E-Science Activity in Indonesia

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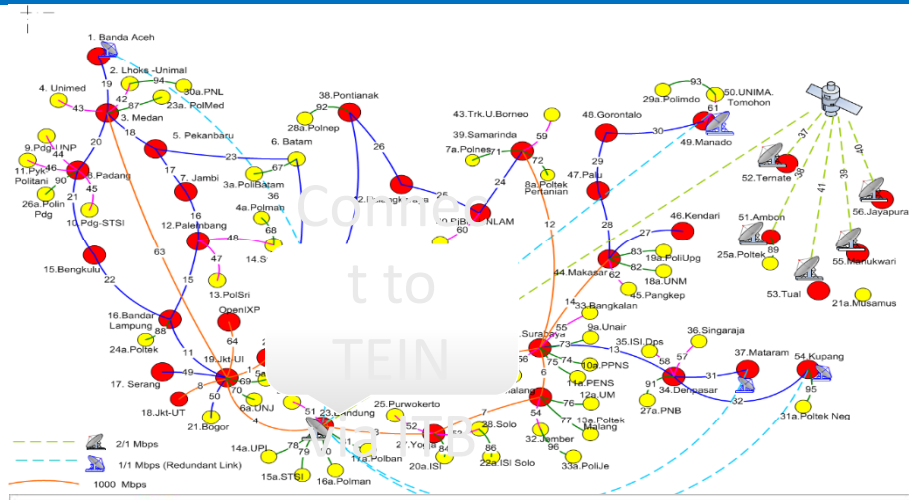
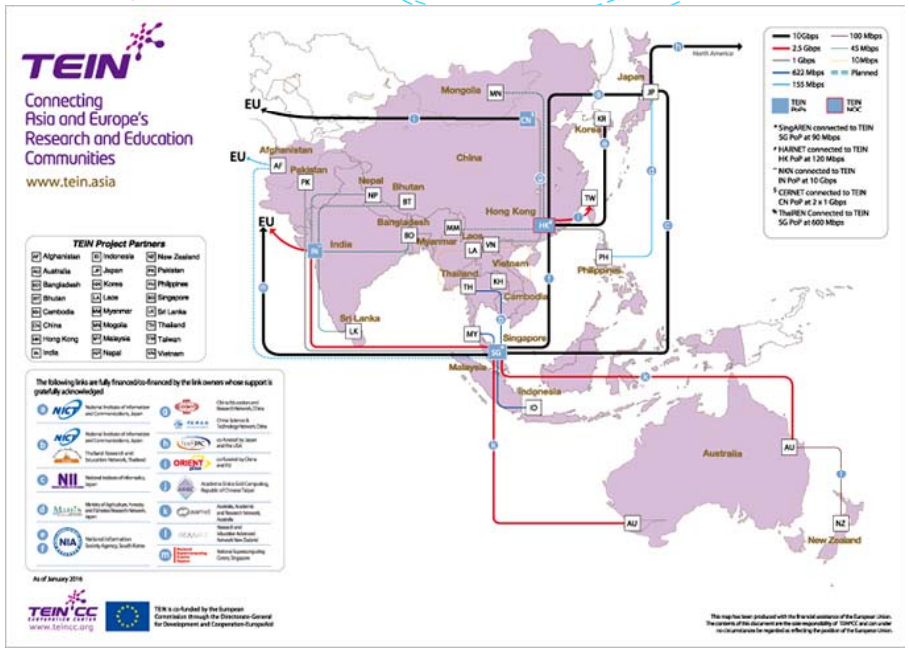
Presentation Outline

- Infrastructure Status
- National Scientific Priorities
- Support Computation
  - Weather Modelling
  - Openstack @ITB
  - Integration with Existing Cluster
- Firewatch @Indonesia

Current Status of NREN@Indonesia

- Due to financial policy for NREN , Inherent has been stop on operation in 2013
  - The P2P link among the universities are stop
- The Universities still connecting to Internet and TEIN4 , gateway in ITB :
  - Using tunnel through IIX /OpenIXP
  - Develop Network Called IDREN
- Connect to TEIN4 622 Mbps to SG pop



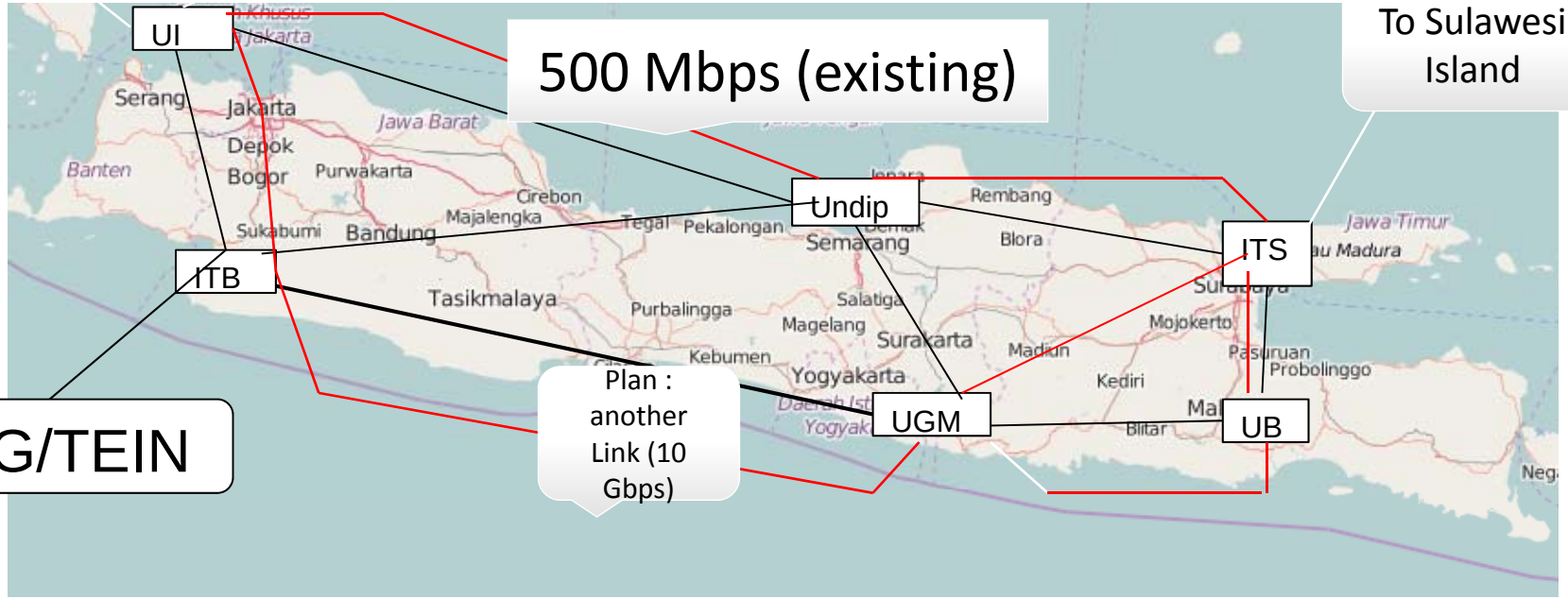


NREN Backbone @java Island

To Sumatra Link

Telco's Clound Network Infrastructure

Multi connection Multi operator



Map source:http://www.openstreetmap.org/directions#map=7/-7.368/109.094

Eduroam Initiatives (XeAP project)

- Initiatives by TEIN4 and lead by Aarnet
- Setup NRO (National Roaming Operator) in Indonesia through ITB
- Status :
  - System was developed by Aarnet
  - Website for ready (http://eduroam.ID)

Indonesia' status

- Current status
  - There is no big Computational capability
  - Several institution build the cluster for the computation such as for Disaster simulation models
  - And publish result just only on the web (not as a raw data)
- Indonesia Institute of Science (LIPI)
  - Several computational Cluster for Fluid Dynamics
- National Space Agency (LAPAN)
  - Small Cluster
- Meterological,Climatological and Geophysical agency (BMKG.go.id)
- ITB weather prediction model (http://weather.meteo.itb.ac.id/

Indonesian Current Condition

- Weather and climate information monopoly by of Meteorology, Climatology and Geophysics (BMKG) agency
- Climate-related research at several institutions (LAPAN, BPPT, Research and Agriculture) with funding and human resources are still very limited
- The density of weather and climate observation stations is still limitedClimate and weather data is very difficult to obtain from official agencies (BMKG)

National Scientific Priorities

- Disaster Mitigation
  - Tsunami Early Warning System (INATEWS)
- Disaster Reduction
  - E.g: Flood
- Climate Change Impact

  Using data available in some government agencies:
  - LAPAN (Indonesian National Institute of Aeronautics and Space)
  - BMKG (Indonesian Agency for Meteorology, Climatology, and Geophysics)
  - LIPI (Indonesia Research Institute)
  - BNPB (National Diaster Management Authority)
- Fire Hazard on Forestry
  - the Ministry of Forestry in Indonesia, in coordination with he Western Australian Government's Land Information Agency, Landgate, and the Indonesian space agency, LAPAN.

High Performance Computing @ITB

Weather Forecast - Cluster

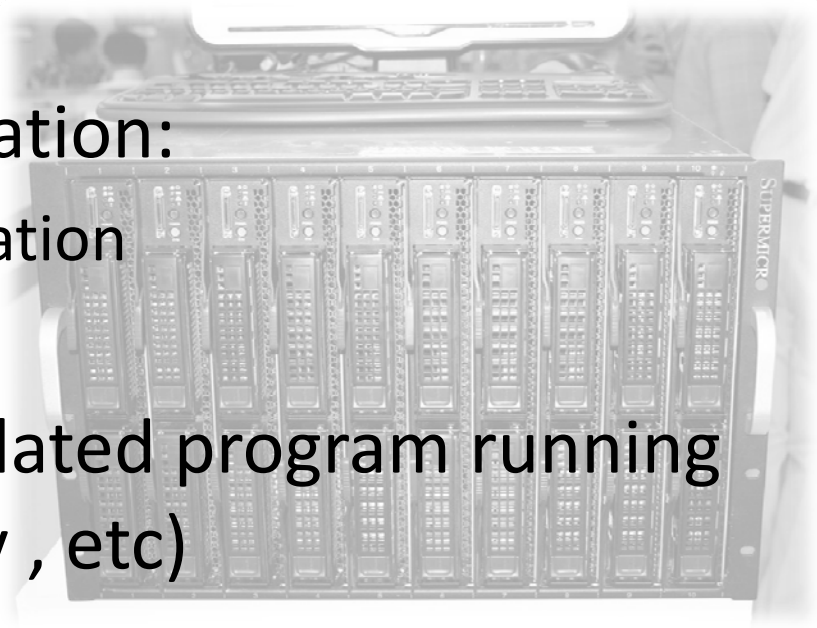
- managed by Atmospheric Science Research Group in Faculty of Earth Sciences and Technology, Institut Teknologi Bandung.
- Current application used for Weather Forecast (WRF) running on 8-nodes Cluster with Open Suse 10.3 as the Operating System.
- Develop and Running on GPU Cluster

GPU Cluster

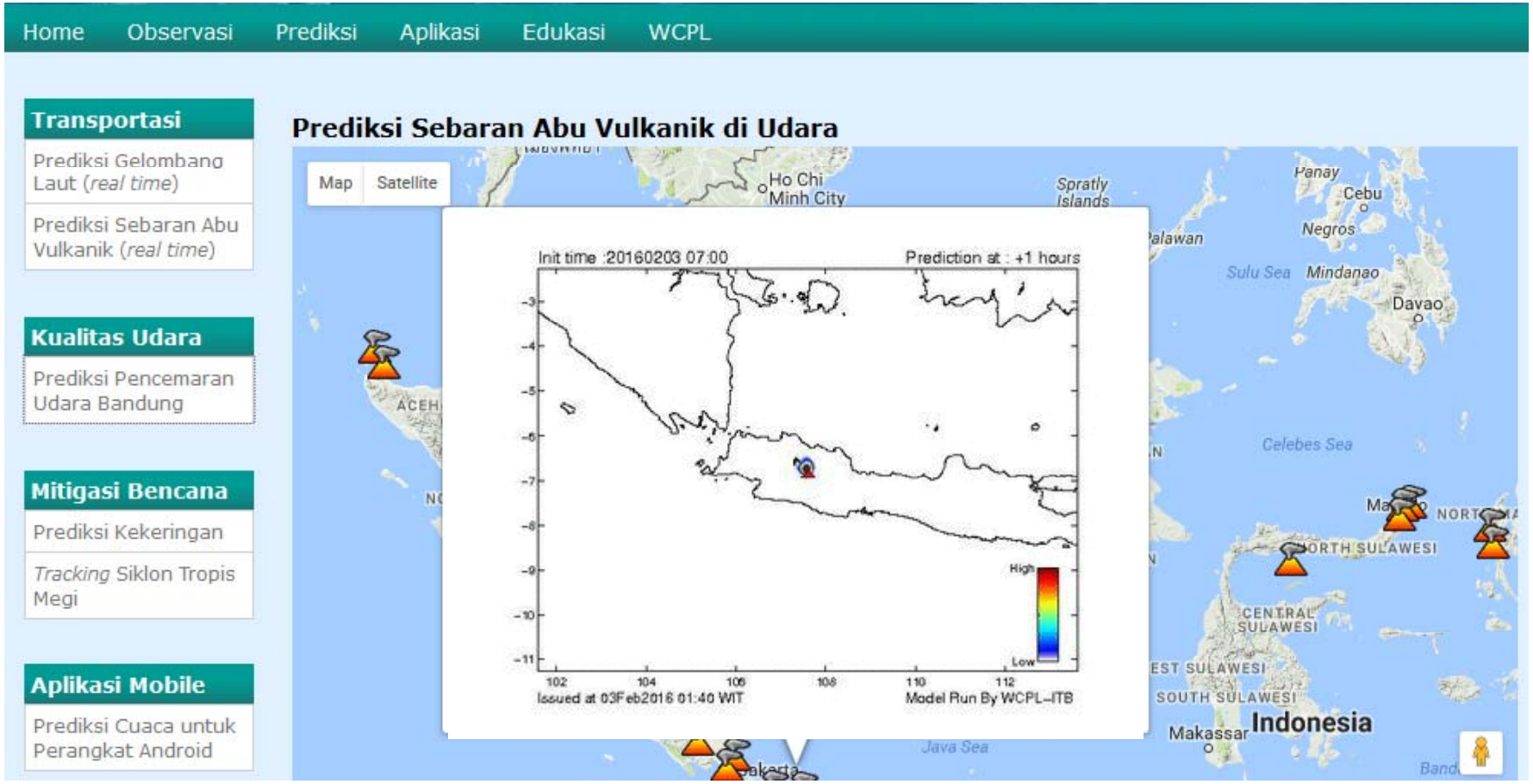
- Objectives
  - Build the GPU for the weather prediction model
  - Build for support computational for education
- Build 4 (2 cluster) GPU
  - 2 Machine with GPU 4000 core
  - 2 machine with GPU 2000 core
  - 2 machine running on Redhat 6 Entreprises
  - 2 Machine running on Linux Suse 11
  - 10 Tbytes storage
- Operational mode : Focus on weather prediction model
- Computational Chemistry

GPU Cluster

- Spesification
  - GPU optimized 4U / tower solution up to 2 Teraflops DP (Double Precision) of performance per system
  - 4 GPU Installed per system
- Existing GPU Cluster utilization:
  - Weather Prediction Application
  - Move the OS to Sci Linux 6
- Still have problem with related program running on GPU (Compiler , library , etc)

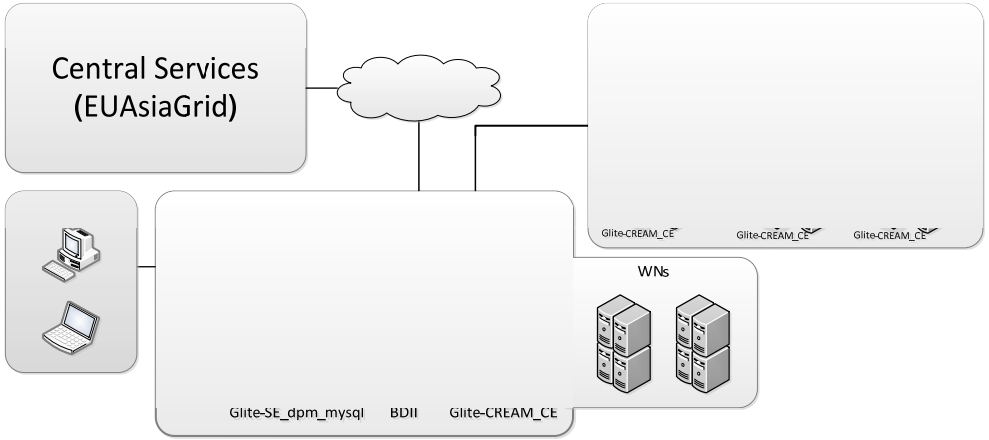


http://weather.meteo.itb.ac.id/volcanomap.php



ID-ITB Site

- Problems encountered:
  - Lack of resources
    - Developer and Operational
  - Hardware problem (32 bit to 64 bit)
    - New investment hardware
- Move to Openstack

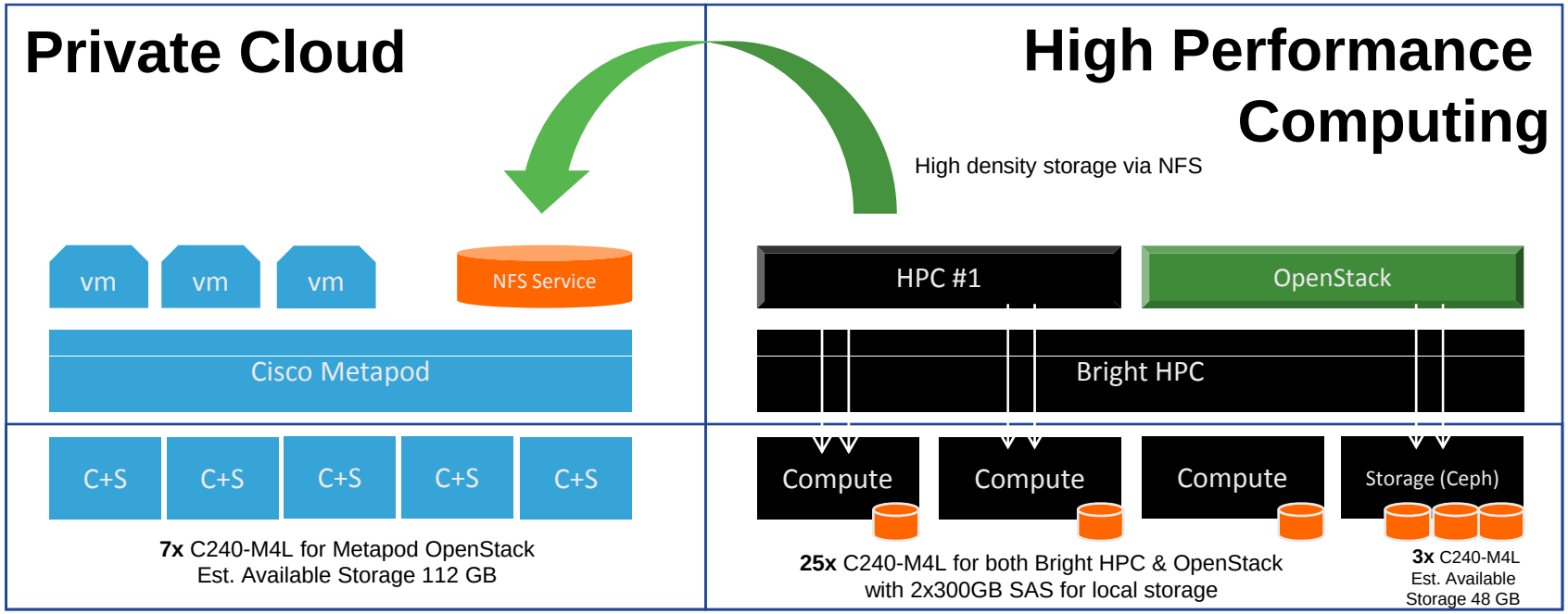


previous ID-ITB site

Background using Openstack

- Needs for
  - general computing purpose
  - computing resources
  - Needs for aggregate storage area
- Limited Resources
  - Hardware and software
  - Consolidated the resources
- Expand the ‘idle time’ (after office hour)

Solution Overview (2017)



FireWatch Indonesia and environment effect in Indonesia

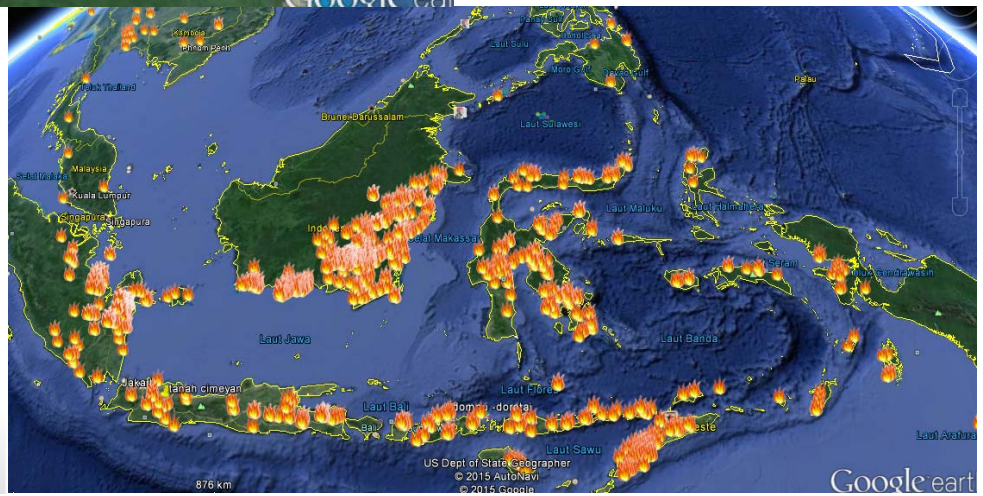
Firewatch Initiatives

- Ministry of Forestry and LAND-gate Australia
  - MODIS-Data from NASA
- Collaboration Ministry Forestry with Ministry of Education (2010) for delivering the Hotspot information (Fire) through the Inherent (University of Palangkaraya and University of Riau)
- In 2015, ITB initiatives again for firewatch
  - Data Analysis through satellite
  - Sosialize the environment impact through the social media (Facebook/twitter)
  - Prevent air filter system solution in classroom
- In 2016
  - Prevent initiatives for building the near realtime model with Authomatic Weather System and Environment Sensor

Infrastructure operation

- Data are downloaded manually from data provider (government agencies)
  - Temperature
  - Humidity
  - Wind Speed
  - Wind Direction
- Data processing done by each institutions, not integrated and not shared (web services)
- Lack of sensors
  - Earthquake sensor (seismic networks)
  - Automatic Weather Sensor Network
  - CO, CO2, and Particulate matters (2,5 micron and 10 micron)
- No middleware server (web services) for collating , analyzing , dan deliver the data from specific area

Google with KML's data from MODIS NASA (2015)



https://earthdata.nasa.gov/earth-observation-data/near-real-time/firms/active-fire-data

IDeate

- By combining the satellite data with meteorological records, Field established that Indonesian fires often occur in association with the ultra-dry conditions in the region that accompany El Niño, a major cyclical weather system. These dry out the underlying peat to the point at which it can catch fire and can't be extinguished until monsoon rains arrive months later. A next step might be to refine the predictions further by including the combined effects of high temperatures and low humidity on peat moisture, says Field.
- He also found that less than 4 millimeters of rain per day during the annual dry season, from August to November – combined with El Niño conditions – seems to be a "tipping point" beyond which fires can to suddenly take off.

https://www.newscientist.com/article/2099496-indonesian-fires-sent-huge-smoke-plume-halfway-around-the-globe/?utm_medium=Social&utm_campaign=Echobox&utm_source=Facebook&utm_term=Autofeed&cmpid=SOC%7cNSNS%7c2016-Echobox#link_time=1470082665

Define

- What we (Indonesia) need it ?
  - Automated Weather Station
    - Rainfall
    - Temperature
    - Humidity
  - Air quality Index and Polution Standard index measurements
    - NOx, SOx , CO , NH3 , O3 and PM 2.5 (10)
  - Sensors and sensors network
  - Prediction models
  - Socialize to peoples (Social Media)

https://en.wikipedia.org/wiki/Pollutant_Standards_Index

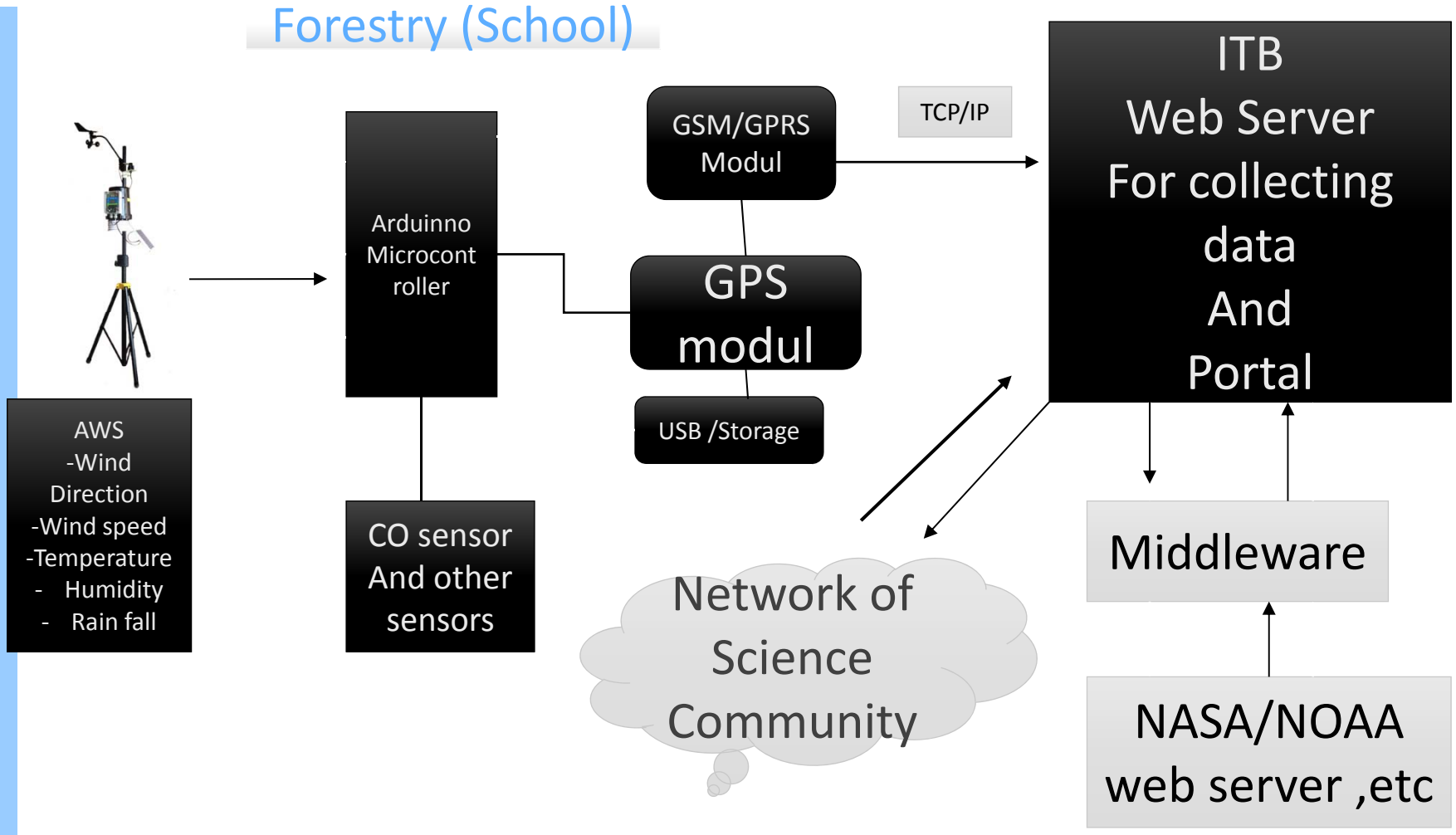
Contraints/obstacle

- In the field
  - There is no power
  - Limited converage by telecommunications system
  - No sensor available
- Source of the fire
  - More than 50 km from nearest

Build Prototype

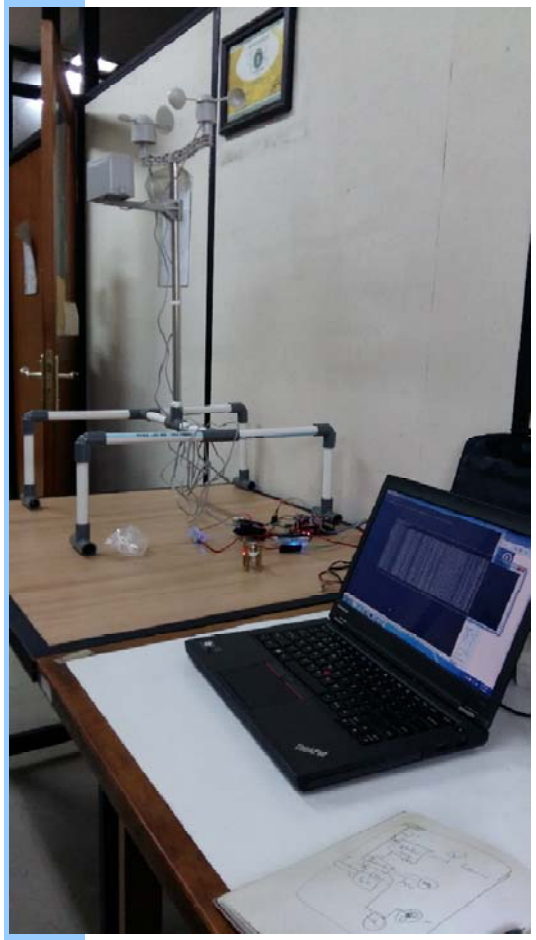
- Build prototype for AWS+sensor base on Arduino
  - Board (I/O)
  - Communication
    - GSM/GPRS/Wifi
    - Ethernet
    - USB/Storage System
  - Sensors
    - Temperature
    - Wind speed
    - Wind direction
    - Humidity
    - Rainfall rate
    - CO
    - Particulate Matters 2.5 and 10 Micron
    - CH4 ?
- Develop Service Oritented Services (SOA) for the
- Put the AWS in the area with near forestry/ peatland

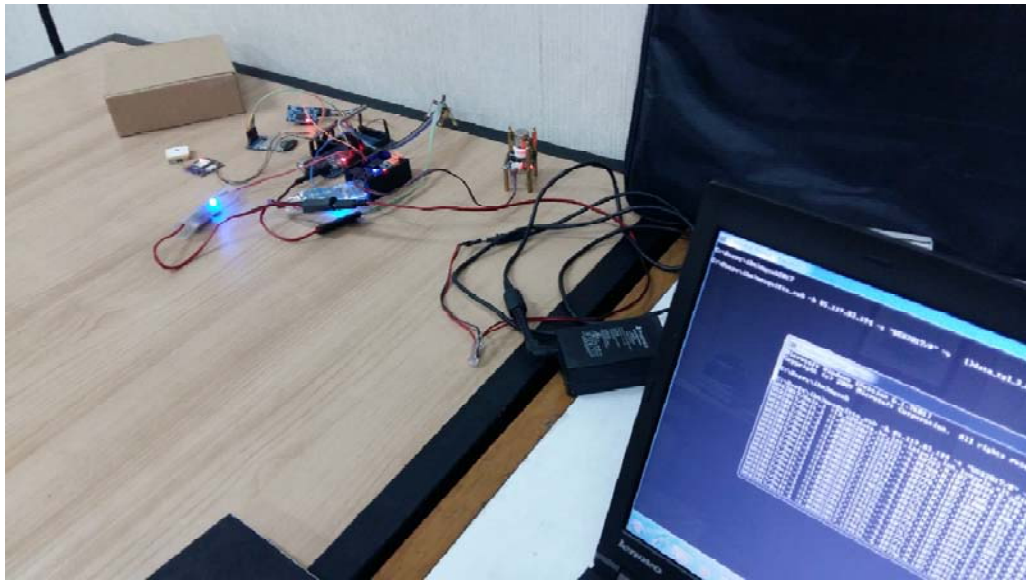
Prototype 1.0



Testing on the Lab

- AWS
  - Windspeed, wind direction, temperature, pressure, humidity, CO2 sensor ,etc
  - GSM /GPRS





Collaborate

- ASGC (TW) for running the simulation model for firewatch (DMCC program)
  - Tsunami wave simulation
  - WRF-Fire
  - WRF-Chem
  - Virtualization, remote access
- Ministry of Forestry and Environment
  - Put AWS+Sensor in peatland areas

Main Challenges (Future)

- Data sharing
  - Data are available only in web based information systems
  - Need to develop web services to make those data available to others
    - http://weather.meteo.itb.ac.id/aws.php is one example that have some of their data available to others using web service (by request)
- Build the model for reduce impact on Disaster
  - Fire on Forestry / Land fires
  - CO/CO2 models
  - PM (Particulate Mattes 2.5 micron)
- Build the Sensor Network
  - AWS (Automatic Weather Station)
  - Carbon Monoxide (CO)
  - Carbon Dioxide (CO2)
  - Particulate Matter
  - Methane
- Simuation on Environment impact peoples