



PRAHEALTHSCIENCES

THE FUTURE OF CLINICAL DEVELOPMENT



US 2018

The Clinical Data Science Conference

June 3rd–6th
Raleigh Convention Center
Raleigh, North Carolina, USA

AB14

Data Science Applications and Scenarios

Giri Balasubramanian, PRA Health Sciences, Chennai, India
Edwin Ponraj Thangarajan, PRA Health Sciences, Chennai, India

06-Jun-2018



Presentation Focus !



- Less researched dimensions of data namely, velocity and variety, which are characteristics of fast data applications
- General-purpose distributed platform to host and interconnect fast data applications in a heterogeneous environment say IoT



- Why Data Science?
- Characteristics of Big Data
- Categories of Data Science Applications
- DS Application Scenario – 1
Integrated Vehicle Management System (IVHM)
- DS Application Scenario -1
Clinical System – Healthcare Monitoring
- Fast Data Application Distributed Platform – An analysis



Why Data Science?



Collecting
myriad
new types
of data

Web logs
Mobile devices
Sensors
Instruments
Transactions

Identify
patterns
and
regularities
in data

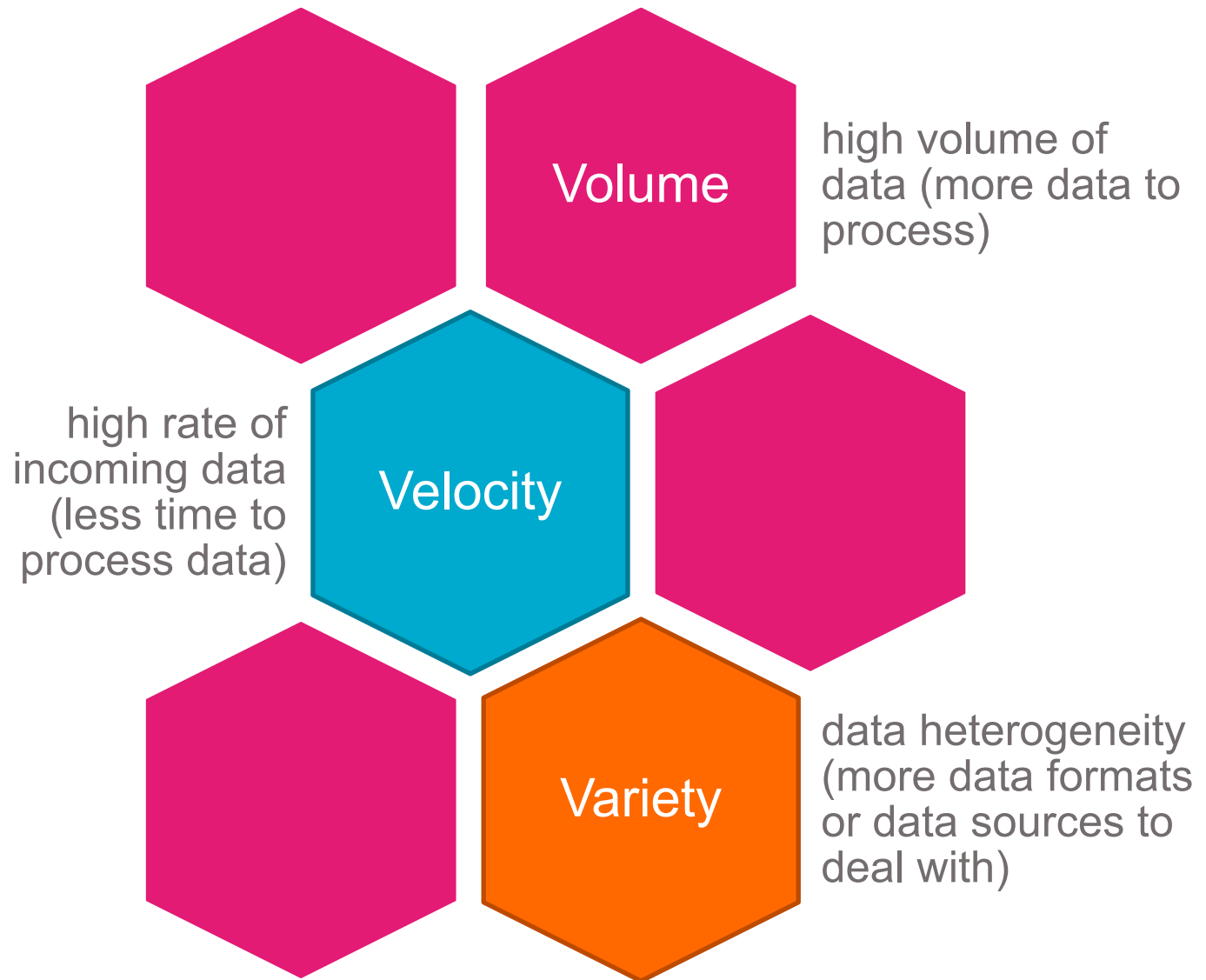
Advance scholarship
Improve the human condition
Create commercial value
Create social value

Scale,
diversity,
and
complexity

New architecture
New techniques
New algorithms
New analytics



Characteristics of Big Data





Data Science Applications

Major Categories



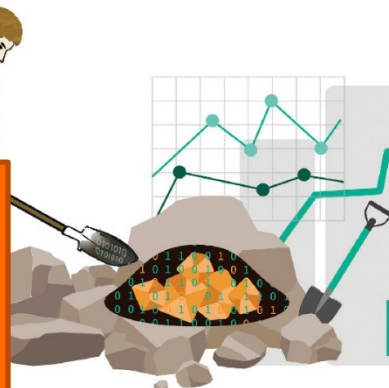
Statistical
Applications



Business
Intelligence



Data Mining



Data
Collaboration





Data Science Application -- Few Areas



In General



Internet Search



Self-Driving Cars



Robots



Delivery Logistics



Fraud and Risk Detection



Airline Route Planning



Image Recognition



Speech Recognition



Digital Advertisements

In Pharma



Patient Disease Identification/Diagnosis



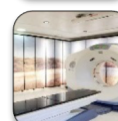
Drug Discovery/Manufacturing



Personalized Treatment/Behavioral Modification



Clinical Trial Research



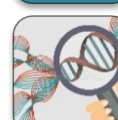
Radiology and Radiotherapy



Epidemic Outbreak Prediction



Health Care Monitoring



Genome Research



Integrated Vehicle Management System (IVHM)

Scenario - 1





❑ Is the process of assessing, preserving, and restoring system functionality across flight & ground systems.

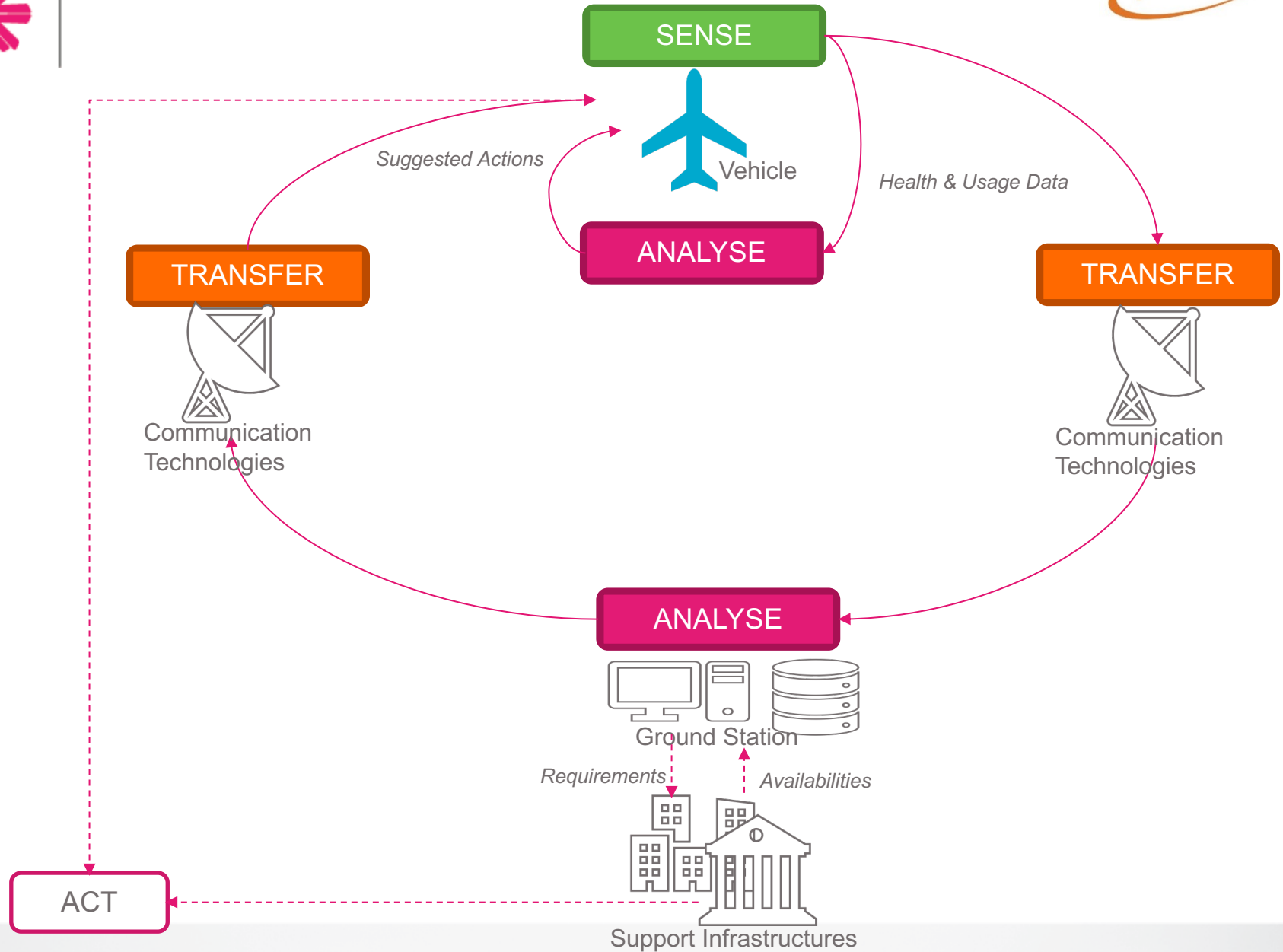
❑ Comprises of:

- Deployment of Sensors [**Variety**]
- Collection of Data @ real time [**Velocity**]
- Analyzed onboard the vehicle
- Health & Usage data transmitted to ground support
- Use of diagnostic & prognostic algorithms to make decisions



Integrated Vehicle Management System (IVHM)

Scenario - 1





Clinical Systems - Health Care Monitoring

Scenario - 2





Clinical Systems - Health Care Monitoring

Scenario - 2

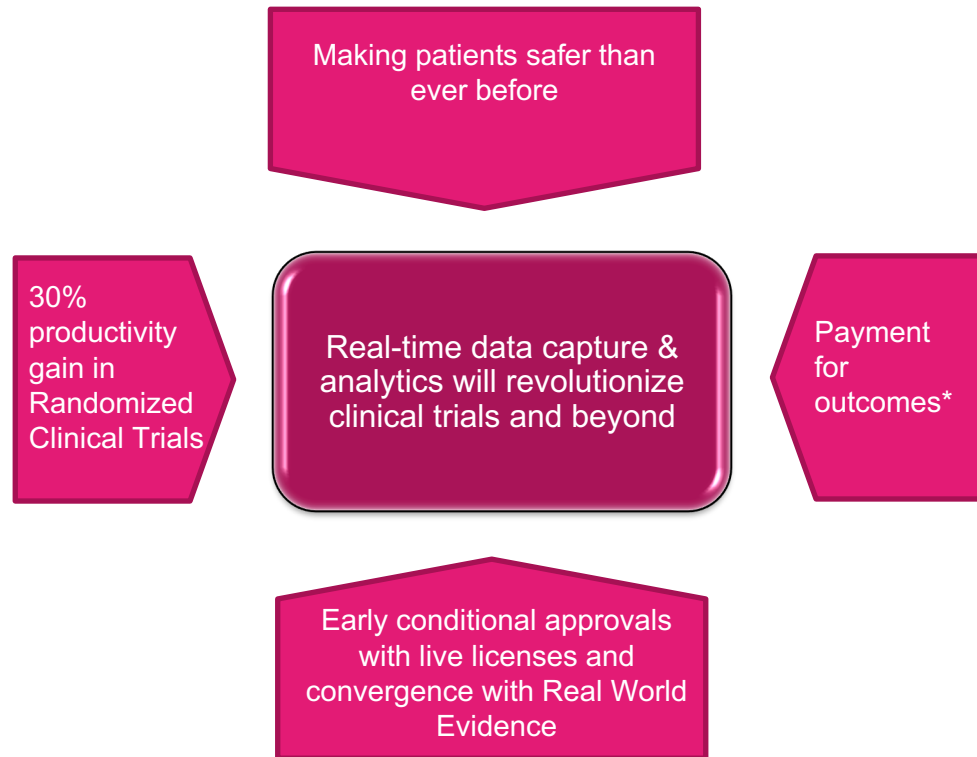


- Advanced Clinical Trials run by:
 - Use of Remote Monitoring techniques
 - Adoption of Wearable devices for data collection
- Facilitates,
 - Real Time Monitoring & Data Capture



Real-time data capture & analytics

Improvements in time, cost & quality of data collected



*Cost pressures on healthcare systems will reach the point that pharmaceutical companies will increasingly be paid for value i.e. if the health outcome of drug treatment is positive in the real-world.



Biomedical Sensors -- *Few examples*



RESEARCH	BIOMEDICAL SIGNALS	DEVICES
Real-time streaming data in healthcare applications	Generic Biomedical signals	Generic Biomedical sensors
Recognition of activities and health monitoring	Heart biomedical signals	Smartphones & wearable devices
Long-term monitoring of respiration and pulse	Respiration and pulse	Non-contact sensors textile-integrated
Diabetes monitoring	Daily activity data	Smartphone & smartwatch
Active assistance	Activity and environment data	Wearable sensors and smartphone
Detect and prevent venous stasis	Pulse and blood flow data	Multi-sensor plethysmography device
Physiological data of elderly patients	Oxygen saturation level, Heart Rate	Biomedical sensors & smartphone
ECG Smart Healthcare monitoring	ECG signals	Wearable ECG sensors and Cloud for processing
Mobile medical computing systems	Medical signal and context information	Different sensors and actuators
Applications in the pervasive environment	Pulse rate, blood pressure, level of alcohol, etc.	Mobile healthcare



Data Science Application – Components

Scenario - 2



DATA COLLECTION & PROCESSING

- Data is captured by the sensors available in wearable devices and smartphones. Data processing is done at sensor in order to create some intelligence in the devices themselves and collaborate in providing advanced applications to the user before transferring the full or processed data.

DATA TRANSFER

- Data collected in wearables can be transferred to a computer or to a smartphone as an intermediate step towards its eventual transfer to a permanent data storage. This transfer can be produced through proprietary solutions or using third-party apps and programs.

PERMANENT DATA STORAGE

- This function is related to the permanent storage of the data. Usually, this permanent storage is performed in proprietary servers, where third parties and final users can gain access to the data.

DATA ANALYSIS

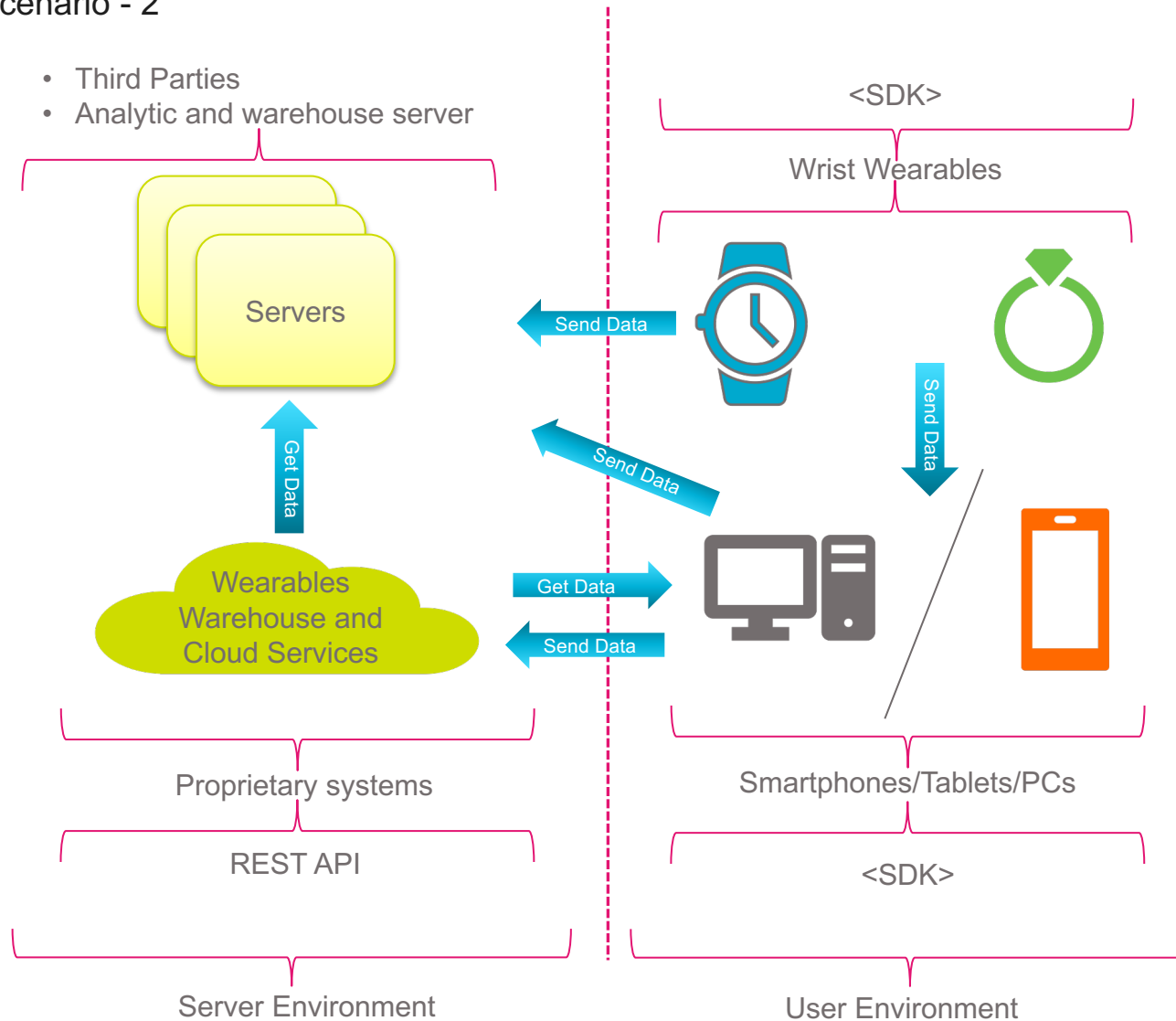
- This is related to the analytic processing of data to provide results of interest. Typically, this processing is performed in servers, both proprietary and third-party.



Clinical Systems - Health Care Monitoring

Scenario - 2

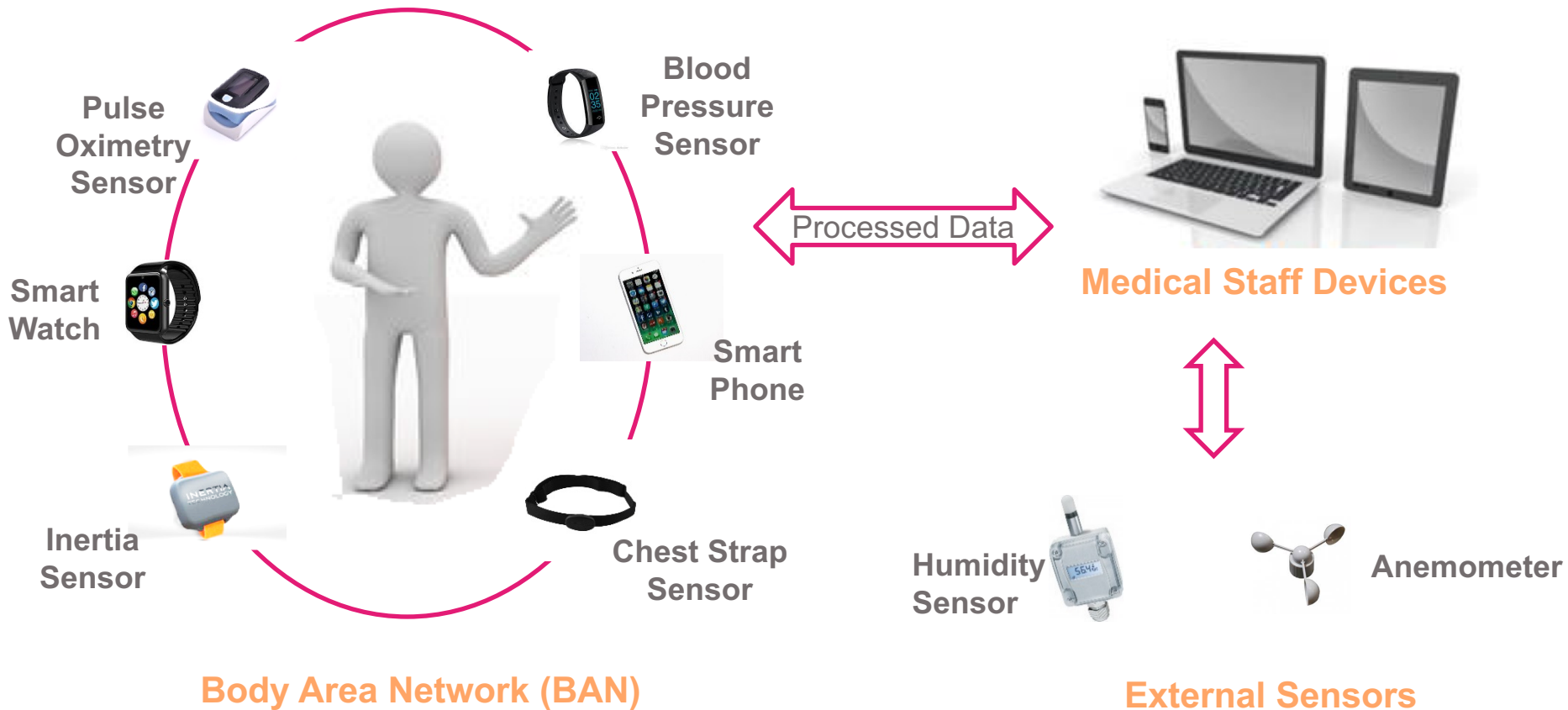
- Third Parties
- Analytic and warehouse server





Clinical Systems - Health Care Monitoring

Scenario - 2





Fast Data Application Distributed Platform





Data Science application architecture is guided to full fill the following requirements.

Enable Apps to consume predictions and become smarter

Bring predictive analytics to the IoT Edge

Become easier, more accurate & faster to deploy and manage

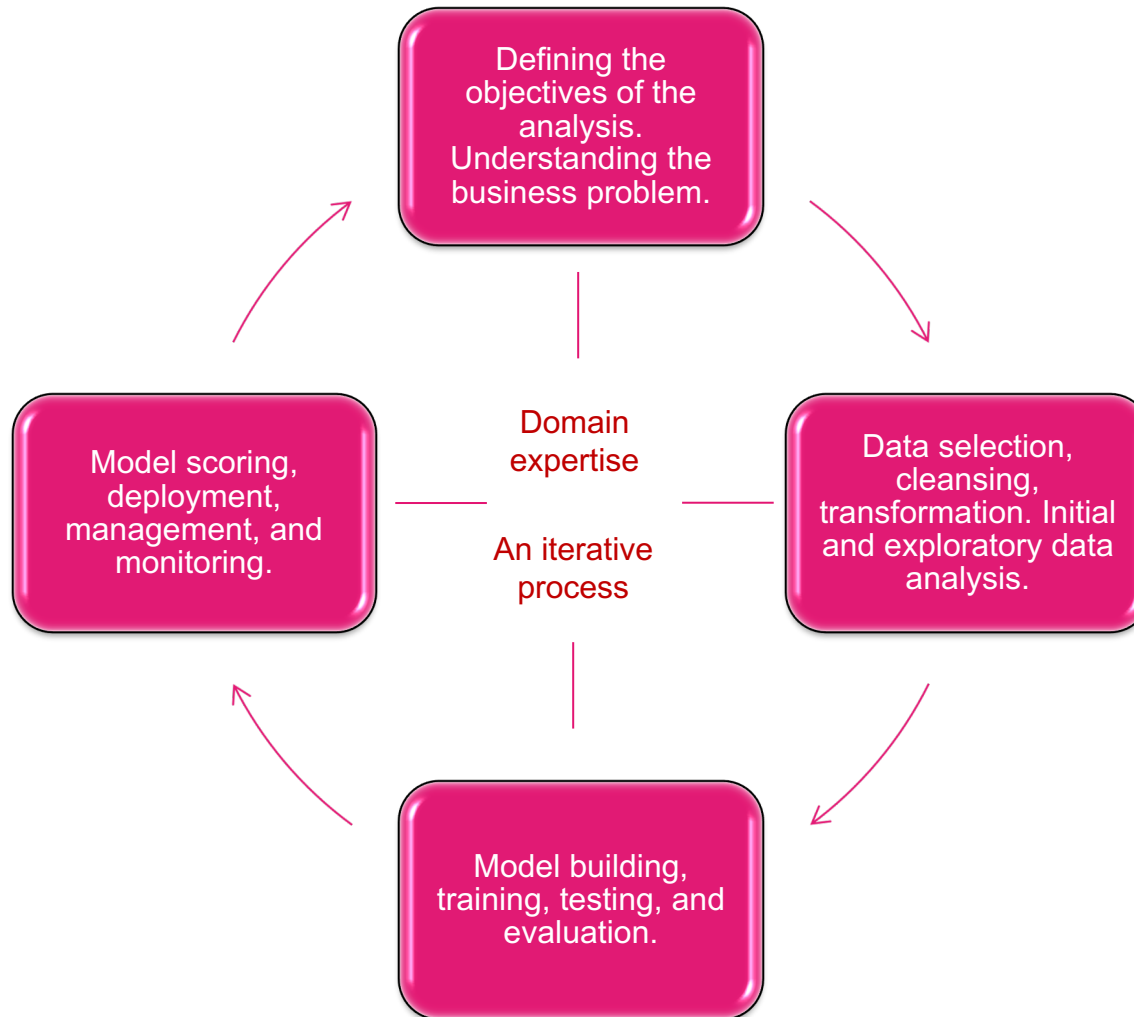
Fully support data science life cycle



Fast Data Application Distributed Platform —An Analysis



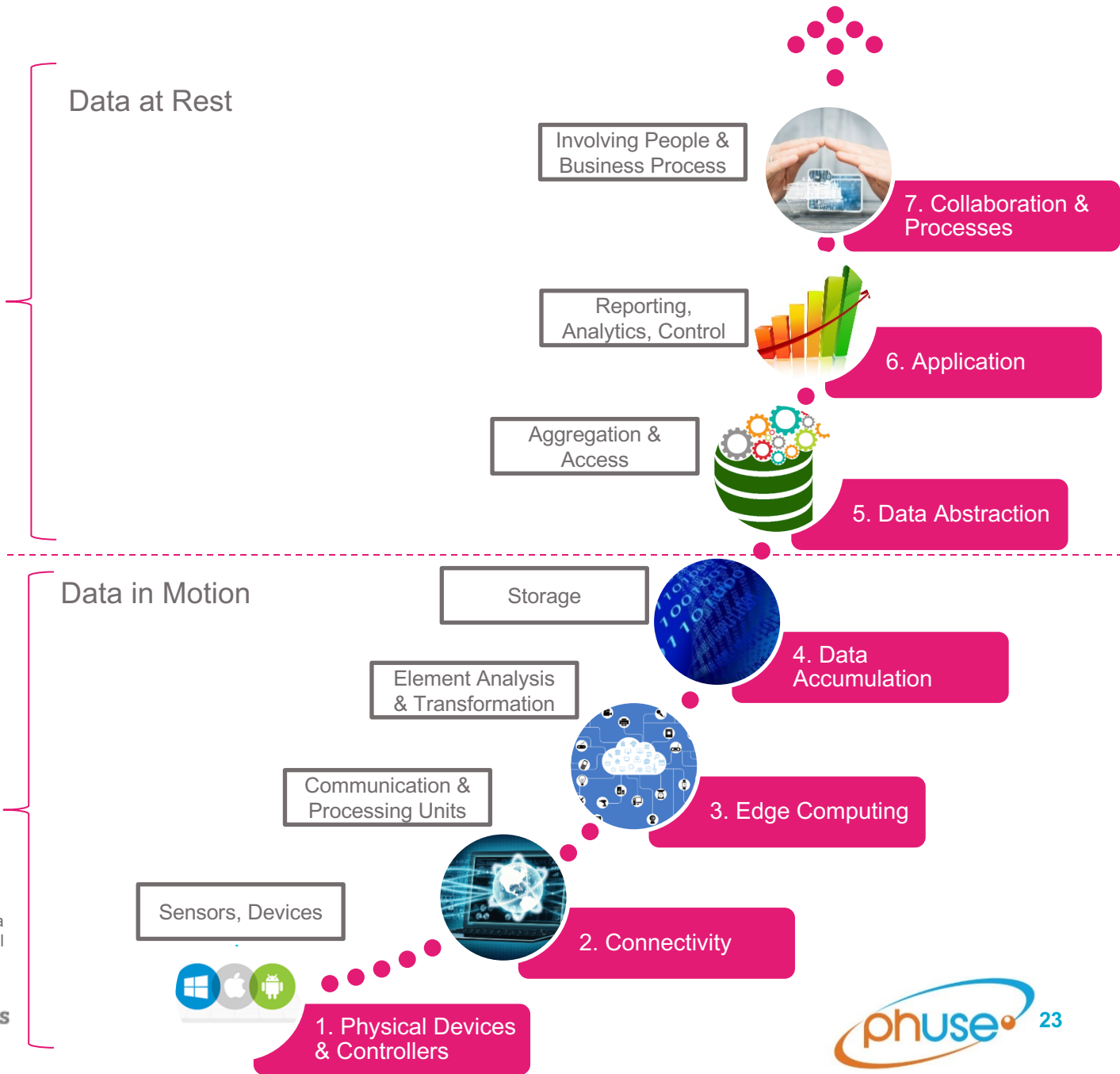
Data Science Application Life Cycle





- Fast Data Application require a new computing model
- Requirements to fulfill:
 - Minimize latency
 - Conserve network bandwidth
 - Address security concerns
 - Operate reliably
 - Collect and secure data across a wide geographic area with different environmental conditions
 - Move data to the best place for processing

IoT Reference Model



Source: Cisco Systems, Inc. has published a white paper with a particular IoT Reference Model that deserves special attention.



- Traditional and Cloud computing architecture cannot support Fast Data Applications
- A new model / architecture to analyze the IoT
- **Edge or Fog Computing**
 - Analyze the most time-sensitive data at the network edge, close to where it is generated instead of sending vast amounts of IoT to the cloud



Thank You





PRAHEALTHSCIENCES

**EXPERIENCE THE FUTURE
OF CLINICAL DEVELOPMENT TODAY.**