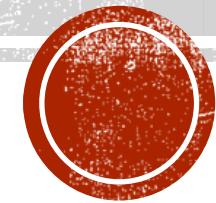


MANAGING CLIMATE EXTREME, DISASTER RISKS AND HUMAN HEALTH IN THE ERA OF MOBILE EDGE COMPUTING

The Case for Scalable and Highly Available Software Defined Data
Storage Management Infrastructure

Hong ONG, PhD

Mimos Berhad

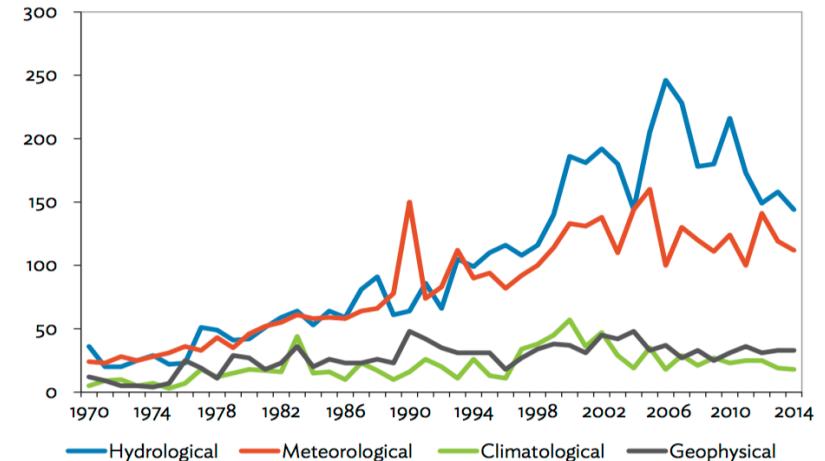


“WEATHER-RELATED DISASTERS IN THE PAST TWO DECADES HAVE KILLED MORE THAN 600,000 PEOPLE AND INFILCTED ECONOMIC LOSSES ESTIMATED AT TRILLIONS OF DOLLARS” – UN FOR DISASTER RISK REDUCTION, 2015



Destroyed houses after a mudslide caused by Tropical Storm Erika in Montrouis, Haiti, in August 2015.

Figure 1: Global Frequency of Natural Disasters by Type (1970–2014)

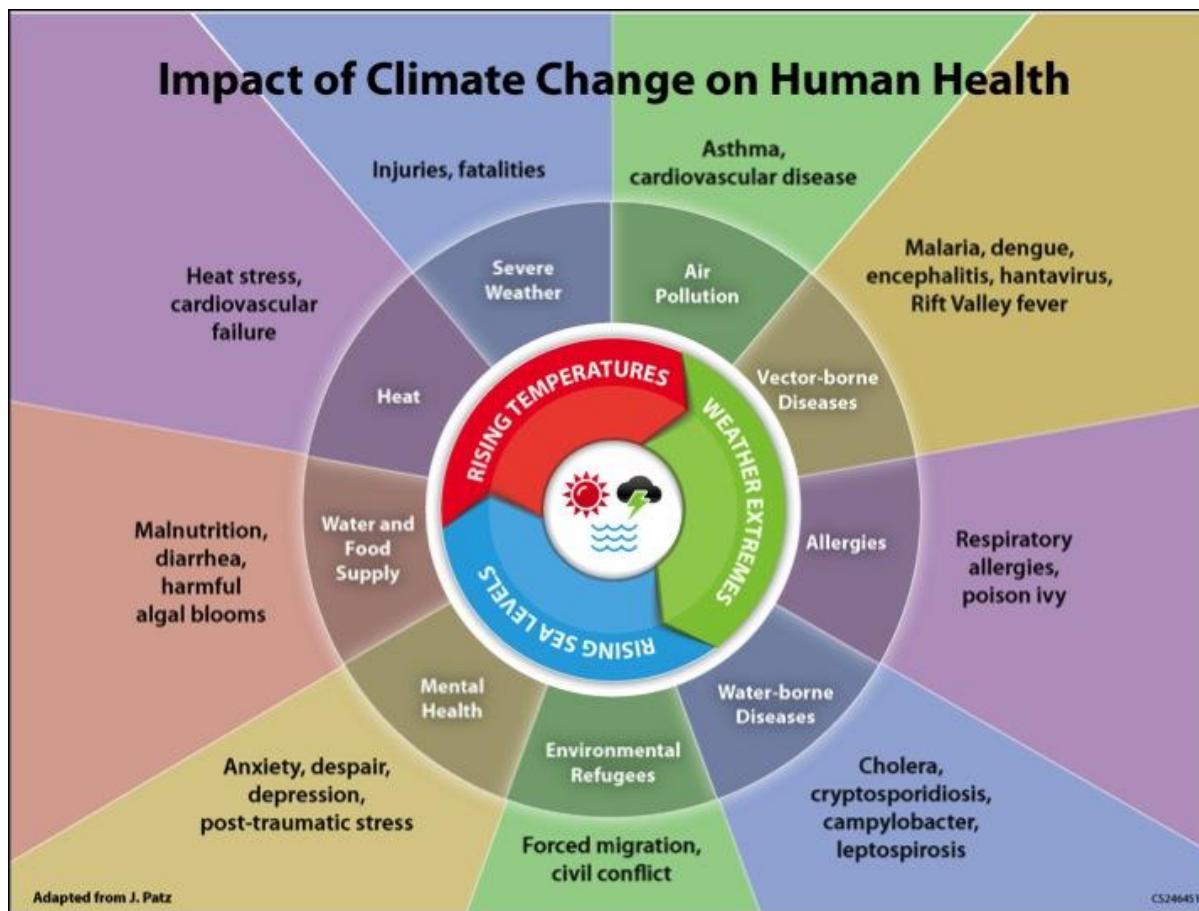


Source: Authors' estimates based on data from the Emergency Events Database (EM-DAT) of the Centre for Research on the Epidemiology of Disasters. <http://www.emdat.be> (accessed 5 March 2015).

Vulnerability is *inability to adapt* and response to climate change



CLIMATE CHANGE IMPACTING PEOPLE HEALTH TODAY

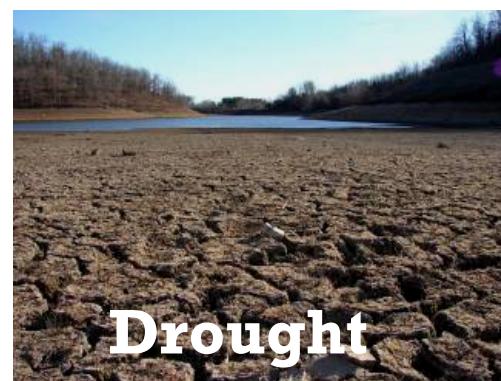
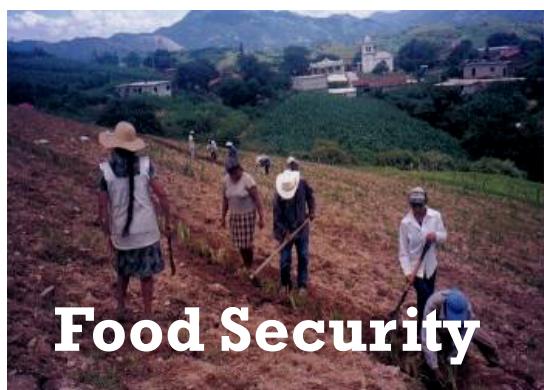


From: toolkit.climate.gov

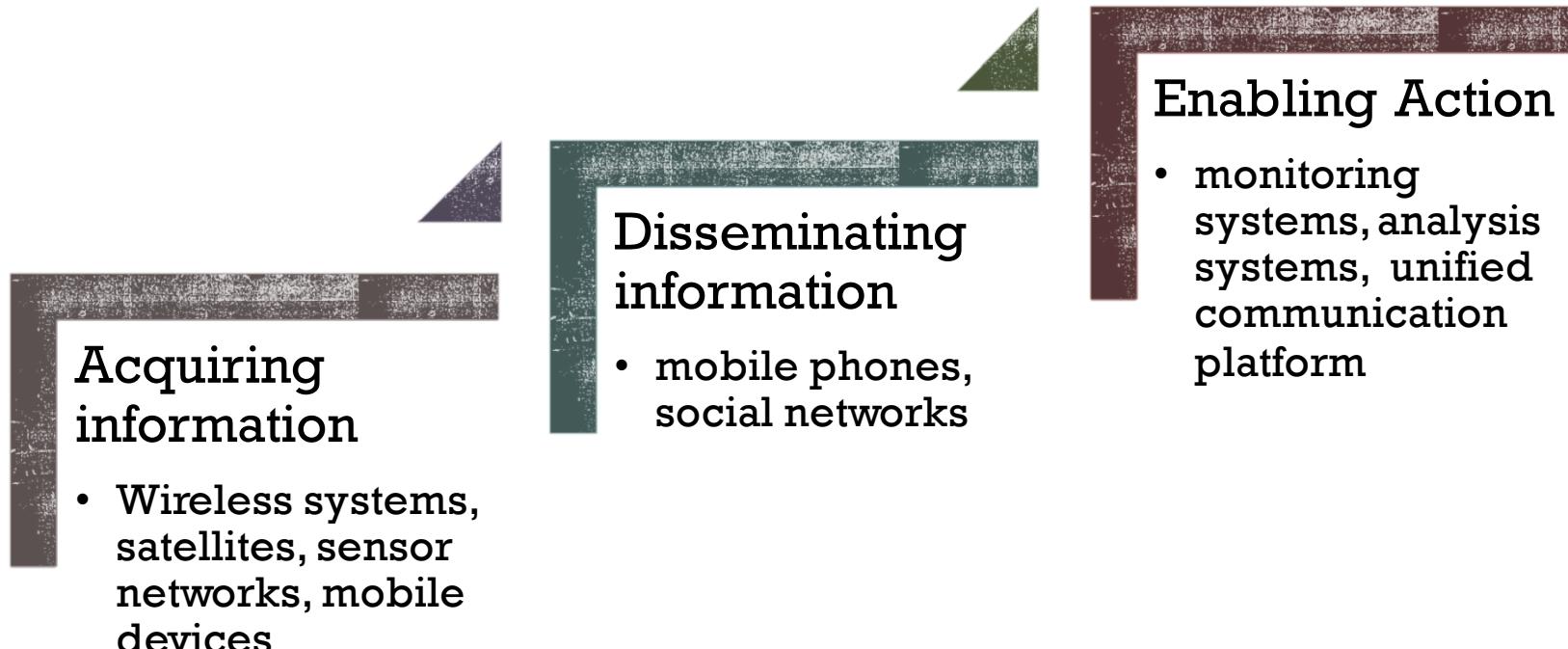
The negative health effects are
PREVENTABLE!



INFORMATION SCARCITY INCREASES VULNERABILITY

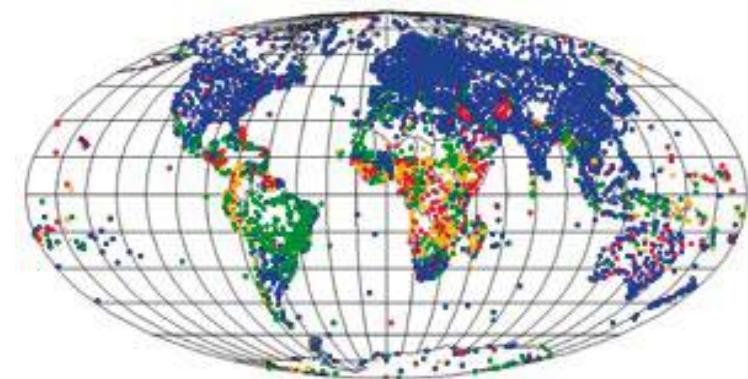


ADDRESSING INFORMATION SCARCITY



WEATHER INFO FOR ALL

- Put automated weather stations on GSM towers
- 19 stations East Africa by mid '10; 500 thereafter
- Global Humanitarian Forum, WMO, Ericson, Zain, Earth Institute
- See video: YouTube: weather info for all



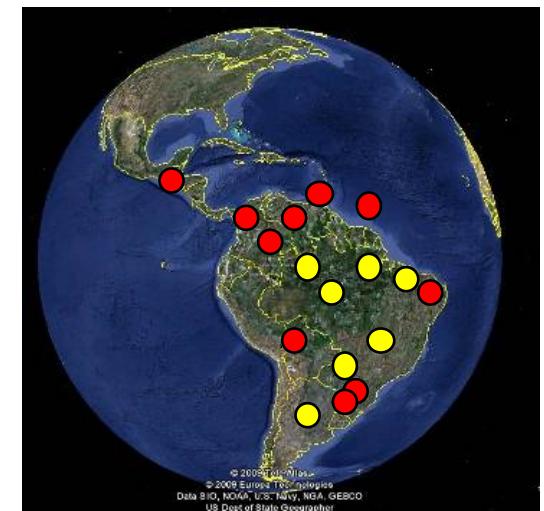
Weather report coverage



NOT ONLY SATELLITE IMAGERY – COMMUNITY SURVEILLANCE AS WELL

What would it take to create:

A global network of citizens who monitor Earth's resources and life supporting systems



RIGHT INFORMATION, RIGHT PLACE, AND RIGHT PEOPLE?

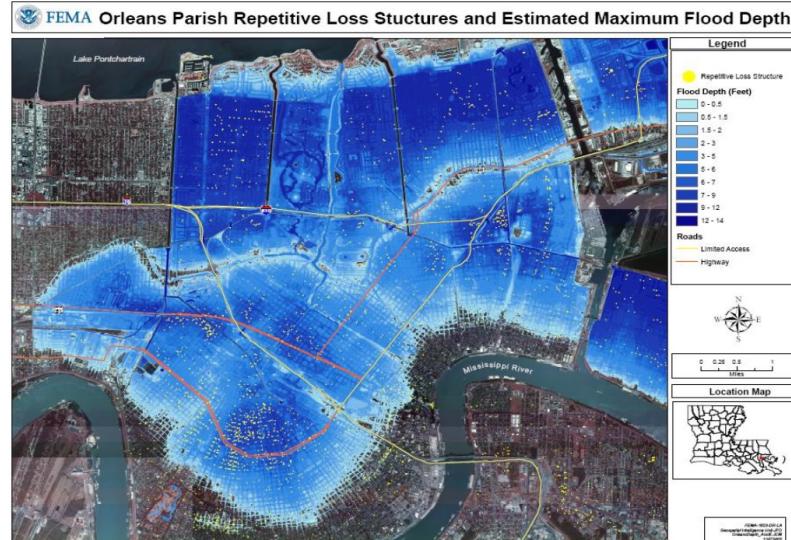


Saving Lives....



The Hurricane Katrina response took about one week to integrate and develop relevant response geospatial information. **The time is too long for responding.**

When flooding happened, we need the right information to the right place and right people almost **in real time**



INFORMATION SCARCITY KEY CHALLENGE IN MANAGING NATURAL DISASTERS

- Climate-related natural disaster is happening and will increasingly affect the poor.
- Adaptation is necessary and there is a need to integrate responses to climate change and adaptation measures into strategies for poverty reduction to ensure sustainable development.
- Knowledge technology can play an important role in addressing the information scarcity problem.



IMAGINE . . .



- What if we can
 - Integrate all geospatial data, information, knowledge, analysis in a few minutes
 - Generate and send the right information in real time to the people including decision makers, first responders, victims
- This dream requires a computing and data platform that
 - can be ready in a few minutes (i.e., programmable & reliable)
 - can reach out to all people needed (i.e., cost effective)
 - won't cost to maintain after the emergency response (i.e., maintainability)
- This is exactly what *Software-defined Edge Computing (SDEC)* can provide

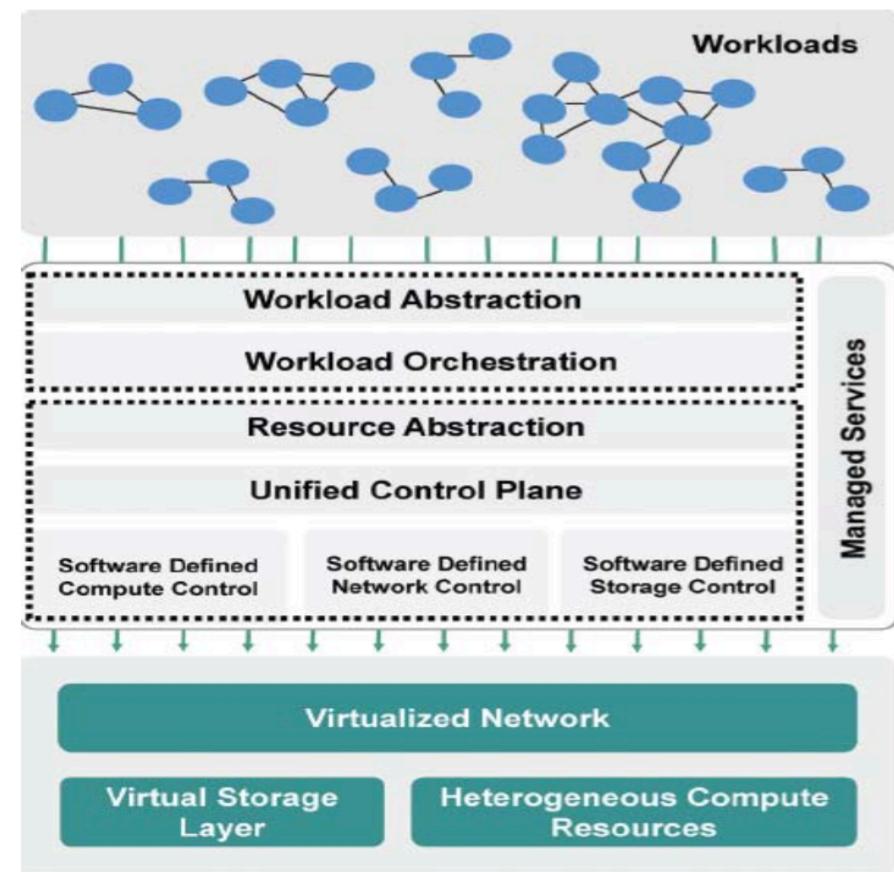


Software defined systems

- Software definition of system configuration/behavior via management interfaces
 - Computing, networking, storage resources
- Improving performance
- Flexible and easy deployment

Examples:

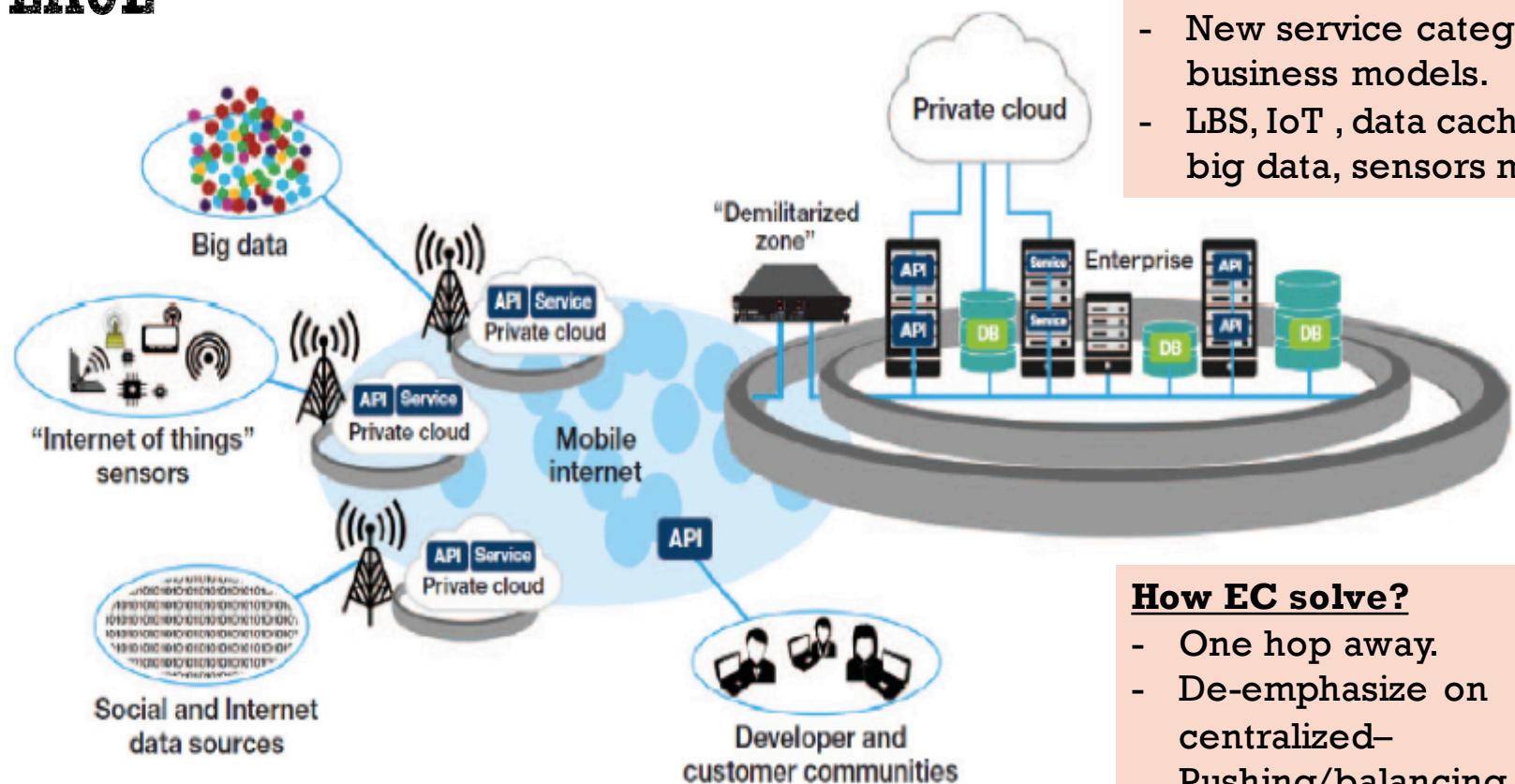
- Specialized communication protocol
- Application-specific workloads
- Business continuity plan



EDGE COMPUTING HELPS TO ENSURE THAT THE RIGHT PROCESSING TAKE PLACE AT THE RIGHT TIME AND PLACE

Why Edge? Not just Cloud?

- User Quality of Experience (QoE) bad
- General problem - response time, latency, bandwidth



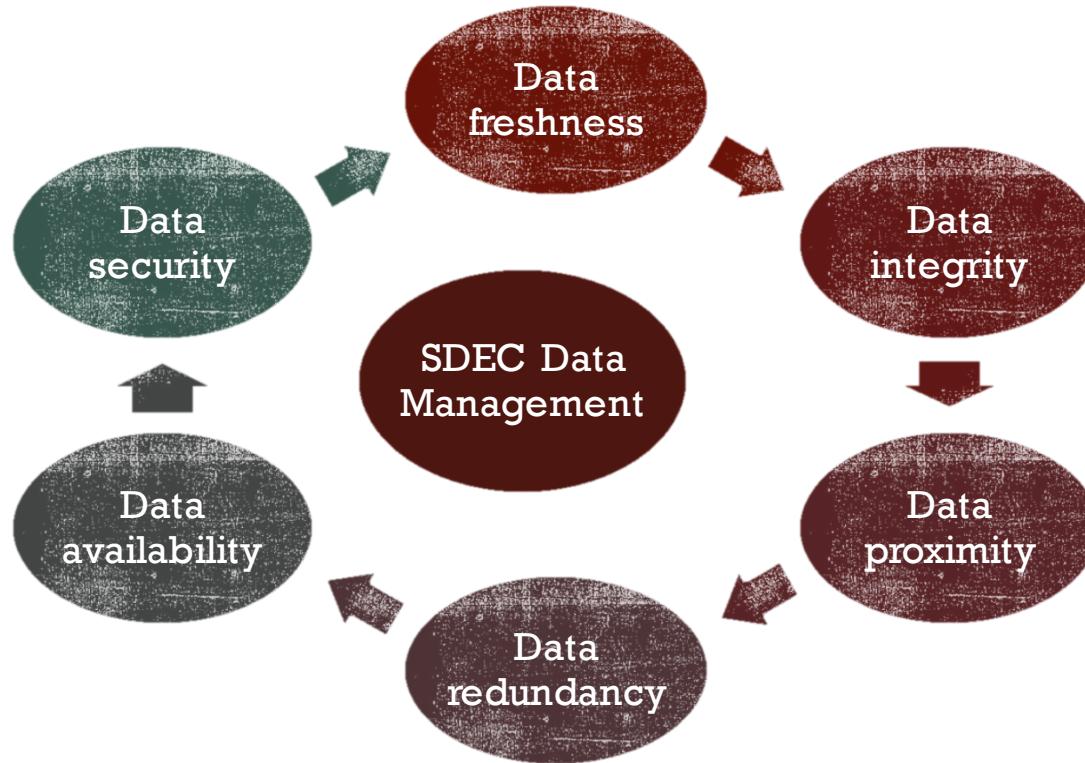
EC values?

- New service category, business models.
- LBS, IoT , data caching, big data, sensors mon

How EC solve?

- One hop away.
- De-emphasize on centralized– Pushing/balancing data or service.

DISTRIBUTED STORAGE CHALLENGES IN SDEC



- How are different storage strategies may impact other aspects such as computational requirements?



CONSIDER A NATIONAL HEALTH CARE “CLOUD” DEPLOYMENT SCENARIO...

- 3000+ clinics in sub-urban to remote rural areas with different connectivity and bandwidth/latency (wired and wireless – 2G/3G/4G/Satellite)
- Numerous major hospital in urban areas with different bandwidth (wired)
- 2 or more central data center(s)
- What if a natural disaster happened and rural clinics are isolated?
 - How do we ensure service continuity of these isolated clinics while waiting for connectivity to be restored?
 - How do we ensure critical data are available?

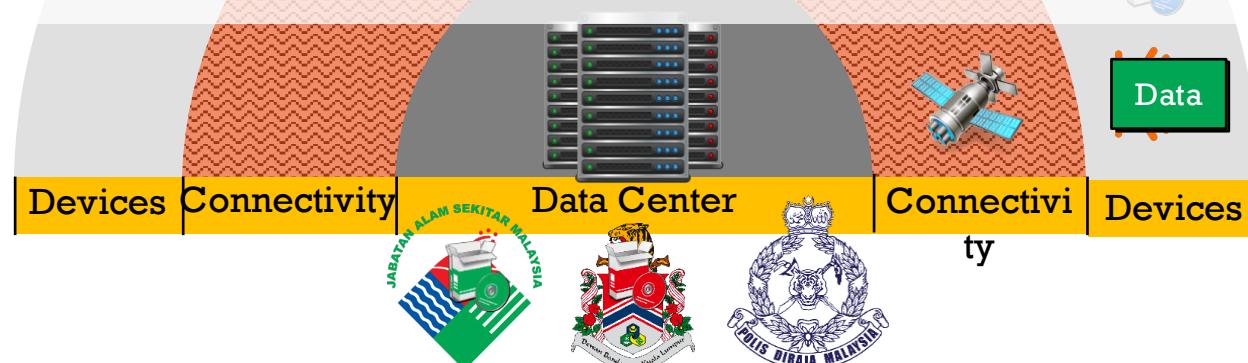


SMART CITY AND OCEAN OF SENSORS...

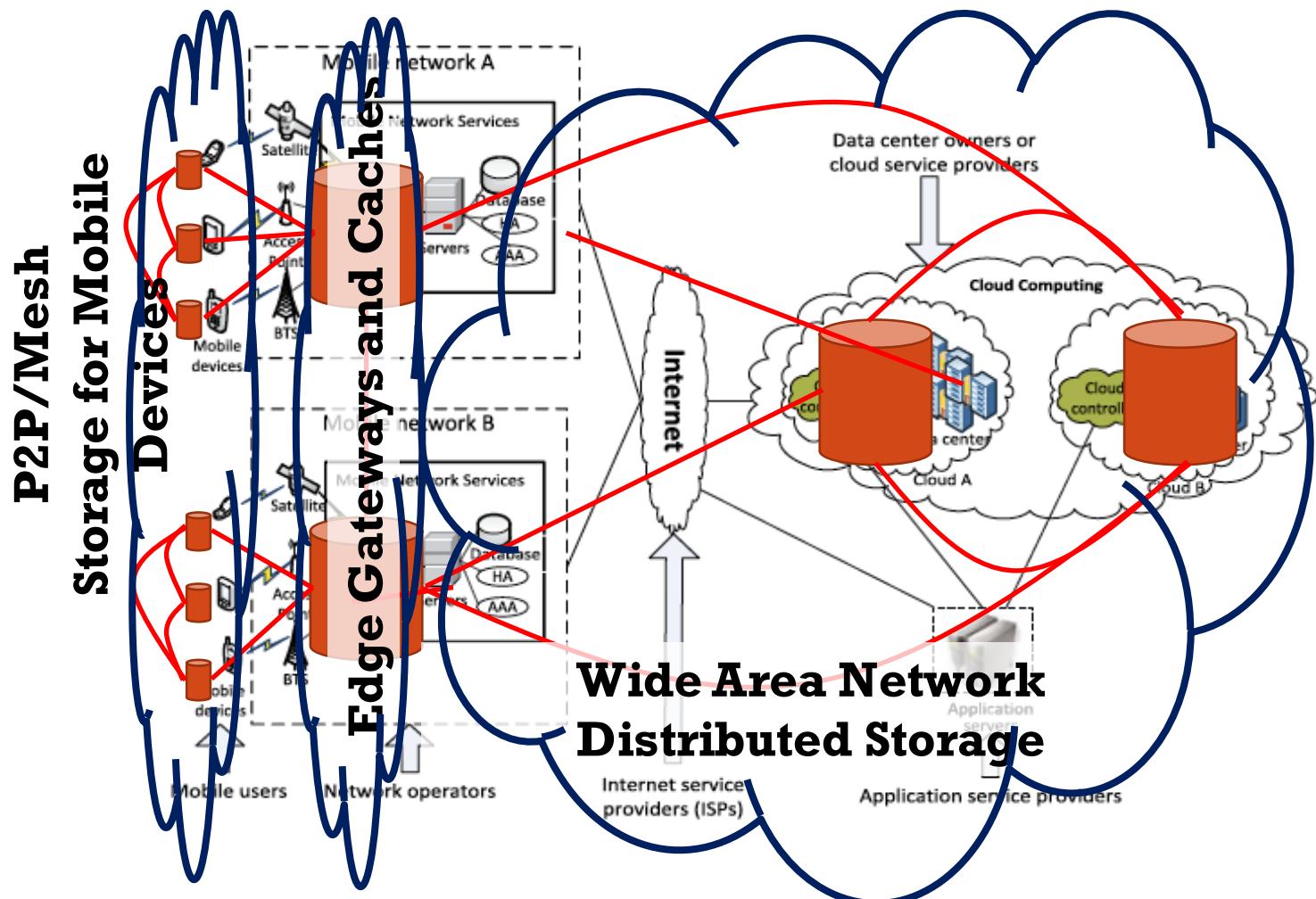
Categorize applications
into three categories:
Transport, Environmental,

Public Safety

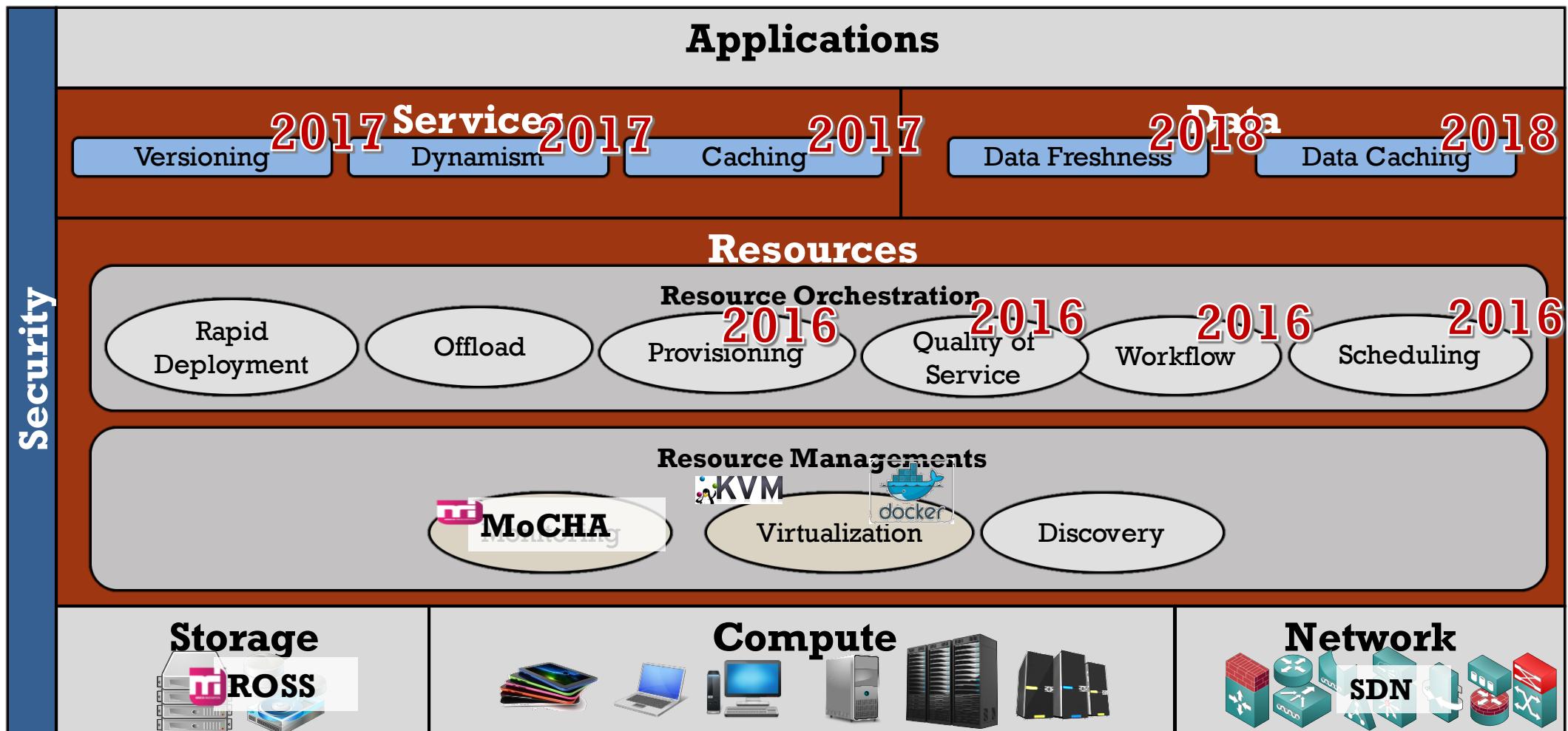
How to exchange/share data quickly? And securely?
How can citizens participate with their mobile devices?
What data to be processed ? And Where?
Which data should be stored? How?



POSSIBLE SOLUTION: A DISTRIBUTED STORAGE FOR SDEC



MIMOS FOCUS PLATFORM



MI-ROSS: BACKGROUND

- Started as a simple idea to provide:
 - a simple user interface (web) to manage a Ceph based backend
 - means for storage admin to create file share services (NFS and SAMBA) via RADOS Block Device
- More importantly to have a base for which the team can further research and improve towards a **Software Define Storage solution/platform**
- New challenge with EC
 - How to reliably manage data and storage at the edge/devices?
 - How to deal with network latency and bandwidth as well as reliability?



MI-ROSS: TOWARDS A RELIABLE DISTRIBUTED OBJECT STORAGE SOLUTION FOR EDGE COMPUTING



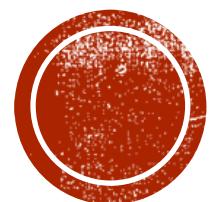
- 2015
 - Data Center focused
 - Ceph Backend and Management
 - Simple File Share support (NFS & SAMBA)
- 2016-2017
 - Wide Area Network Storage Management
 - Multi Storage Backend (Ceph, HDFS, direct attached storage, etc.)
 - Hierarchical Storage Management/Data Life Cycle Management
- > 2017
 - Edge Gateways and Cache
 - P2P/Mesh Storage for Mobile Devices



SUMMARY

- Software Defined Data Storage & Management in EC poses different challenges depending scenarios.
- Activities can be created to investigate some of these challenges in the following areas:
 - Data freshness
 - Data integrity
 - Data proximity
 - Data redundancy
 - Data availability
 - Data security





THANK YOU

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