CENTER FOR DATA SCIENCE AND BIG DATA ANALYTICS

Strength in Numbers

OAKLAND UNIVERSITY

IOT, CONNECTED CARS & BIG DATA ANALYTICS

Subramaniam Ganesan, School of Engineering and Computer Science

Vijayan Sugumaran, Ravi kattre and other members of the Center

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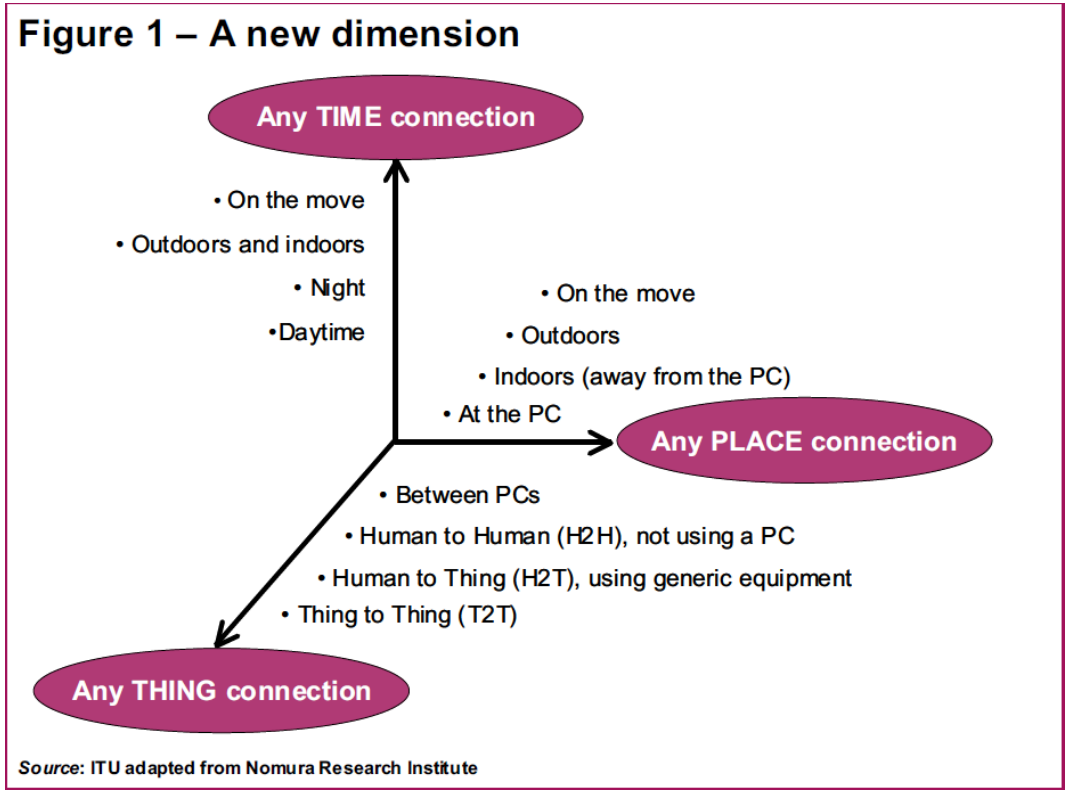
What's the Internet of Things

From any time ,any place connectivity for anyone, we will now have connectivity for anything!

The Internet of Things, refers to a wireless network between objects, and internet.



IIOT- Industrial Internet of Things

Energy, health care, automotive, manufacturing Industries are viewing at IIOT.

Here Robots, sensors, machines in a plant etc are connected as IIOT.

Industrial Ethernet, WiFi, Bluetooth mesh network .....

Sensor technology

Wireless sensor technology play a pivotal role in bridging the gap between the physical and virtual worlds, and enabling things to respond to changes in their physical environment. Sensors collect data from their environment, generating information and raising awareness about context.

Example: sensors in an electronic jacket can collect information about changes in external temperature and the parameters of the jacket can be adjusted accordingly

A connected car

It is a car that is equipped with internet access, and usually also with a wireless local area network. This allows the car to share internet access to other devices both inside and outside the vehicle.

A connected car is connected to Internet, other cars and infrastructure.

Vehicle-to-Infrastructure Communication

- We want to know where vehicles are, what they're doing
- Many sensors are already in the field/car to do this
- With V to I, we wish to communicate the hazardous road conditions and about approaching vehicles.

How it Works

- Transmit data from the vehicle
  - Data from GPS, accelerometers, magnetometers, or in-vehicle sensors
- Transmit to other vehicles or roadside equipment using
  - Cellular, Bluetooth, WiMAX, Wi-Fi, DSRC

Potential of Connected Vehicles

- Three ways to connect:
  1) Vehicle-to-vehicle:
     - For Crash avoidance
     - Broadcast your vehicle speed etc to other vehicles
  2) Vehicle-to-infrastructure:
     - Incident detection
     - Weather/ice detection
  3) Infrastructure-to-vehicle
     - Broadcast traffic signal timing
     - Dynamic re-routing

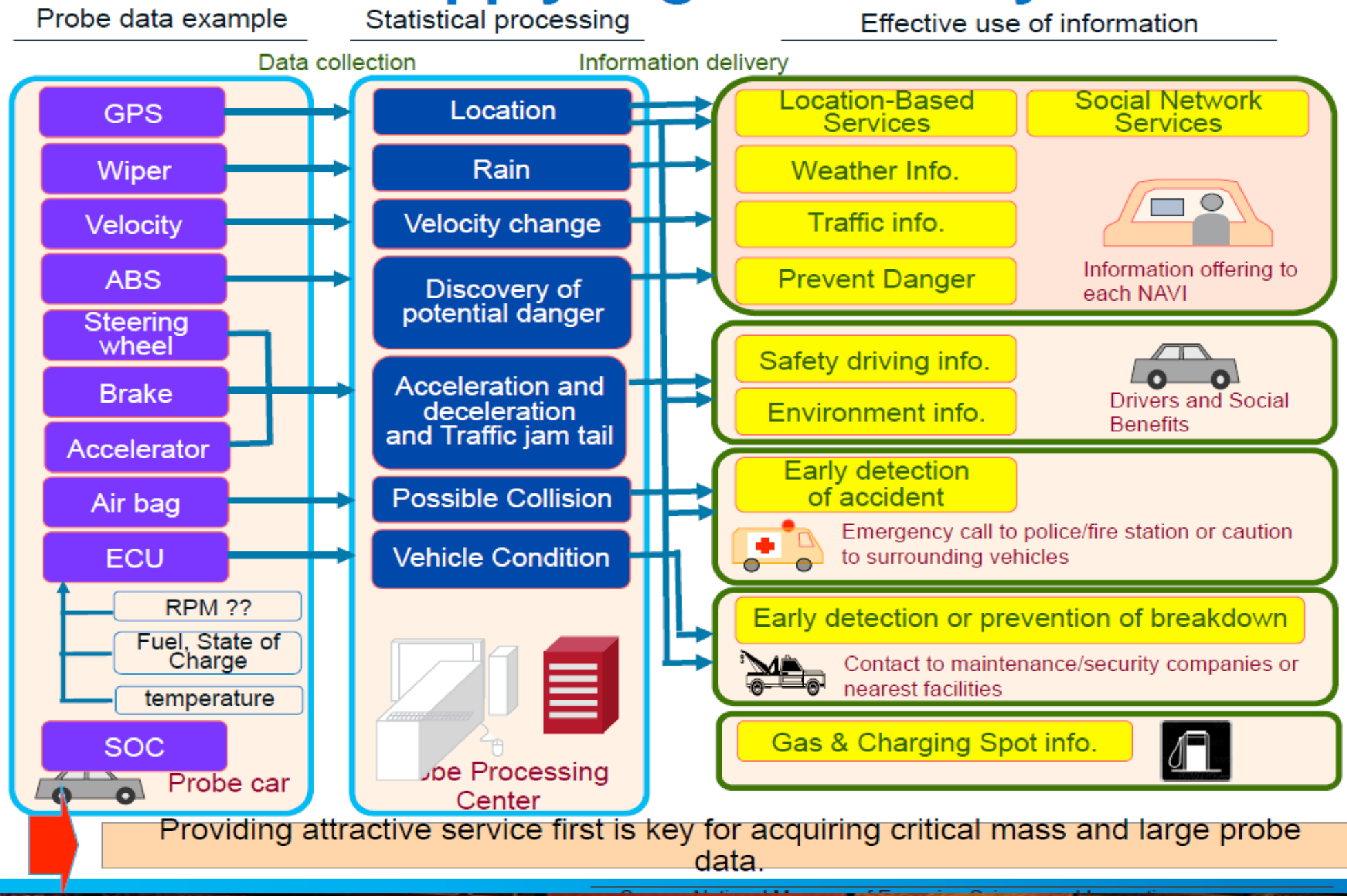
Automotive Sensor Net

- A network of sensors like multiple radars and camera in automobile help in lane sensing, object, and hazard identification.
- Safety applications include adaptive cruise control, pre-crash prediction, active head-rest, tire pressure monitoring, rain sensors to adjust braking, multiple airbag.
- Fusion of multiple sensors.

Technical Challenges

- Development of new types of smart-sensors for different applications
- Development of low cost sensors with more functionality, small size, and low power consumption.
- Integration of sensors in the application or system
- Sensor Maintenance:
  - Self diagnosing
  - Self healing
  - Self calibrating
  - Self correcting

Possibilities to apply Big Data Analysis



Providing attractive service first is key for acquiring critical mass and large probe data.

Imagine the opportunities to use real-time data from the vehicle. Complex analytical models running in the cloud or even on board the vehicle can predict service events and notify the driver. In real time, drivers could be notified of a defect in the vehicle or maintenance issue.

Volvo Truck is doing exactly that, and more. It strives to provide service and maintenance before a breakdown. Volvo monitors quality and product warranties, analyzing more than 100 parameters to predict the wear on a component, identify abnormal events and speed up the diagnostics of incidents affecting the vehicle.

Location Based Analysis and Service

Location-based offers: traffic, weather, parking, gas and charging station locations are used to communicate with a person in the environment. It can be used to pass information and marketing details

Big data analytics is the process of examining large **data** sets to uncover hidden patterns, unknown correlations, market trends, customer preferences and other useful business information.

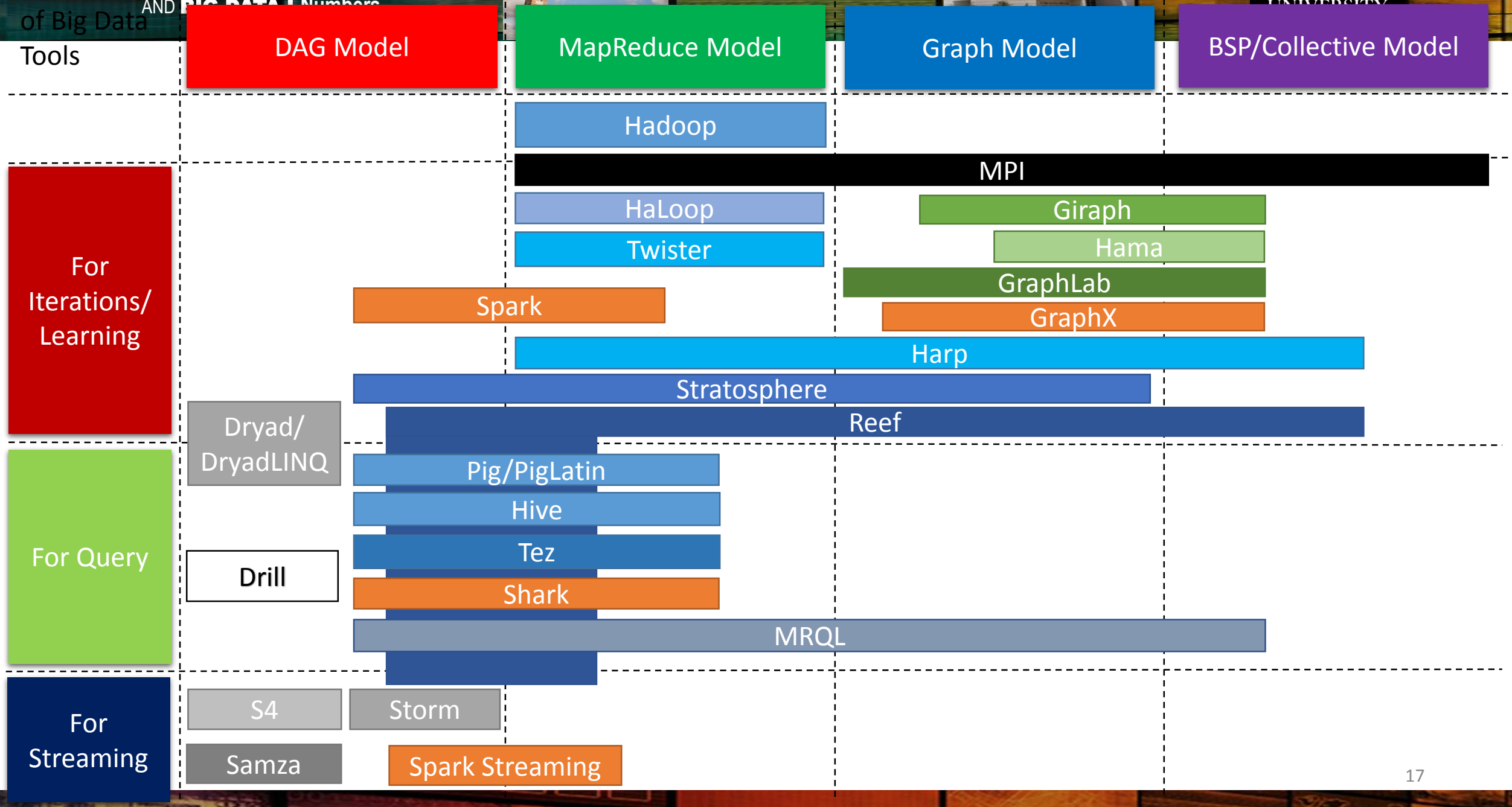
What is Data Mining?

- Discovery of useful, possibly unexpected, patterns in data
- Non-trivial extraction of implicit, previously unknown and potentially useful information from data
- Exploration & analysis, by automatic or semi-automatic means, of large quantities of data in order to discover meaningful patterns

Data Mining Tasks

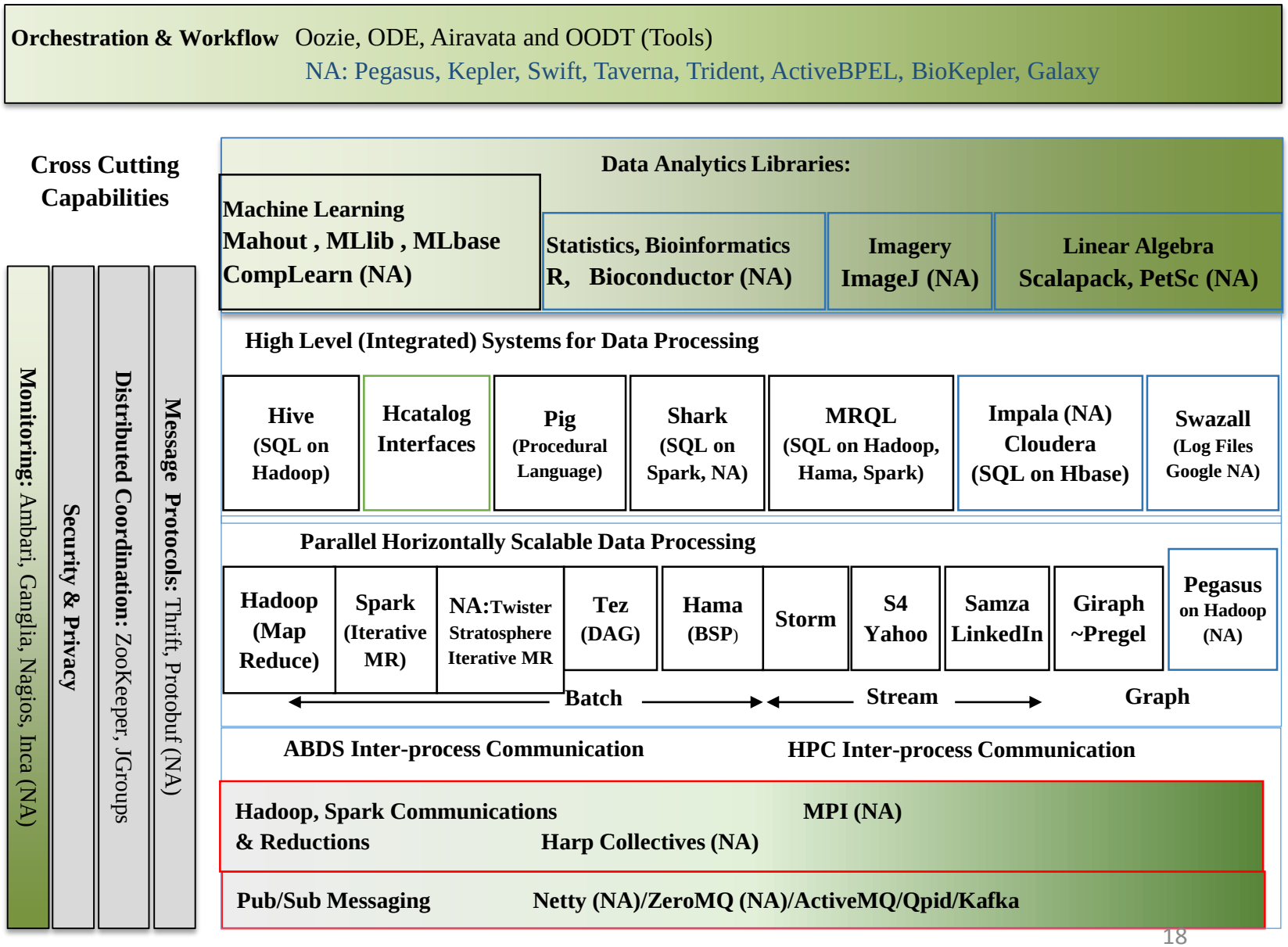
- Classification [Predictive]
- Clustering [Descriptive]
- Association Rule Discovery [Descriptive]
- Sequential Pattern Discovery [Descriptive]
- Regression [Predictive]
- Deviation Detection [Predictive]
- Collaborative Filter [Predictive]

The World of Big Data Tools



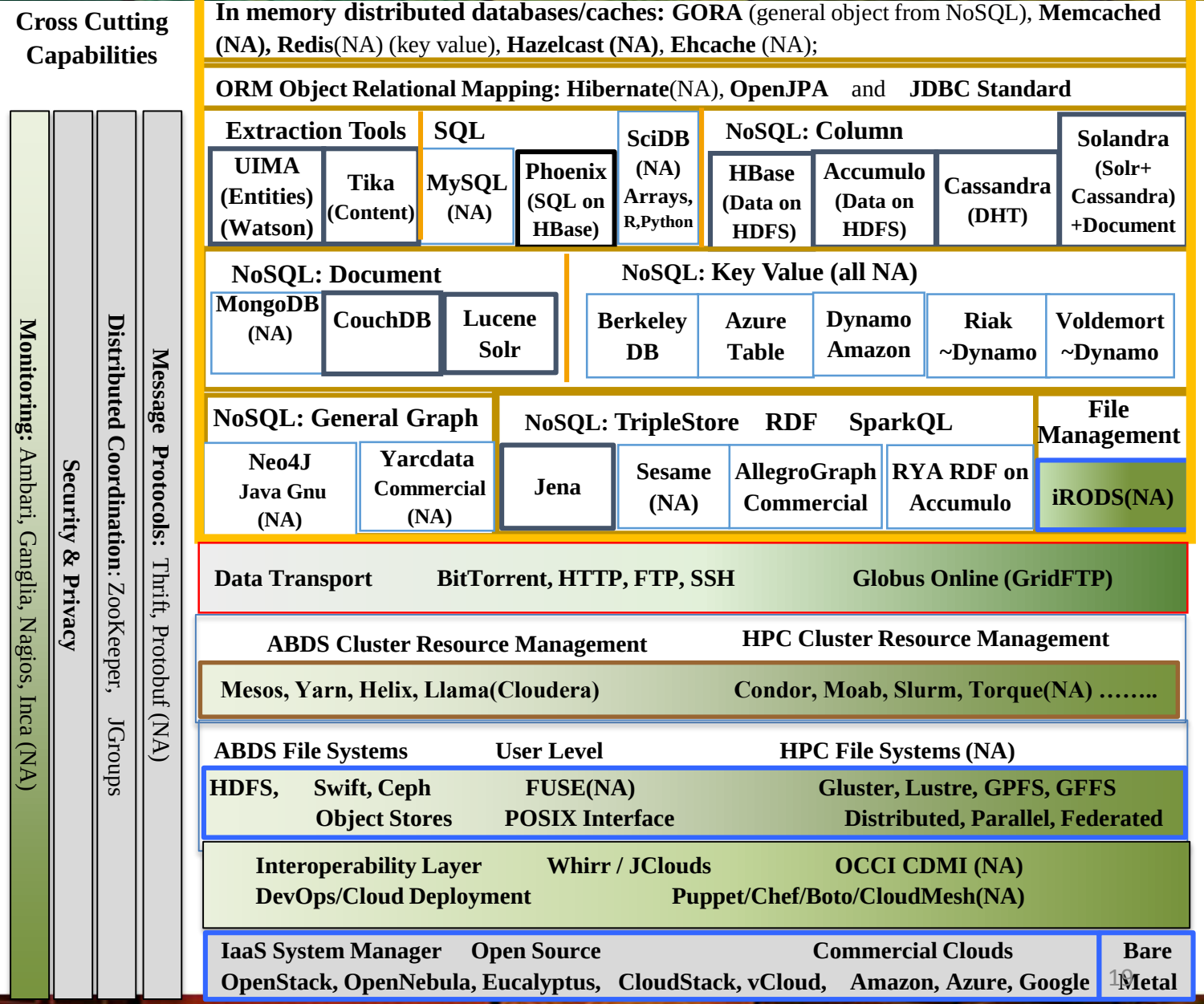
Layered Architecture (Upper)

- NA – Non Apache projects
- Green layers are Apache/Commercial Cloud (light) to HPC (darker) integration layers

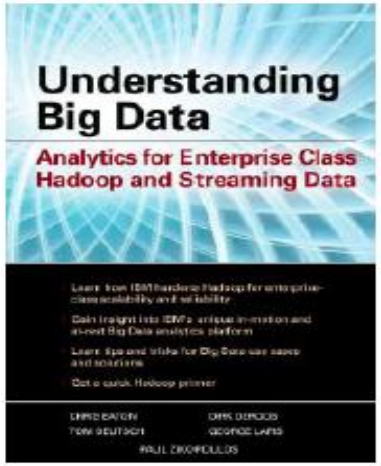


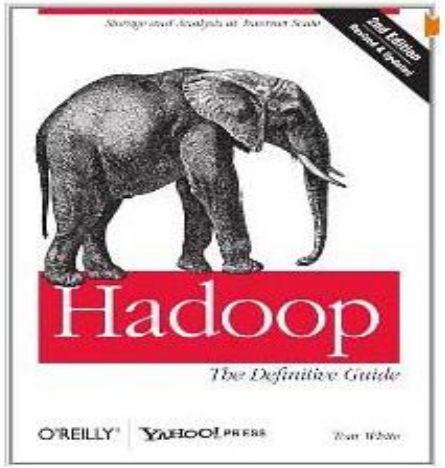
Layered Architecture (Lower)

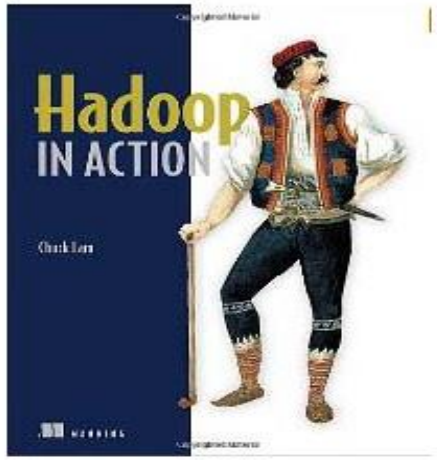
- NA – Non Apache projects
- Green layers are Apache/Commercial Cloud (light) to HPC (darker) integration layers

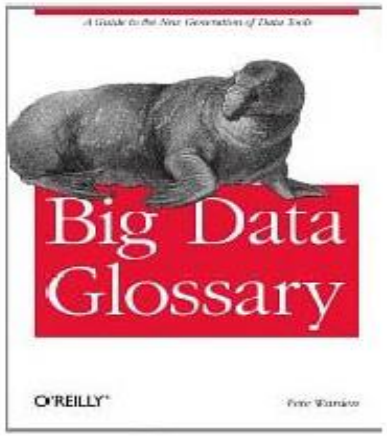


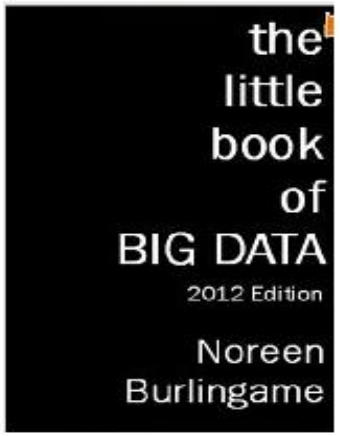

Big data: The next frontier for innovation, competition, and productivity

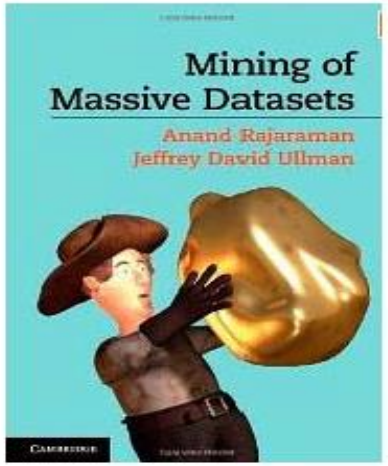

Understanding Big Data
Analytics for Enterprise Class Hadoop and Streaming Data

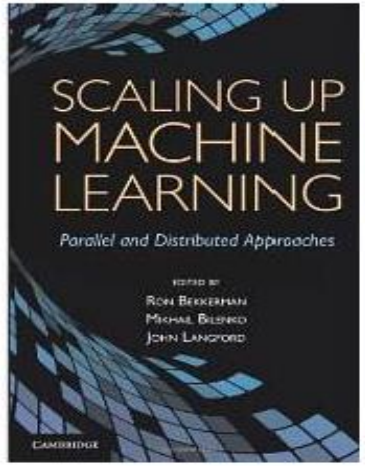

Hadoop
The Definitive Guide
O'REILLY
YAHOO! PRESS


Hadoop
IN ACTION


Big Data Glossary
O'REILLY


the little book of BIG DATA
2012 Edition
Noreen Burlingame


Mining of Massive Datasets
Anand Rajaraman
Jeffrey David Ullman


SCALING UP MACHINE LEARNING
Parallel and Distributed Approaches

- We work on Data Mining and Algorithms development.
- We mine the Data collected from connected cars for Condition based maintenance (CBM) and predictive maintenance.
- CBM is useful for Military Vehicles diagnostics and preventive maintenance based the sensor data before failure.

A few PhD thesis, MS thesis, and journal articles have been completed on CBM and related areas

Big Data and Health Sensor Monitoring

- We develop sensors for health monitoring.
- Develop techniques to collect health data of a Vehicle driver
- Develop algorithms to analyze the health data and alert Hospital.

We have published papers and written project proposals on health data monitoring

Our Expertise in Data center.

Data Center has multi disciplinary expertise including, Statistical and data analysis, bio data intelligence etc.
We bring expertise in Sensor, wireless communication, data base architecture, real time processing etc.

We will have 4 and 8 credits Engineering and Computer Science graduate and undergraduate student projects and independent studies done in the center.

Regular Interaction with the Center faculty will result in good quality projects.

Interaction with the Industry and Government agencies through the Data Center will provide wide opportunities to work on projects relevant to community.

Questions?

Thanks

ganesan@Oakland.edu