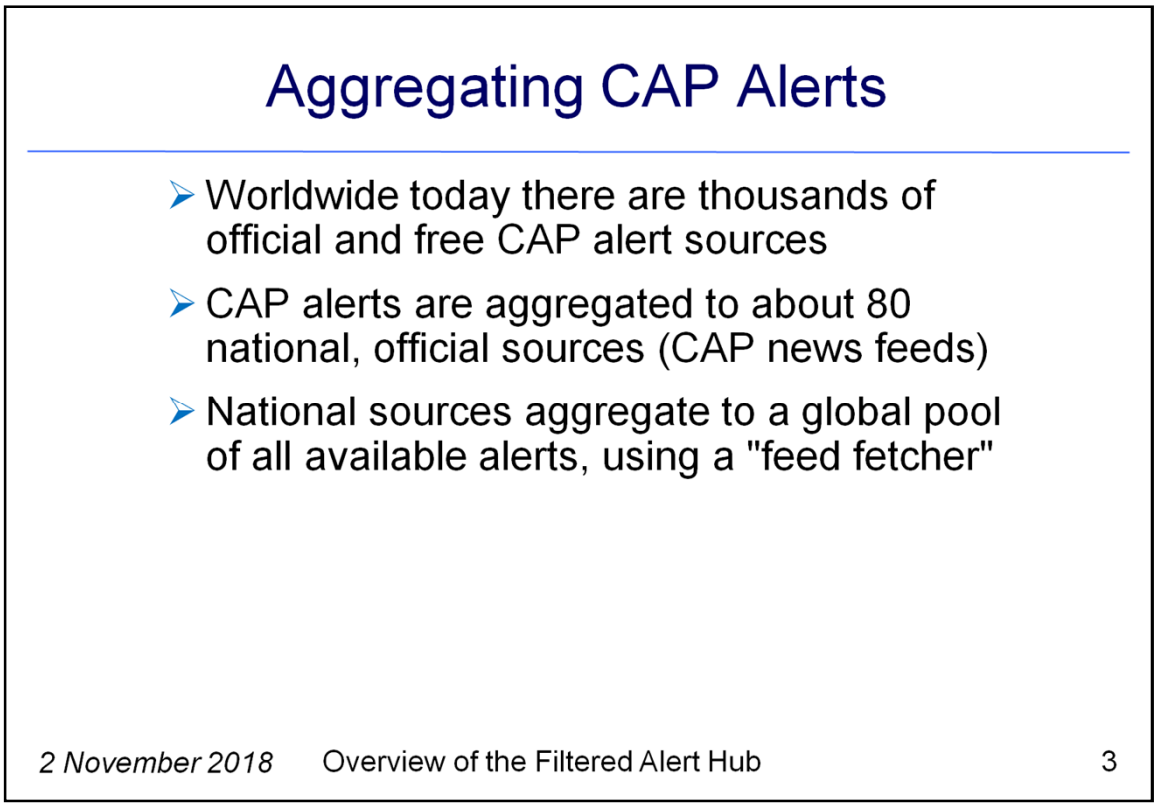
Internet news feeds and the CAP standard enable alerting at any scale--community, city, nation, region, worldwide. The smallest scale CAP systems are "Neighborhood Watch". At the city scale, CAP systems are available in products and services such as "Microsoft CityNext" and IBM's "Smarter Cities". Many countries have a national-scale CAP system, and there are international systems such as MeteoAlarm in Europe. A few systems exists at the global scale as well.

Some prominent commercial weather services make extensive use of CAP, including The Weather Company, Accuweather, and MeteoFrance International. Also, the International Federation of Red Cross and Red Crescent Societies is actively pushing CAP-based alerting, especially in its "Hazards App".

Although governments often have a lead role in CAP-based alerting, many CAP systems are not official government sources.

Also, some official CAP systems never issue public alerts. For example the World Health Organization "Public Health Information Network" is for private use among public health professionals wroldwide.

We should also recognize that much of the world's CAP-enabled alerting is not free. For instance, Pinkerton's serves 80 of the world's largest 100 businesses and has CAP-based alerting that is not free.



There are now many thousands of official and free CAP alert sources. For instance, the U.S. Integrated Public alert and Warning System alone aggregates more than 1100 CAP alert sources nationwide.

Through the efforts of the U.S. and other national CAP system operators, CAP alerts are aggregated at national scale to comprise about 80 national, official sources.

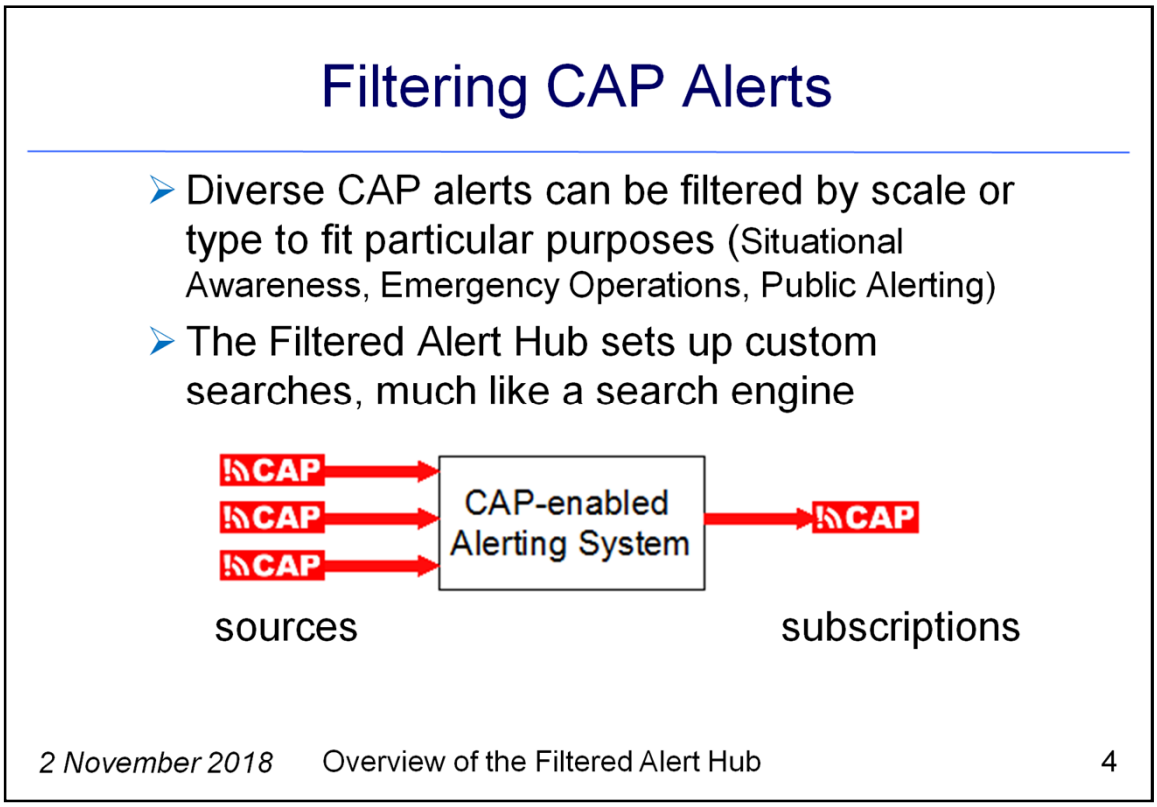
That is still far more than most users can track, especially given that the sources are typically national governments spread all over the world.

Yet users want to get every alert of interest regardless of which source originated the alert.

For example, users in a particular city want to get all alerts affecting their city, even though the alert source may be far away. This is clearly the case for threats such as earthquakes, tsunami, and space weather.

So, it is necessary to have an aggregator which creates the pool of all available alerts on a global scale. This is like the "Web crawler" function that gathers Web pages for any of the search engines operating on global scale.

Because the CAP alerts are available on news feeds, CAP alert aggregators use a technology called a "feed fetcher".



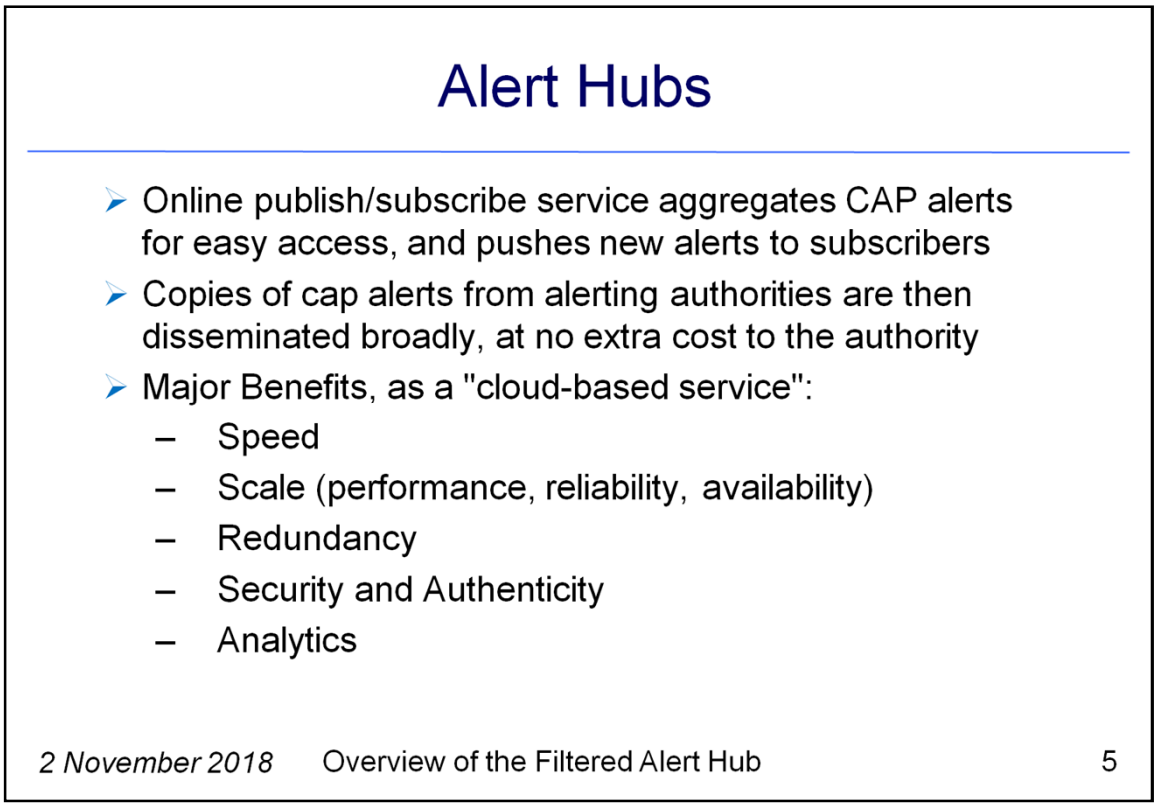
Given a pool of all available CAP alerts, it is typical to apply filtering for particular purposes. Most operational systems do filter alerts by the geographic area of interest, such as a city or a country. Sone systems allow individual persons to specify their areas of interest--one of which is a "moving bubble" surrounding the GPS coordinates of his/her cell phone.

The priority of alerts is another typical filter. Local police or fire stations may want to see all available CAP alerts to address their Situational Awareness and Emergency Operations needs. Yet, for Public Alerting it makes sense to filter out those alerts that are of low priority, so that the public is alerted only when it is really necessary for people to act in response to a threat.

The filtering of CAP alerts can be quite specific. For instance, a wind farm operator may want only weather alerts, and just a subset of those. Again, it is useful to think of CAP filtering as a kind of search engine that helps serve all of these "selective dissemination" needs.

The Filtered Alert Hub in particular is designed to allow setting up specific criteria for selecting a subset of available CAP alerts. The search criteria is applied whenever a new alert arrives from any of the many input CAP alert feeds that are aggregated.

The result of applying a particular customized criteria is an output CAP news feed. In the Filtered Alert Hub, we call that customzied CAP alert feed a "subscription".



So, in this discussion, a CAP Alert Hub aggregates CAP alert news feeds. This is much like a search engine for Web resources. But, in a CAP Alert Hub, the only resources ingested are CAP alerts.

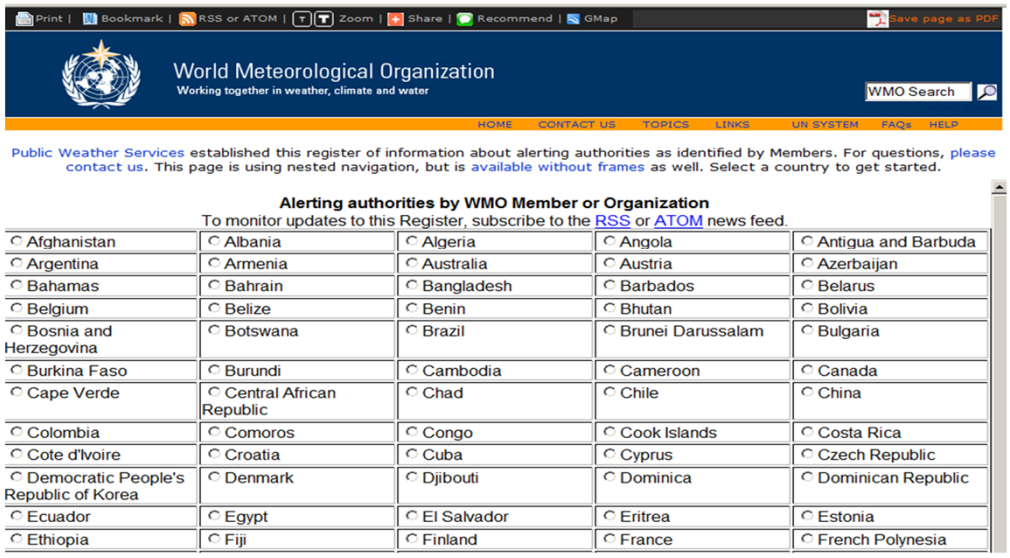
As soon as the alert is ready to be posted online, the alert publisher just puts a copy of the CAP alerts on an Internet news feed known to the Hub, This extra copy is in addition to, and does not interfere with, any other ways that the authority publishes alerts.

The advantage of this Alert Hub publishing is that Google, The Weather Company, Accuweather, IFRC, news organizations, telecomm services, and others will then help disseminate alerts to everyone who needs them. This extra dissemination help comes at no cost to the alerting authority.

When implemented on the cloud, a CAP Alert Hub has other benefits, too:

Speed - Dissemination time is crucial for sudden-onset events such as earthquakes, tsunami, and tornadoes
Scale - The global scale dissemination infrastructure has high performance, high reliability, and high availability
Redundancy - An additional copy of alert messages is kept elsewhere from the originator
Security and Authenticity
Analytics - A centralized aggregator simplifies analysis and enables optimization of alert dissemination

WMO Context: Register of Alerting Authorities



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World Meteorological Organization
Working together in weather, climate and water

WMO Search

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Public Weather Services established this register of information about alerting authorities as identified by Members. For questions, please contact us. This page is using nested navigation, but is available without frames as well. Select a country to get started.

Alerting authorities by WMO Member or Organization
To monitor updates to this Register, subscribe to the RSS or ATOM news feed.

Afghanistan	Albania	Algeria	Angola	Antigua and Barbuda
Argentina	Armenia	Australia	Austria	Azerbaijan
Bahamas	Bahrain	Bangladesh	Barbados	Belarus
Belgium	Belize	Benin	Bhutan	Bolivia
Bosnia and Herzegovina	Botswana	Brazil	Brunei Darussalam	Bulgaria
Burkina Faso	Burundi	Cambodia	Cameroon	Canada
Cape Verde	Central African Republic	Chad	Chile	China
Colombia	Comoros	Congo	Cook Islands	Costa Rica
Cote d'Ivoire	Croatia	Cuba	Cyprus	Czech Republic
Democratic People's Republic of Korea	Denmark	Djibouti	Dominica	Dominican Republic
Ecuador	Egypt	El Salvador	Eritrea	Estonia
Ethiopia	Fiji	Finland	France	French Polynesia

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Now let's look at CAP Alert Hubs in a WMO context. This approach stands in contrast to other global-scale Alert Hubs in a couple of crucial ways.

As noted earlier, some CAP Alert Hubs may be for private use by paid subscribers or for subscribers with a particular role. These include the business intelligence services offered by Pinkertons and the Global Health Information Network operated by World Health Organization for the private use of public health professionals.

In other cases, the CAP Alert Hub provider may be unwilling to distinguish official from non-official sources of alerting information. This is a major reason why the Google Alert Hub is not suitable as a global resource for access to emergency alerts.

So, it is very important to note that the WMO Alert Hub is a free resource and is not restricted to users having any particular role. Also, the WMO Alert Hub is designed to distinguish official from non-official sources of alerting information.

The distinction of official sources is based on the international Register of Alerting Authorities. This Register was established in 2009 in a collaborative effort by ITU and WMO. Today there are about 300 registered authorities, including at least one from each of the WMO Member nations.

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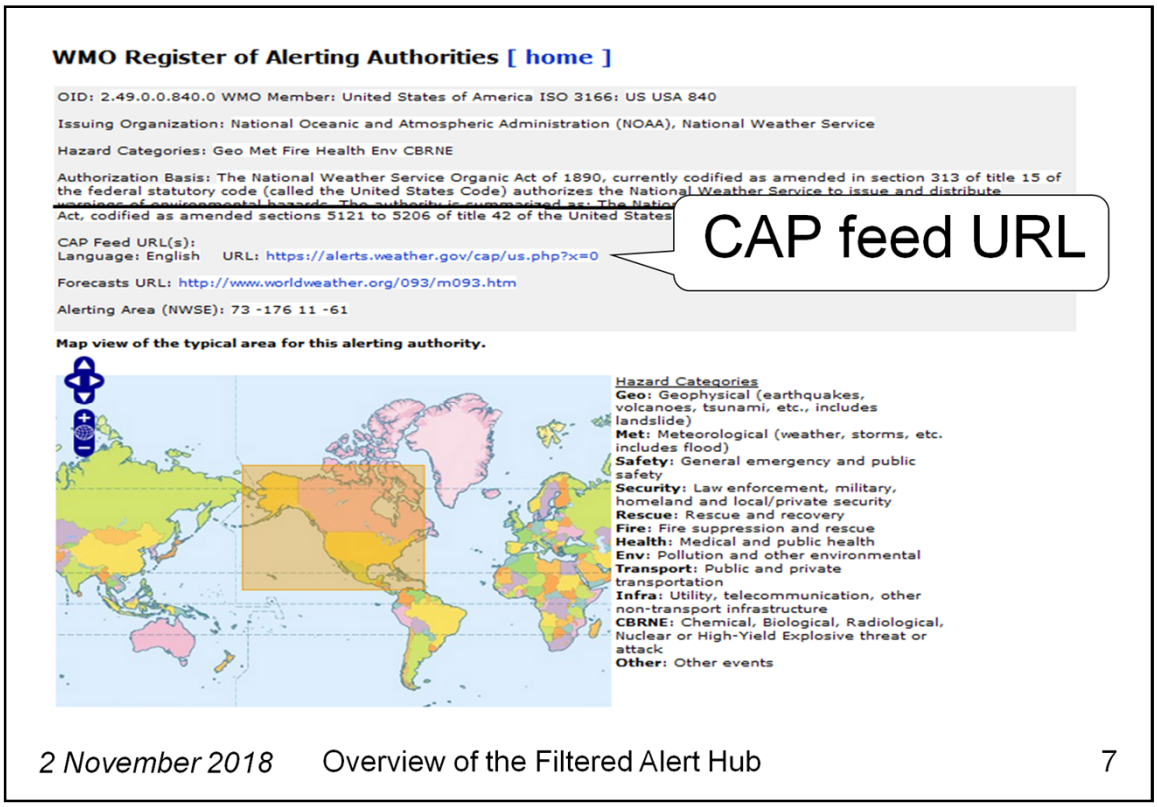
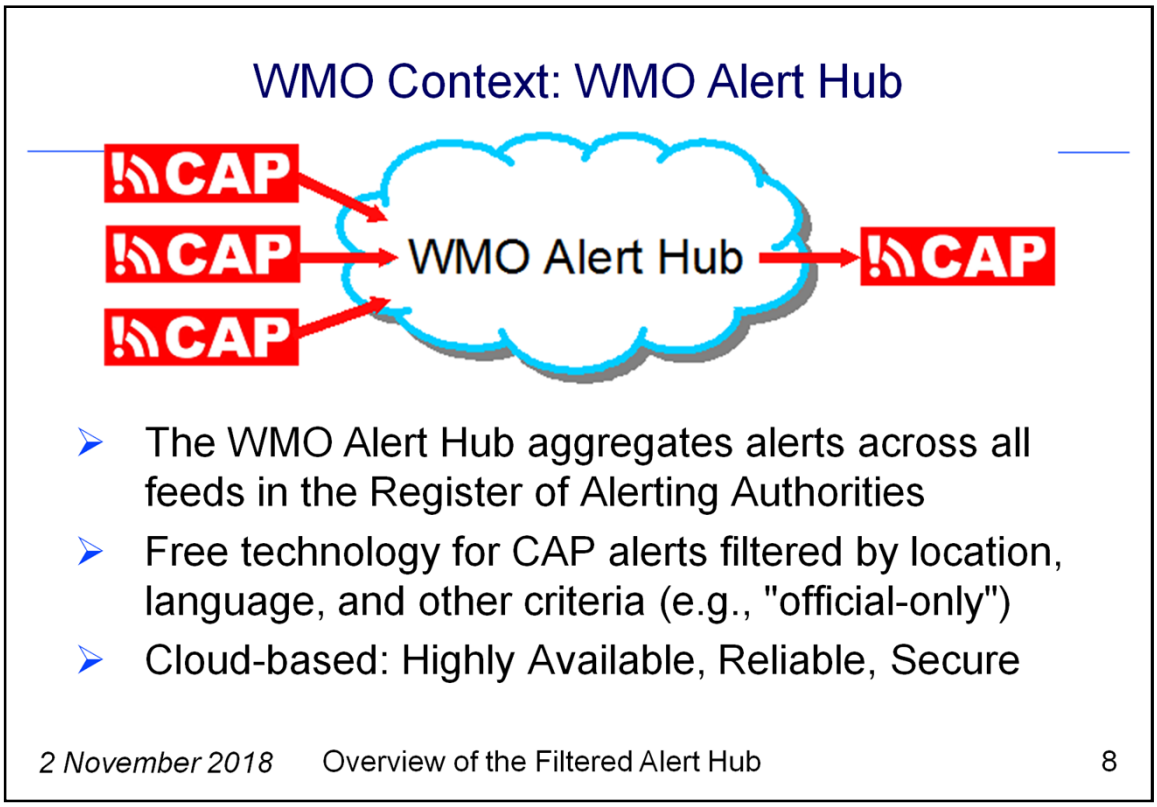


Within the international Register of Alerting Authorities, there is a mechanism to identify an official source of CAP Alerts. Specifically, the source would be an Internet news feed, accessible in "publish/subscribe" mode and compliant with either the RSS standard or the ATOM standard.

Here is a screen shot of one alerting authority. It is offered by the United States government through NOAA's National Weather Service. This official alerting authority specifies its "CAP alert feed", and you see the URL for that.



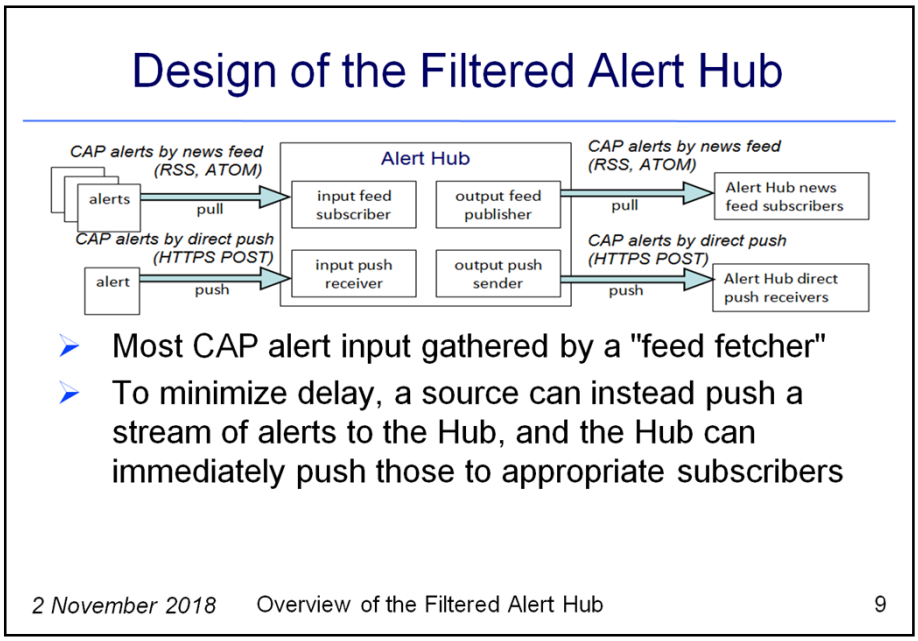
The WMO Alert Hub is a simple concept: establish a CAP alert hub that aggregates from CAP alert feeds as given in the official Register. This was proposed by the United States several years ago, and has been widely endorsed in WMO.

Certainly, we can envision alternatives to the WMO Alert Hub. For instance, there could be a "Red Cross Alert Hub" branded by the International Federation of Red Cross and Red Crescent Societies. That would also be a free and trusted source, and it would have the advantage of association with a very well-known brand. It might also be attuned to the full range of hazard threats addressed by public alerting.

The prototype WMO Alert Hub aggregates CAP alerts from about 8-national sources. The output is a set of customized CAP news feeds known as "subscriptions". For example, there is a filtered feed for "official-only" and "high-priority only". This feed selects high-priority CAP messages from official sources, making it easy to quickly warn everyone in the alerting area to take immediate action.

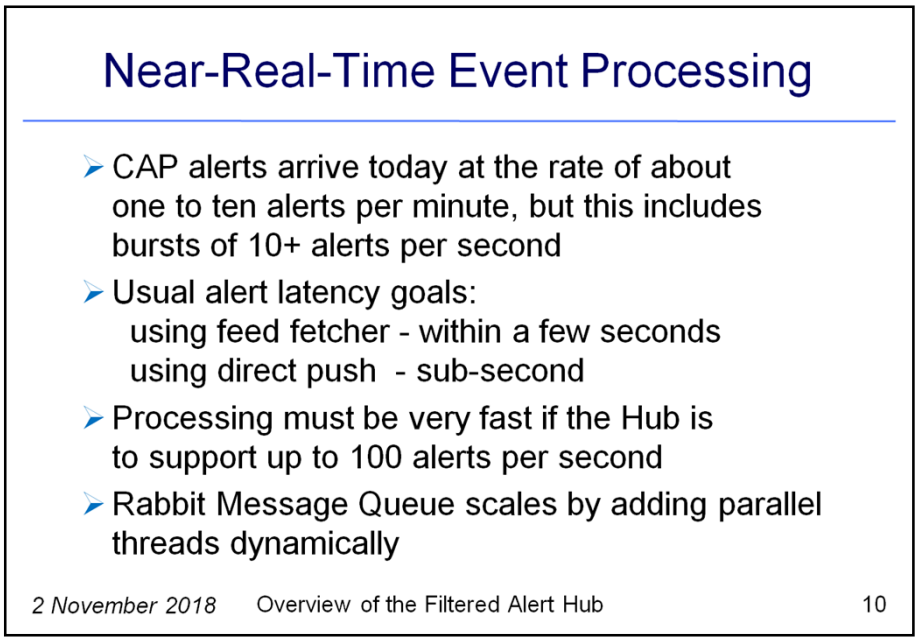
The Filtered Alert Hub project is providing free, open source software for handling CAP alerts at global scale. The technology is cloud-based, and it intends to be highly available, reliable, and secure.

Now I want to describe some components of the Filtered Alert Hub architecture. Of course, much more detailed discussion of this will occur in the all-day event on Friday.



As mentioned earlier, most CAP alert input to the Filtered Alert Hub is gathered by a "feed fetcher". CAP alert feeds are normally polled periodically, typically once per minute.

However, for sudden-onset events such as earthquakes, tsunami, and tornadoes, even seconds of delay could be deadly. So, the Filtered Alert Hub allows for alerts to be pushed immediately to the Hub, and pushed immediately from the hub to specific subscribers. Used this way, critical warnings can be delivered within a second or two.



The core of Hub processing is "Near-real-time Event Processing".

A key performance measure for the Filtered Alert Hub is alert latency--how much time elapses between taking in an alert and sending out that alert. Recall that this latency should be under a second to be responsive for sudden onset emergencies such as "Earthquake Early Warning".

Yet, we hope for the Filtered Alert Hub to support throughput rates of more than 100 alerts per second. Achieving sub-second latency while servicing very high alert arrival rates is only possible if alert processing is very fast. Therefore, a high degree of parallel processing is essential.

We are hoping that Rabbit Message Queue has the potential to deliver the desired performance at reasonable cost without high administrative complexity. This belief is primarily based on the ability of Rabbit MQ functions to scale by adding parallel processes ("threads") dynamically.

Our first implementation was based on the Lambda architecture offered by Amazon Web Services. We are in the process of moving to Rabbit MQ, for three reasons:

- A Rabbit MQ implementation would be more portable to other clouds, because Lambda is only offered on AWS

- A Rabbit MQ implementation would be easier to document and install, becuase Lambda requires a much more complex mixture of steps

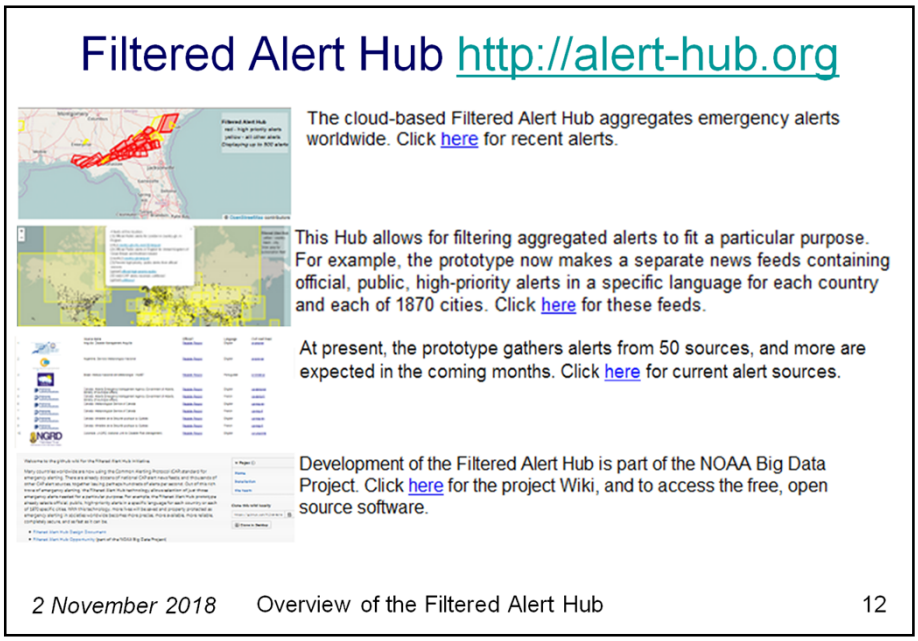
- A Rabbit MQ implementation may be much faster.

To find matches between the alerting areas in an alert against the current set of subscription, this function uses AWS ElasticSearch. This is a search server based on Lucene, a free and open source information retrieval library.

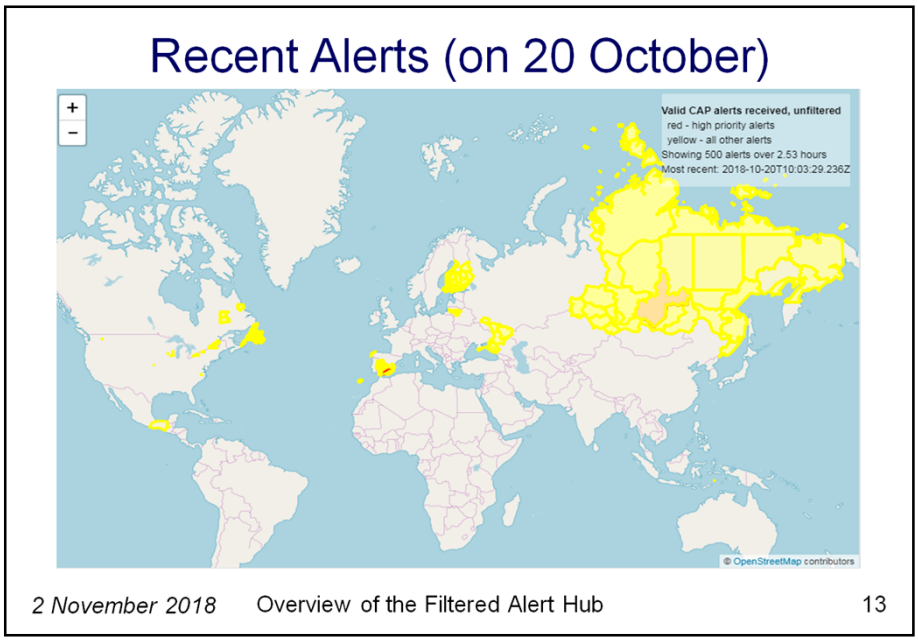
Outside of the near-real-time event processing, ElasticSearch indexes the area filter for each area of interest as specified in the then-current set of Filtered Alert Hub subscriptions. This index of subscriptions areas must be updated whenever the subscriptions change, of course.

Here we see an example of a Filtered Alert Hub subscription. In this case it is a subscription for the country of New Zealand. The area of interest is expressed as a GeoJSON polygon or a circle.

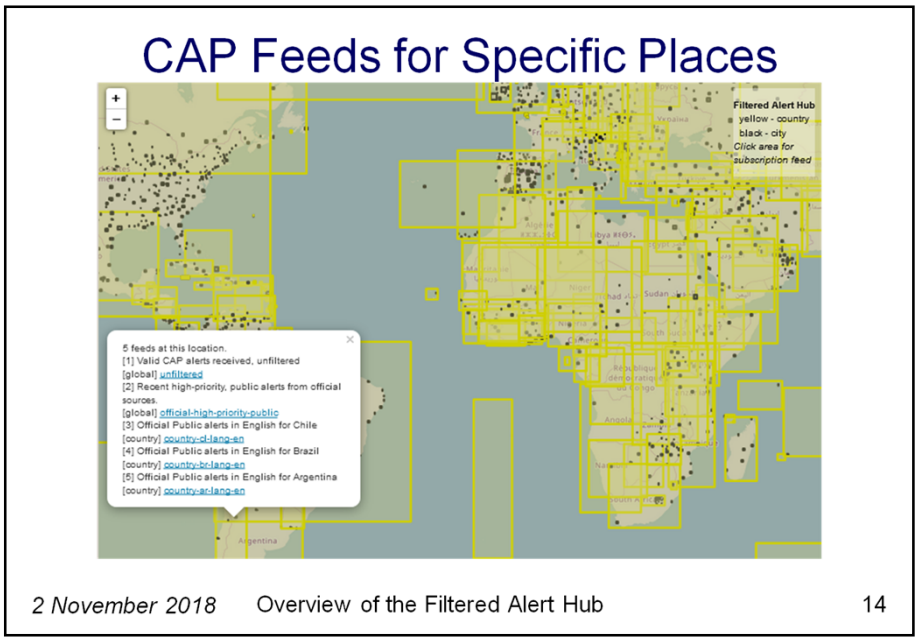
Within the near-real-time event processing, and when a new CAP alert is received, the program uses ElasticSearch to search its index of subscriptions areas for a match on the areas in the new alert. Any subscription that gets at least one hit on the area search then gets the alert added to it.



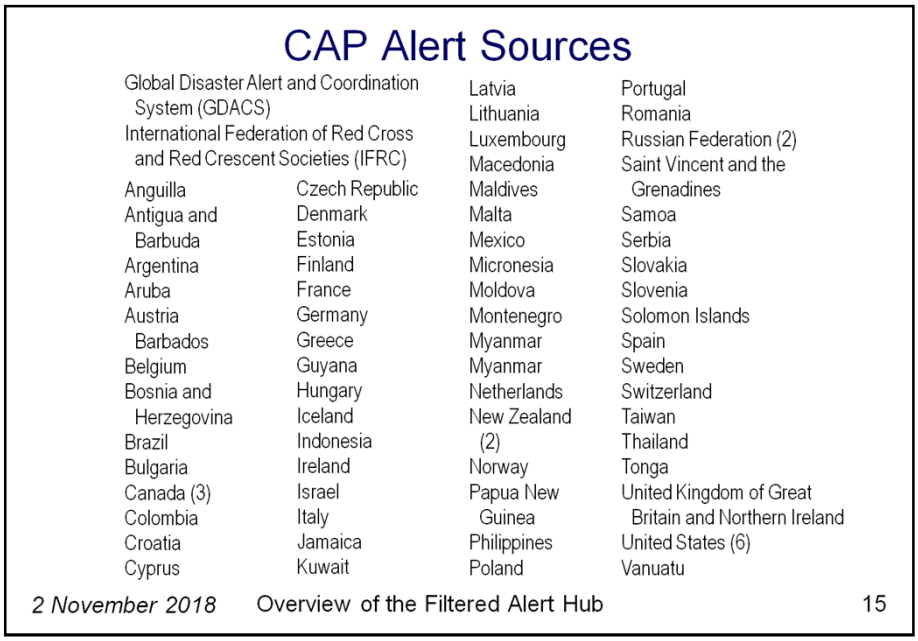
Here is a screen shot of our Filtered Alert Hub web site. The page includes links to: the current CAP alerts, the available subscription feeds, the CAP sources, and the wiki page about our project.



Here is a screen shot, taken ten days ago, showing then-recent alerts.

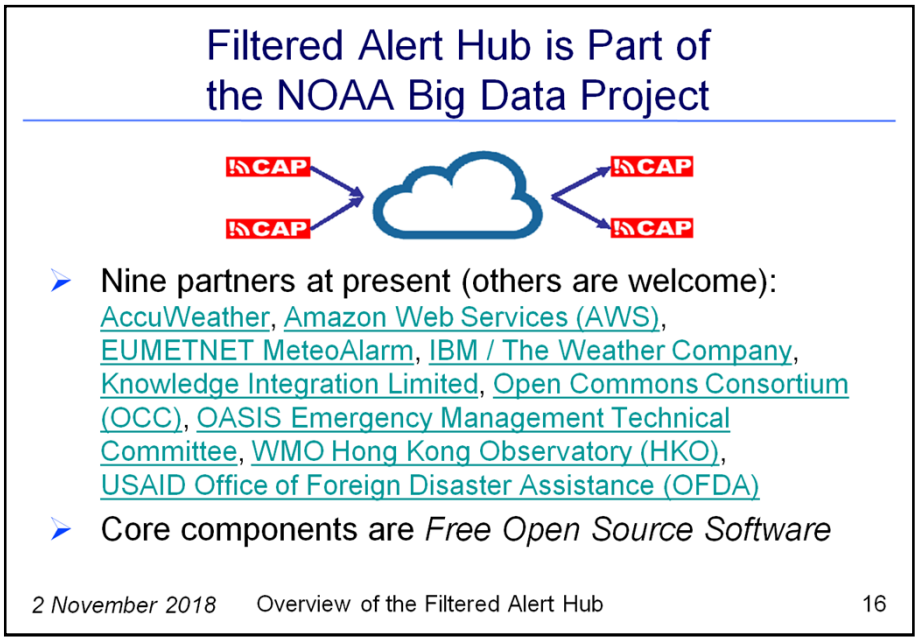


This screen shot shows the areas covered by feeds specific to a place. We generate about 2100 feeds now--one per country and 1870 cities.



Here we see the Filtered Alert Hub list of sources, by name of country name. In some cases, there is more than one CAP alert feed for the country--the number of feeds is in parentheses.

There are also two sources that are international: GDACS and IFRC.

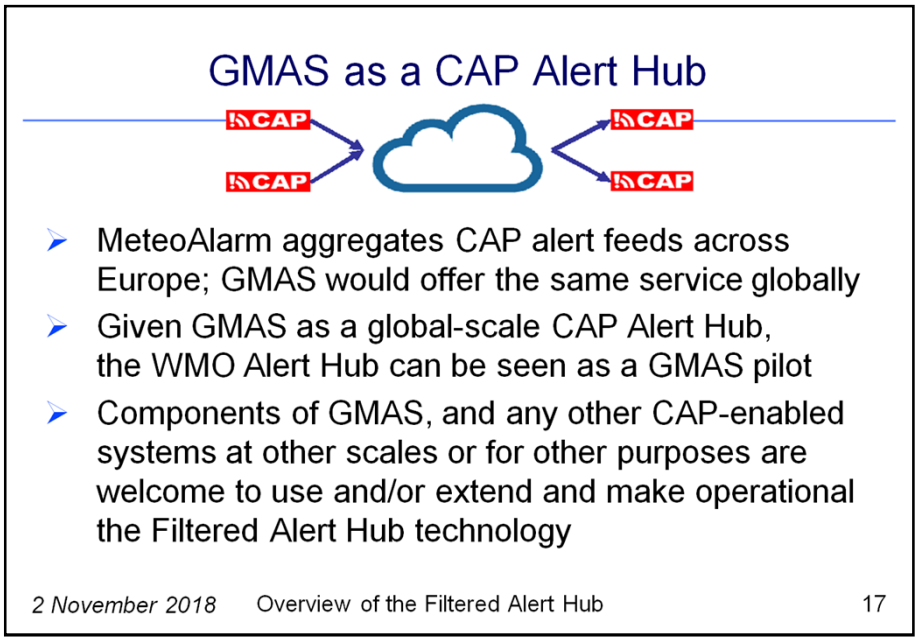


At the wiki page, you would see that collaborators are developing the Filtered Alert Hub technology as part of the NOAA "Big Data Project".

Current collaborators include AccuWeather, Amazon Web Services, MeteoAlarm, IBM and The Weather Company, Knowledge Integration Limited, the Open Commons Consortium, the OASIS Emergency Management Technical Committee, WMO's Hong Kong Observatory, and The USAID Office of Foreign Disaster Assistance.

I am leading this initiative and we welcome other collaborators.

It is notable that core functions of the Alert Hub will be maintained as Free Open Source Software in the public domain.



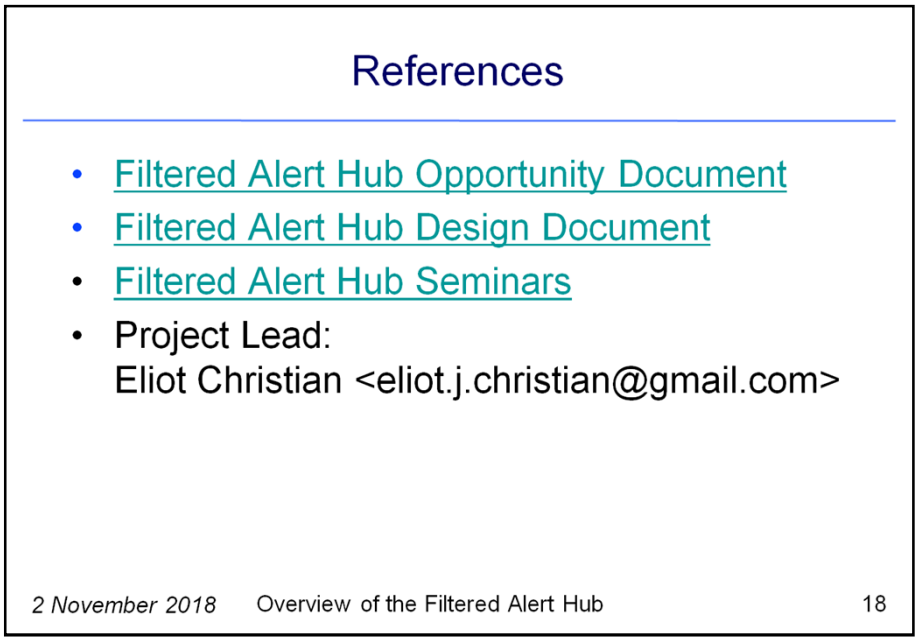
Before I conclude, I would like to offer my vision for a way to implement WMO's Global Multi-Hazard Alerting System (GMAS) based on our prototype of the WMO Alert Hub.

MeteoAlarm already aggregates CAP alert feeds across much of Europe, and GMAS would offer a similar service globally. In essence, GMAS would be a global-scale CAP Alert Hub, much like the WMO Alert Hub.

One can use, in an experimental or operational manner, any part of the Filtered Alert Hub technology for GMAS overall, for GMAS components, and for any CAP-enabled system at other scales or for other purposes.

I would say that any organization interested in pursuing this approach can start today. I don't see that any special permissions, agreements, or new funding are needed in order to take that step.

As things evolve in WMO and its partnerships such as IN-MHEWS, I am very confident that the basic facilities of the Filtered Alert Hub and the WMO Alert Hub prototype will prove very useful in any future CAP-enabled alerting systems, including, but not limited to, GMAS.



Here are links to some key documents on which my presentation is based.

This concludes my presentation.

Thank you.