From Data to Action, at Scale

Abhijit RS, Environmental Defense Fund

Making Sense of Sensors 28 Sep 2017

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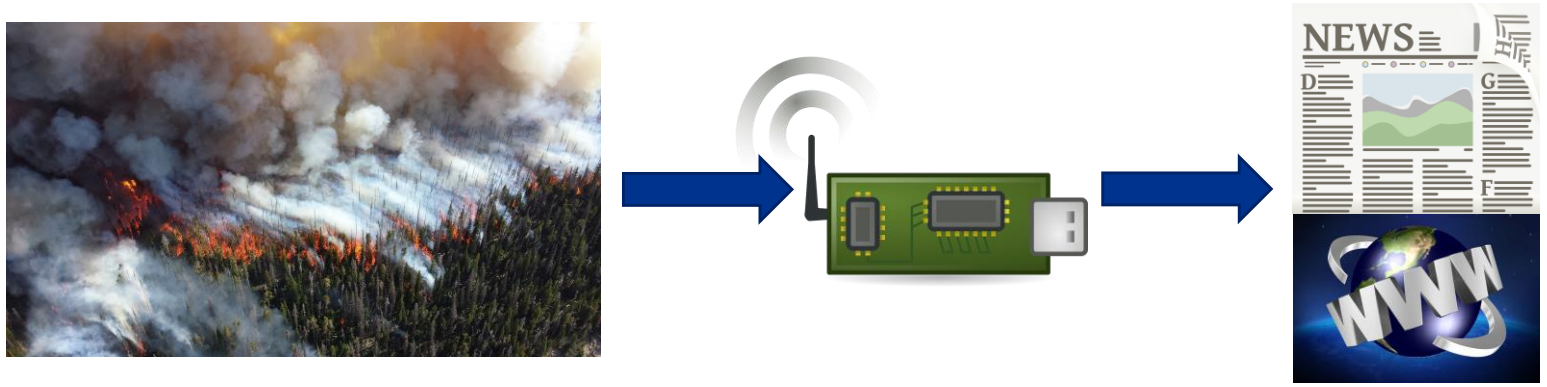
AGENDA

- Data Dissemination
- Air Quality Data Life Cycle
- Data-Knowledge-Action
- Air Sensor Workgroup

Data Dissemination



AQ Data Dissemination – Acute Event

VOC Levels - Harvey Aftermath

Chemical companies have already released 1 million pounds of extra air pollutants, thanks to Harvey

Old refineries and chemical plants across the Texas Gulf Coast released more than 1 million pounds of dangerous air pollutants in the week after Harvey struck, according to public regulatory filings aggregated by the Center for Biological Diversity.

More Than 40 Sites Released Hazardous Pollutants Because of Hurricane Harvey

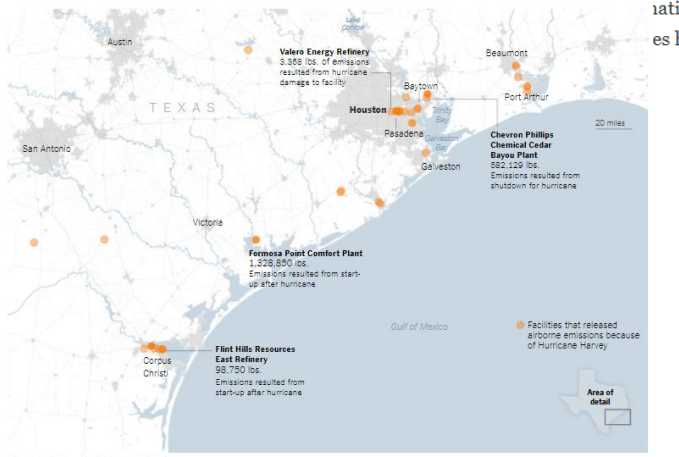
By TROY GRIGGS, ANDREW W. LEHREN, NADJA POPOVICH, ANJALI SINGHVI and HIROKO TABUCHI SEPT. 8, 2017

Houston's sprawling network of petrochemical plants and refineries released millions of pounds of pollutants in the days after Hurricane Harvey began barreling toward Texas.

Even under normal operations, the hundreds of industrial facilities in the area can emit harmful chemicals. But from Aug. 23 to Aug. 30, 46 facilities in 13 counties reported an estimated 4.6 million pounds of airborne emissions that exceeded state limits, an analysis by the Environmental Defense Fund, Air Alliance Houston and Public Citizen shows.

Federal and state regulators say their air monitoring shows no cause for alarm. But the extra air pollution is just the latest concern for residents and environmental groups in the days after the storm. At least 14 toxic waste sites were ...r damaged, raising fears of waterborne ...ination. And nearly 100 spills of hazardous ...es have been reported.

Air Pollutants Were Released Across the Region



Estimated data from Aug. 23 to Aug. 30, 2017

Flooded Texas Chemical Plants Raise Concerns About Toxic Emissions

August 30, 2017 · 5:02 AM ET
Heard on Morning Edition

MOSE BUCHELE

A refinery in Deer Park, Texas, in the aftermath of Hurricane Harvey. Some residents and environmentalists are concerned about toxic chemicals that could be emitted into the air if there's any damage.

FROM KUT 90.5

On Sunday morning, as soon as she woke, Je... Houston's East End to see the impact of ... water that surprised her.

"As soon as I opened th...

At first she th... says the ...

'Unseen Dangers' of Harvey: Petrochemical Plants Release 1 Million Pounds of Harmful Air Pollution

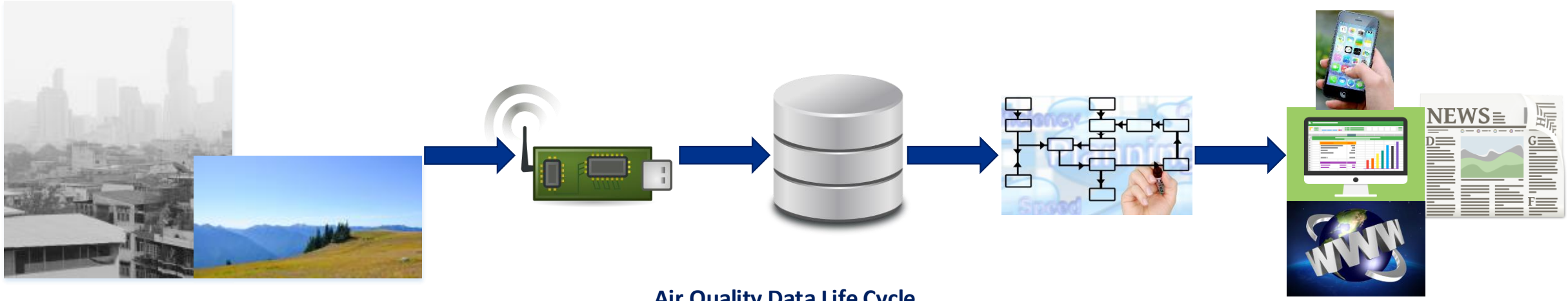
As some of the nation's largest crude processors and refineries shut down their facilities amid " unprecedented" rainfall and flooding from Harvey, residents nearby are reporting noxious, gaseous smells clouding the air.

"I've been smelling them all night and off and on this morning," Bryan Parras, from the environmental justice group TEJAS, told New Republic on Sunday.

Some locals are also experiencing "headaches, sore throat, scratchy throat and itchy eyes," Parras added.

Paris said that the chemical-like smells emanate from Houston's East End and are particularly strong in communities nearby the petrochemical plants. Problem is, the fence-line community cannot leave or evacuate as they are surrounded by devastating flooding, "so they are literally getting gassed by these chemicals," he said.

Air Quality Data Life Cycle



Air Quality Data Life Cycle

Data Dissemination - Considerations

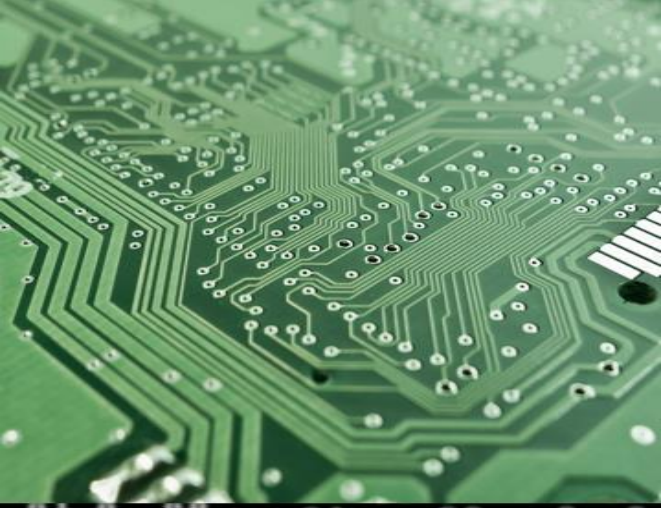
- Purpose - awareness, policy reco, call to action
- Audience - identify and know your audience
- Timing - not too early, not too late
- Content - raw data, analyzed data, history data
- Format - static or interactive reports, APIs

Things Often Ignored

- Data quality
  - (in)completion
  - Data accuracy and reliability
  - Data source and lineage
  - Sensor selection and maintenance
- Balance between time to market and ascertained impact

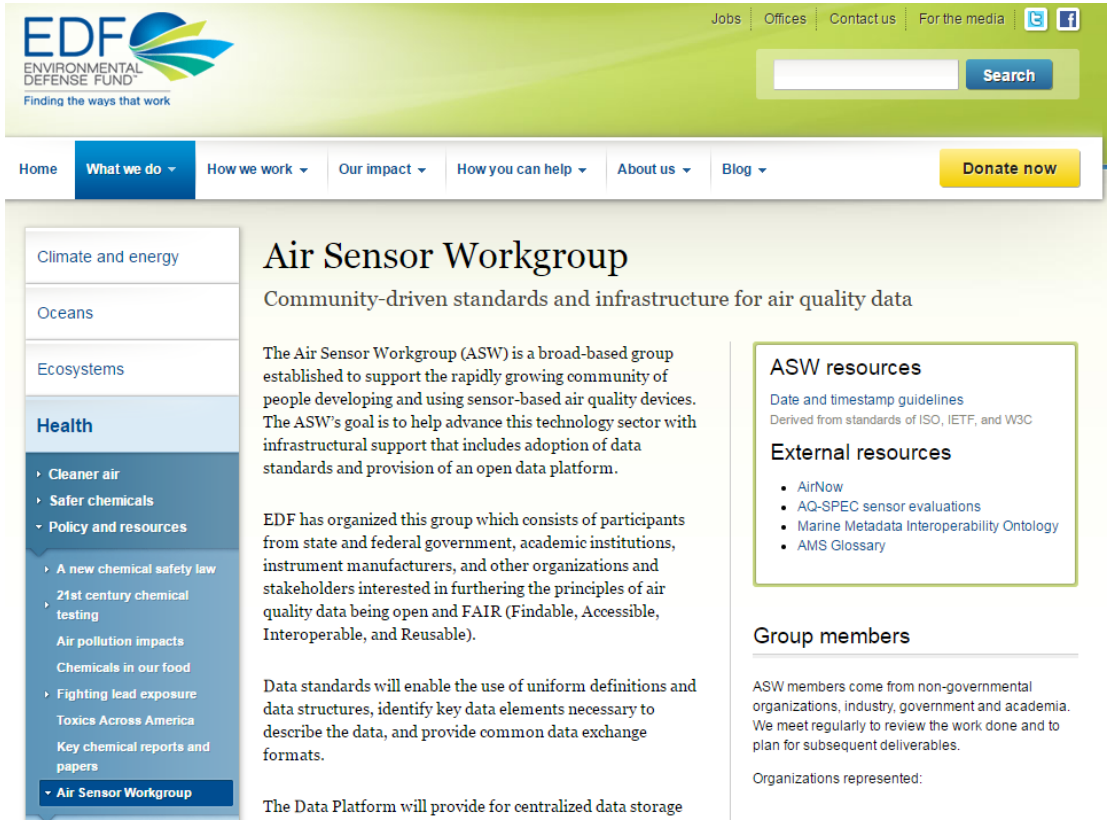
Data-Knowledge-Action

- Data volume and diversity
- Data standardization
- Centralized data repository
- Ability to share data and collaborate
- Ability to derive insights and call to action



Air Sensor Workgroup

Air Sensor Workgroup



https://www.edf.org/asw

Date & timestamp guidelines

By Air Sensor Workgroup

Status of this document

The Air Sensor Workgroup (ASW) adopted the date and timestamp guidelines on 17 January 2017.

Abstract

This document defines the Date and Timestamp Guidelines for use in the field of air quality measurement and monitoring. It has been derived from ISO 8601 standard, IETF RFC 3339 and the W3C profile.

Users and applicability

ASW strongly encourages the manufacturers of low cost sensors, researchers working on air quality and any other air quality data generators and users to use these guidelines.

Purpose of guidelines

Numerous individuals and organizations across the globe have spent effort to measure air quality data and determine the impact of air pollution on human health. However, most of them have been isolated efforts. ASW sees tremendous value in sharing data across data owners so that researchers and other interested parties can take advantage of the vast amount of data to create air quality data products that can help communities worldwide. To this effect, ASW has been developing standards for data generation, storage and exchange.

The Date and Timestamp guidelines apply to data generation and storage by the sensors and their backend database systems, thus facilitating accurate, reliable and efficient exchange of data across various data owners and data users.

Format for data generation

Use Epoch time (aka Unix time, POSIX time) which is time in seconds since Unix Epoch (1970-01-01T00:00:00Z) as a 64-bit unsigned integer at the point of generating date/time value by the device.

3. It simplifies date arithmetic
4. Use 64-bit integer as the data type so as to avoid data overflow in the year 2038
5. Use microseconds granularity in order to support measurements at frequencies higher than once per second (1Hz)
6. Use this format for transmitting data from the sensor to the backend server
7. For writing to the logs, including logs stored on the sensor or the sensor system, use the human readable format and associated guidelines described in the next section. This increases the ease and efficiency of onsite troubleshooting and maintenance.
8. Tools and libraries to convert to human-readable formats are available and can be applied just prior to visualization

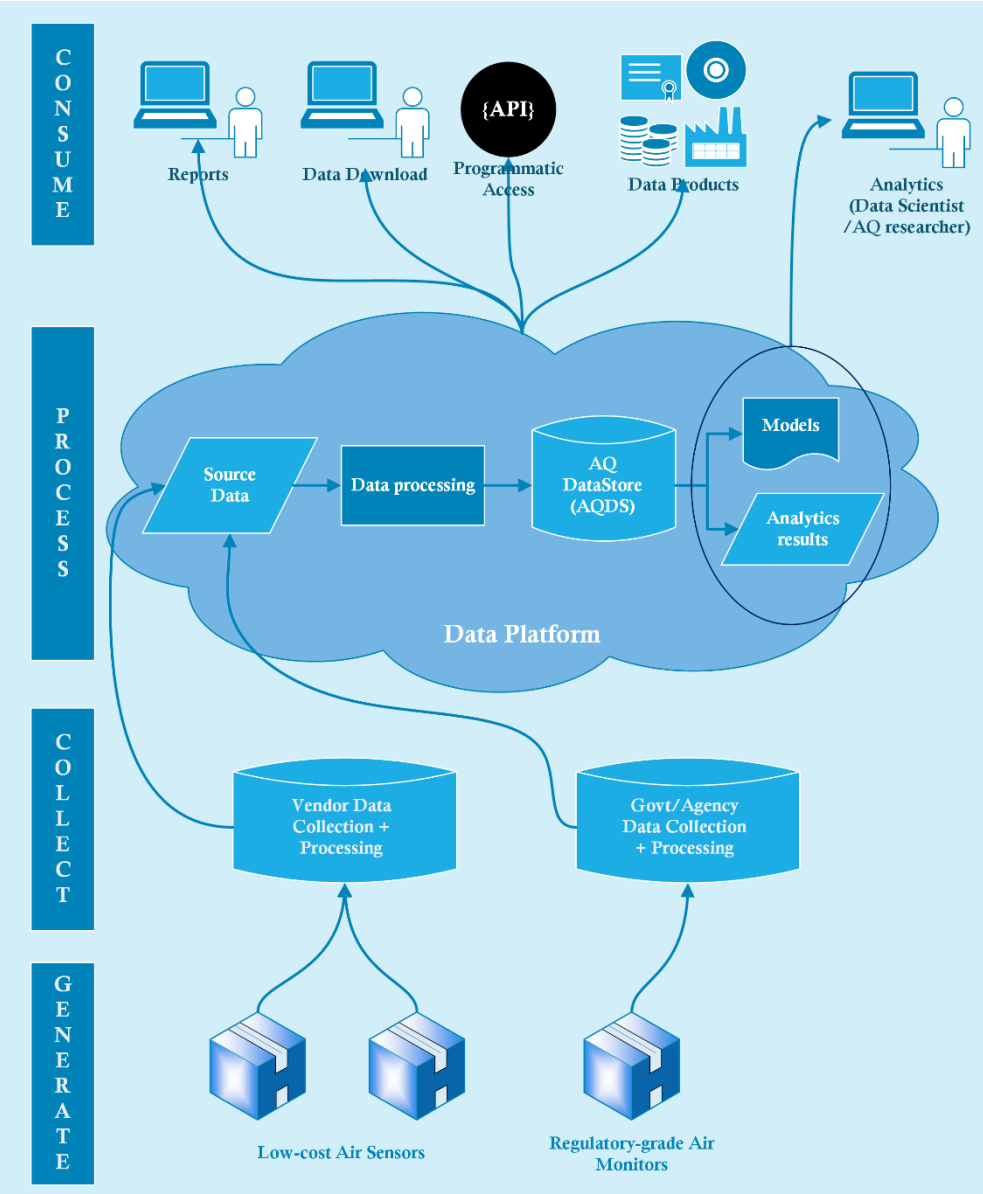
Key considerations

- Multiple application tiers on the device such as I2C/IC/RTC, microprocessor and software may generate the timestamp value. All these tiers must support 64-bit integer. If any of these support 32-bit only, then the Epoch time will overflow on 19-Jan-2038 and reset to 13-Dec-1901.
- Some RTCs have a ceiling on the year they support like 2099, 2100, etc. Pay attention to what is supported and have a plan for subsequent time period.
- Use appropriate data type in the software programs to support 64-bit integer values
- If there is a need for sub-second measurements, explore the built-in support provided by the databases and programming languages (see Appendix).

Format for data storage

The requirements for data storage are driven not only by storage optimization and retrieval (I/O) performance considerations but also the subsequent data usage, including the visualization layer. Store the timestamp value as Epoch time (as received from the

Air Sensor Workgroup



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Thank You

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