Challenges Faced In Developing Safe Interoperable Systems in Healthcare

Tracy Rausch, CCE

Founder and CEO

DocBox Inc

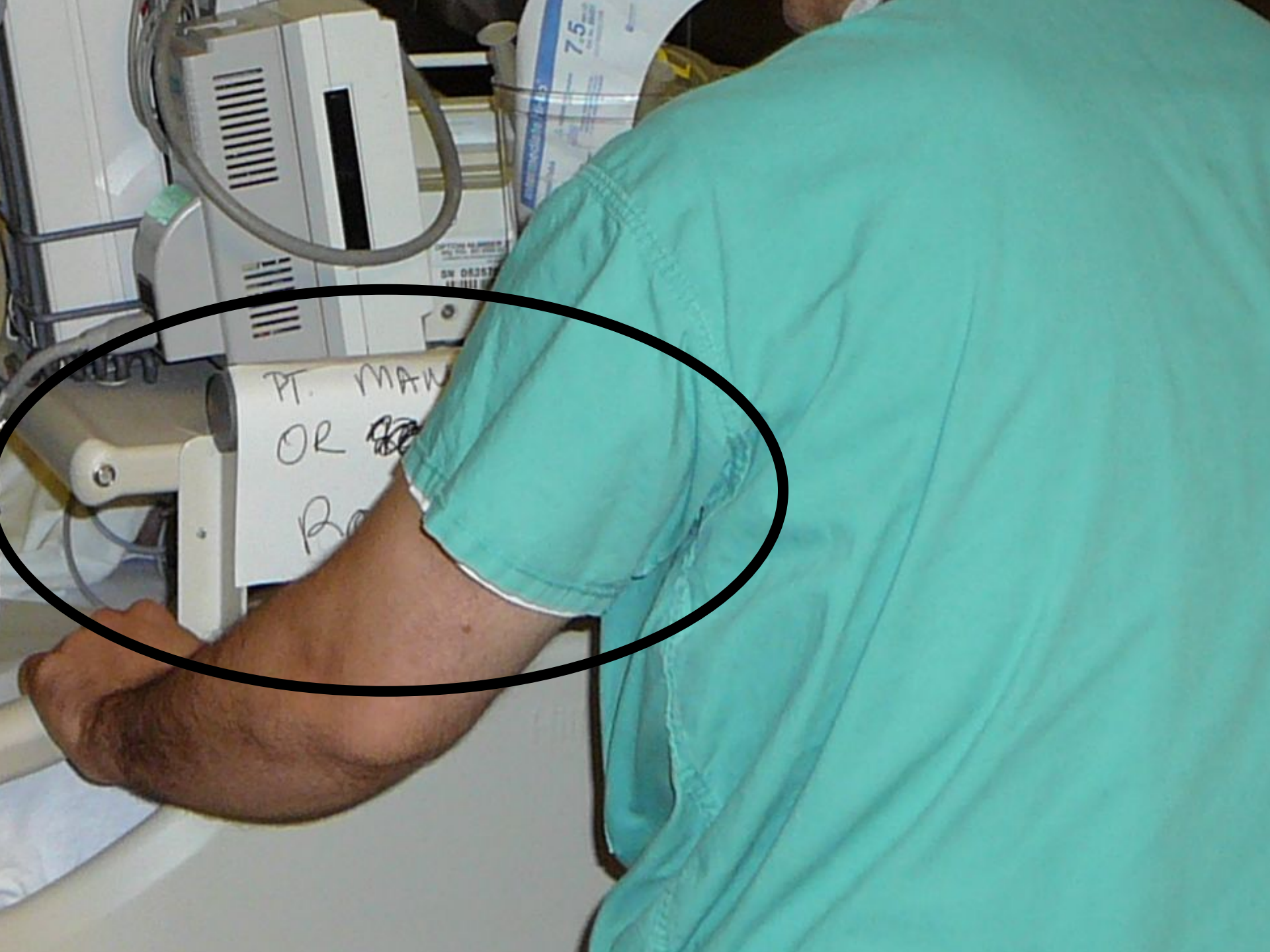
DOCBOX

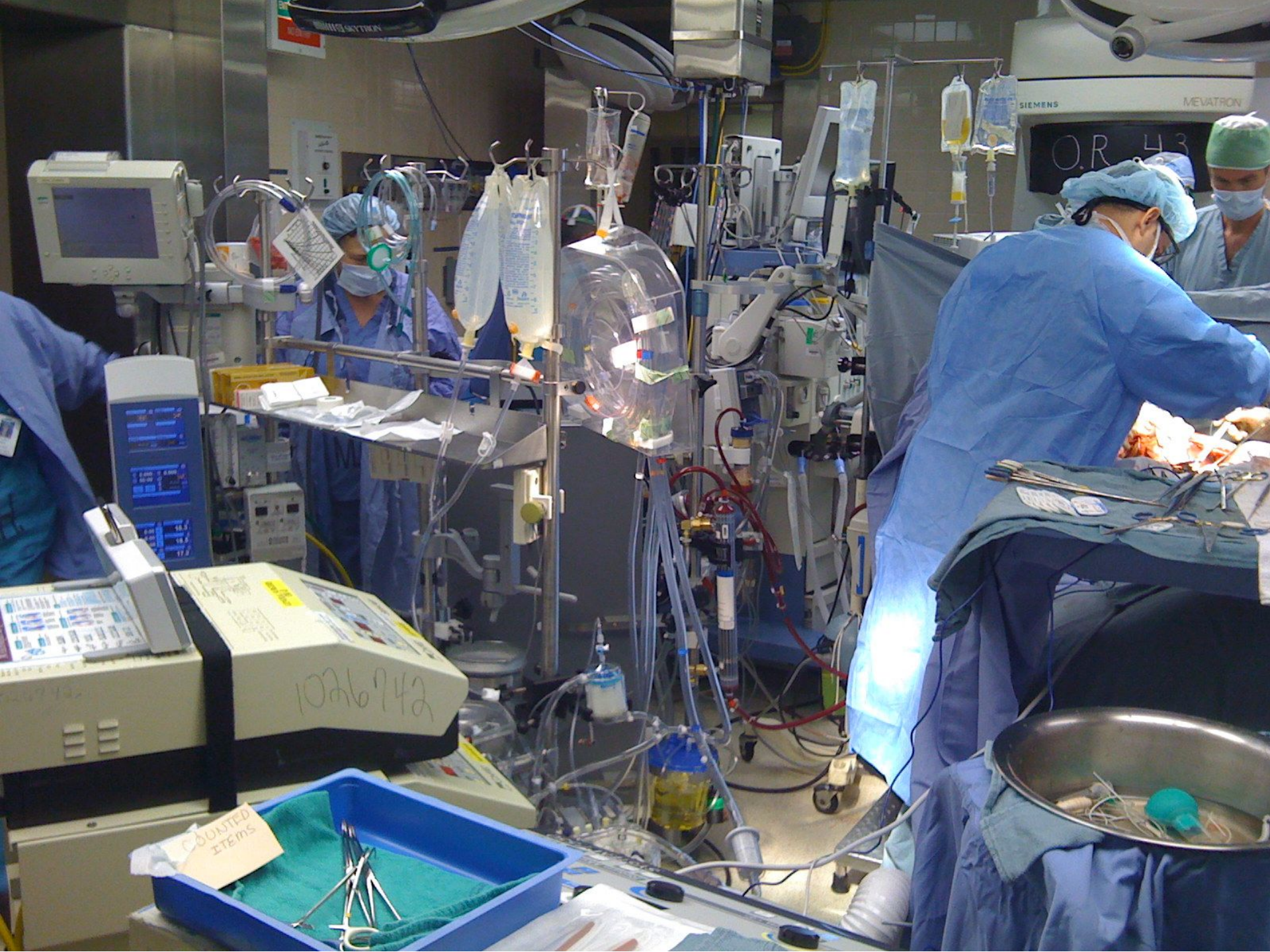
Challenge

Develop and implement of open, safe and effective interoperable system of systems, based on clinical requirements, which enables the creation of evidence based improvements in clinical care.

Requirements from Providers

- Complete and Accurate Data
- Safe Systems
- Secure Systems
- Increased Efficiency
  - Clinical Workflow
  - Device and Systems Maintenance
- Improved Quality
- Flexible (Inpatient to Outpatient)
- Able to deal with new and legacy equipment
- Scalable
- Facilitation of decision support and data visualization


PT.
OR


SIEMENS
MEVATRON
O.R. 43
COUNTED ITEMS

STERIS

Problems

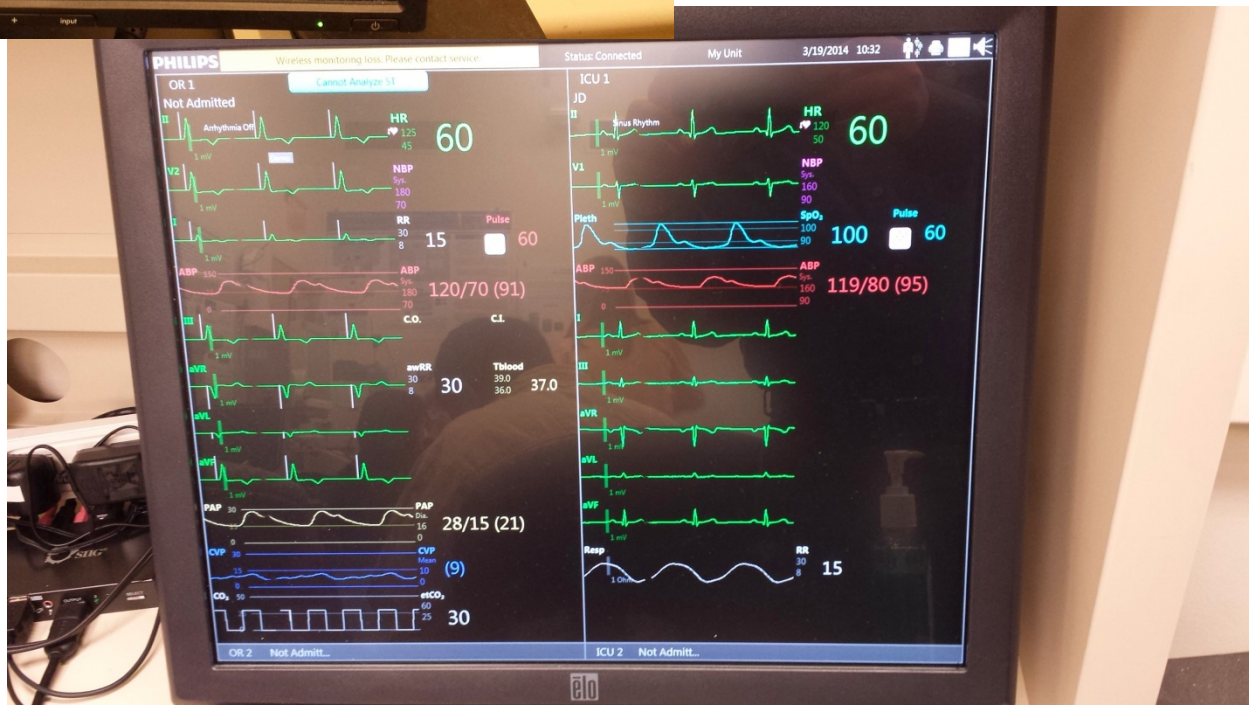
- ~400,000 people a year die from medical errors.
- $5000 - $7000 per hospital admit is the estimated cost of adverse events.
- Data has incorrect or inaccurate time stamps
- Data is incomplete and incorrect
- Data lacks context
- Lack of data models systems level data models which describe the patient

Current Device System Solutions

- Vertically Integrated
- Proprietary
- Lacks Data Models
- Lacks correct time stamps
- Lacks contextually complete data
- Alarms are currently mostly limit alarms or single source alarms.

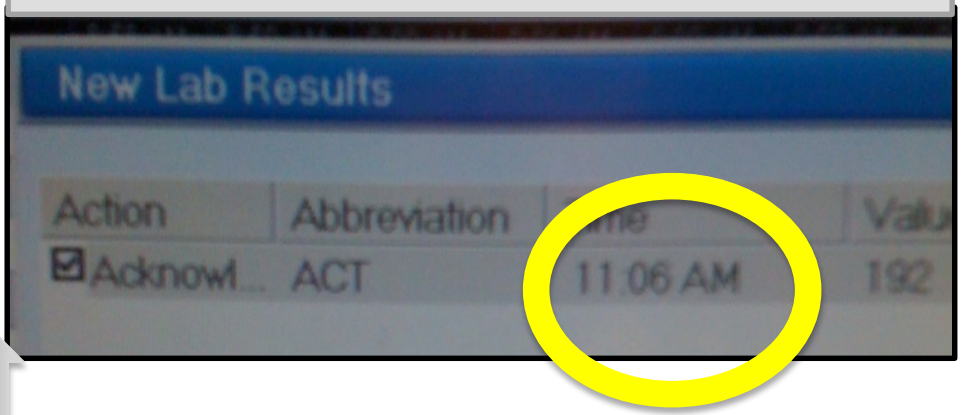
What about EHR's?
What about Big Data?
What about Quality Improvement Systems

09:29 GE Medical Systems Information Technologies, Inc CIC 4CICIC2
SCH07191108GA CA:5.1.0 OS:2.0.4 SV:1.0.3
View Other
Setup CIC
Browser
Graph All
Silence Alarms
4C|230-B*
4C|232-B*
4C|236-B
4C|225-A
ECG
PVC 0
69
NBP X/X(X)
NO COMM
4C|231-A*
4C|233
4C|237-A
Admit
4C|231-B*
4C|234
4C|237-B
4C|232-A*
4C|236-A
4C|238-A
4C|225-A
Real-Time View
Admit
Monitor Setup...
Patient Data...
System Utilities...
NBP X/X(X)
RR - II 19
View All ECG
Sample
Relearn
Configuration
HP LP1965


PHILIPS
Wireless monitoring loss. Please contact service
Status: Connected
My Unit
3/19/2014 10:32
OR 1
Not Admitted
Cannot Analyze ST
ICU 1
JD
HR
60
NBP
120/70 (91)
119/80 (95)
RR
15
Pulse
60
SpO2
100
C.O.
C.I.
awRR
30
Tblood
37.0
PAP
28/15 (21)
CVP
(9)
etCO2
30
OR 2 Not Admitt...
ICU 2 Not Admitt...
elo

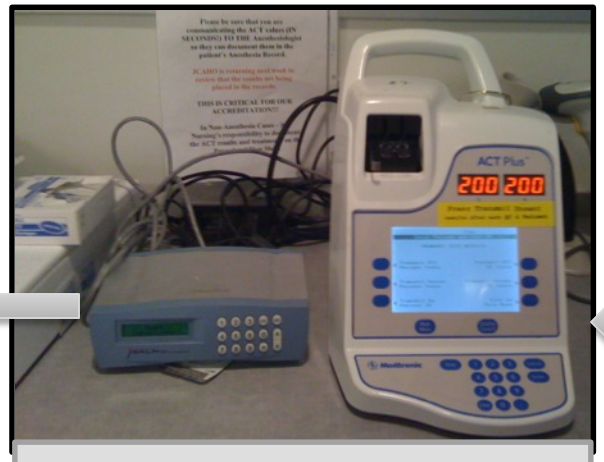
EMR time-stamp error

MetaVision EMR screen



ACT – appeared to have been checked 22 minutes after heparin administration (was actually 30 min). Could → stroke.
Cause – ACT device time incorrect
(Note - device does not use NTP)

Data protocol converter

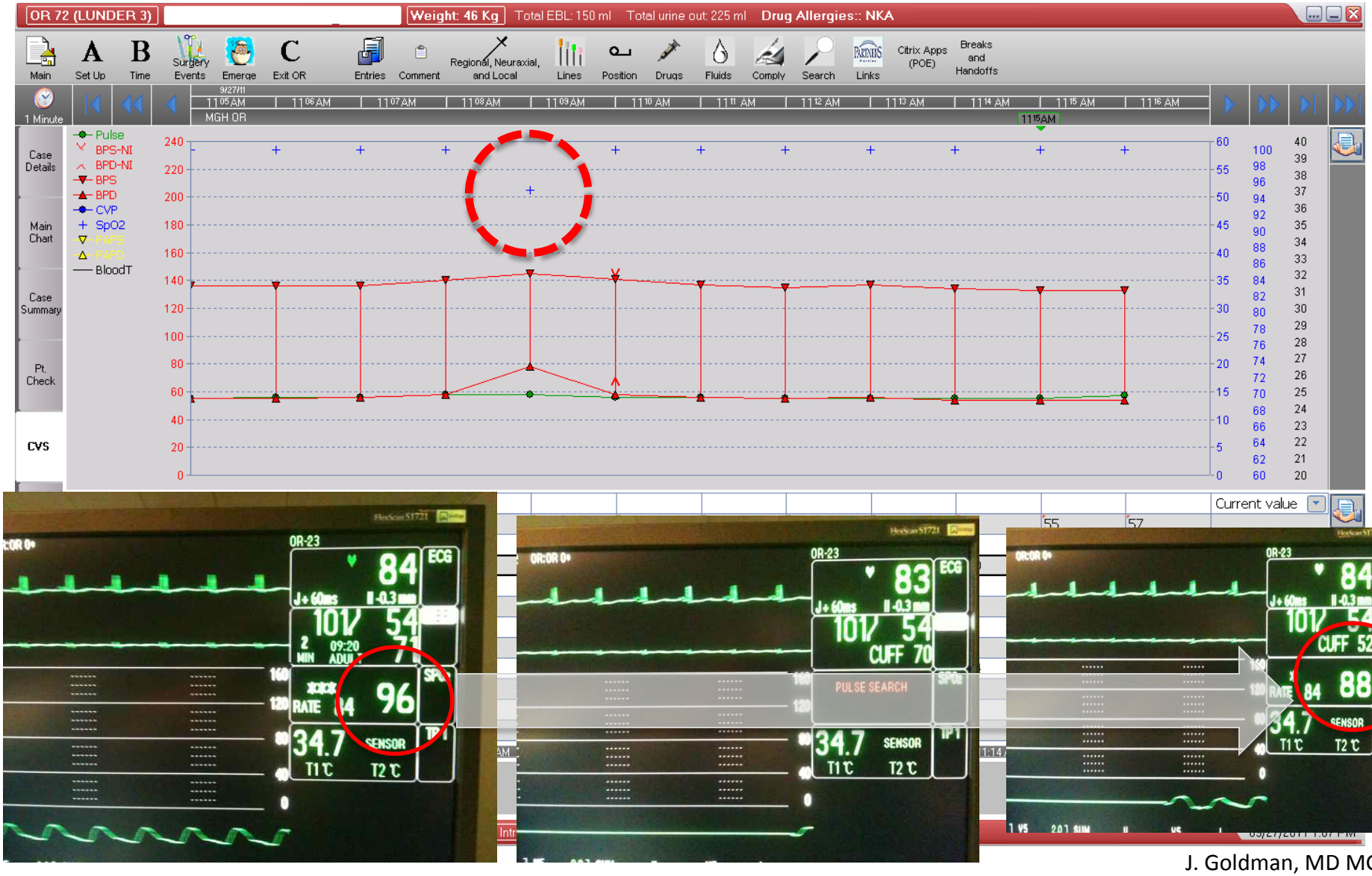


ACT Machine

J. Goldman, MD MGH

"smarter algorithms" need to consider time course of device operations and interactions

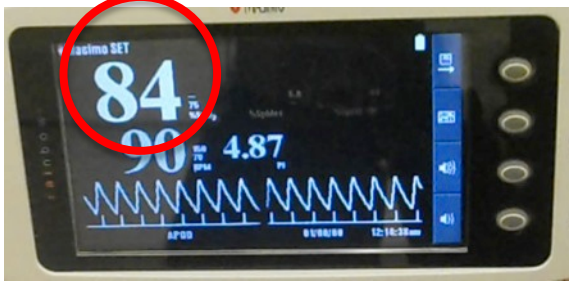
BP Cuff-SpO_2 Interaction (same arm)



J. Goldman, MD MGH

What is the real O_2saturation? Which value will be recorded in EHR or used by analytics engine

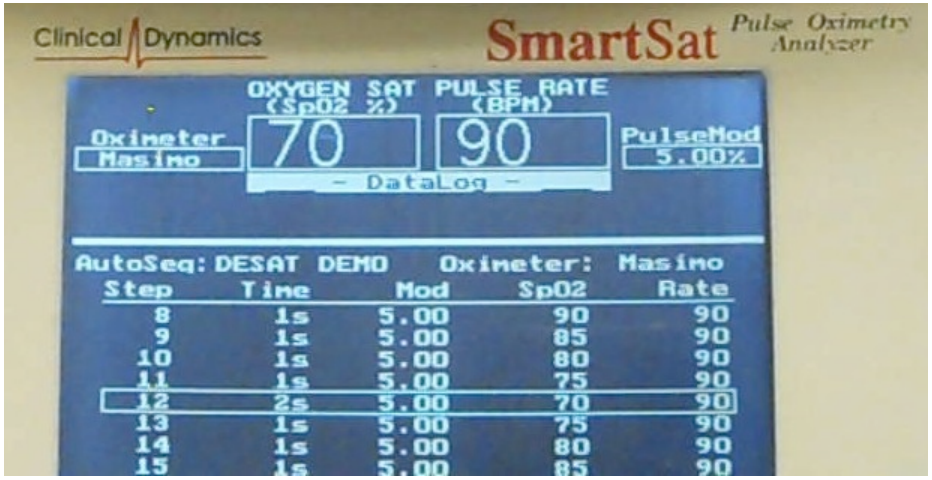
Pulse Ox is set to:
16 sec averaging time



8 sec averaging time

2 sec averaging time

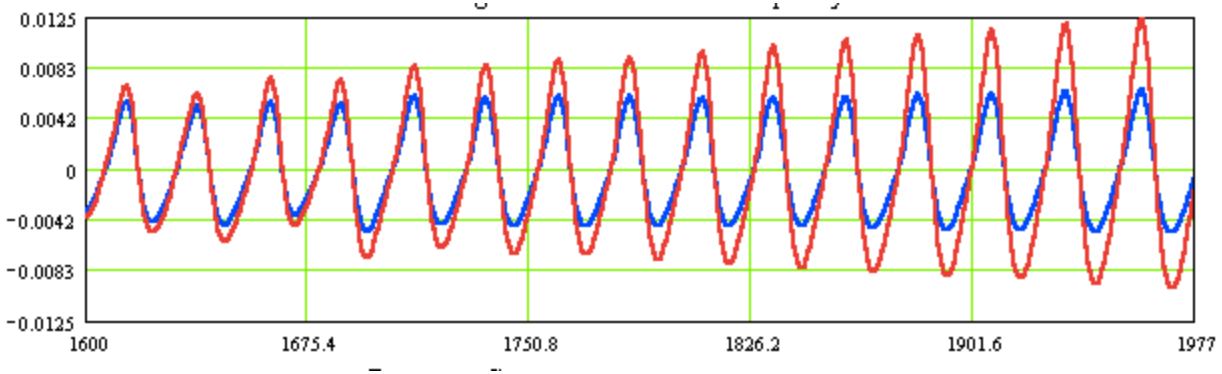
Experiment: Pulse Oximetry
Simulator is set to create transient de-saturation
99%->70%->99%



Photos of pulse ox screens when they display the lowest saturation

Julian M. Goldman, MD / MGH

Pulse oximeter signal averaging can hide physiological changes



6 seconds

76%

31%

Studies suggests that in pre-term infants the desaturation rate may be as high a 7-10% per second (Poets et.al. Early Human Dev. 26, 1-12).

Patient Monitor Recorded Low SpO_2 Alarm Event "84%"

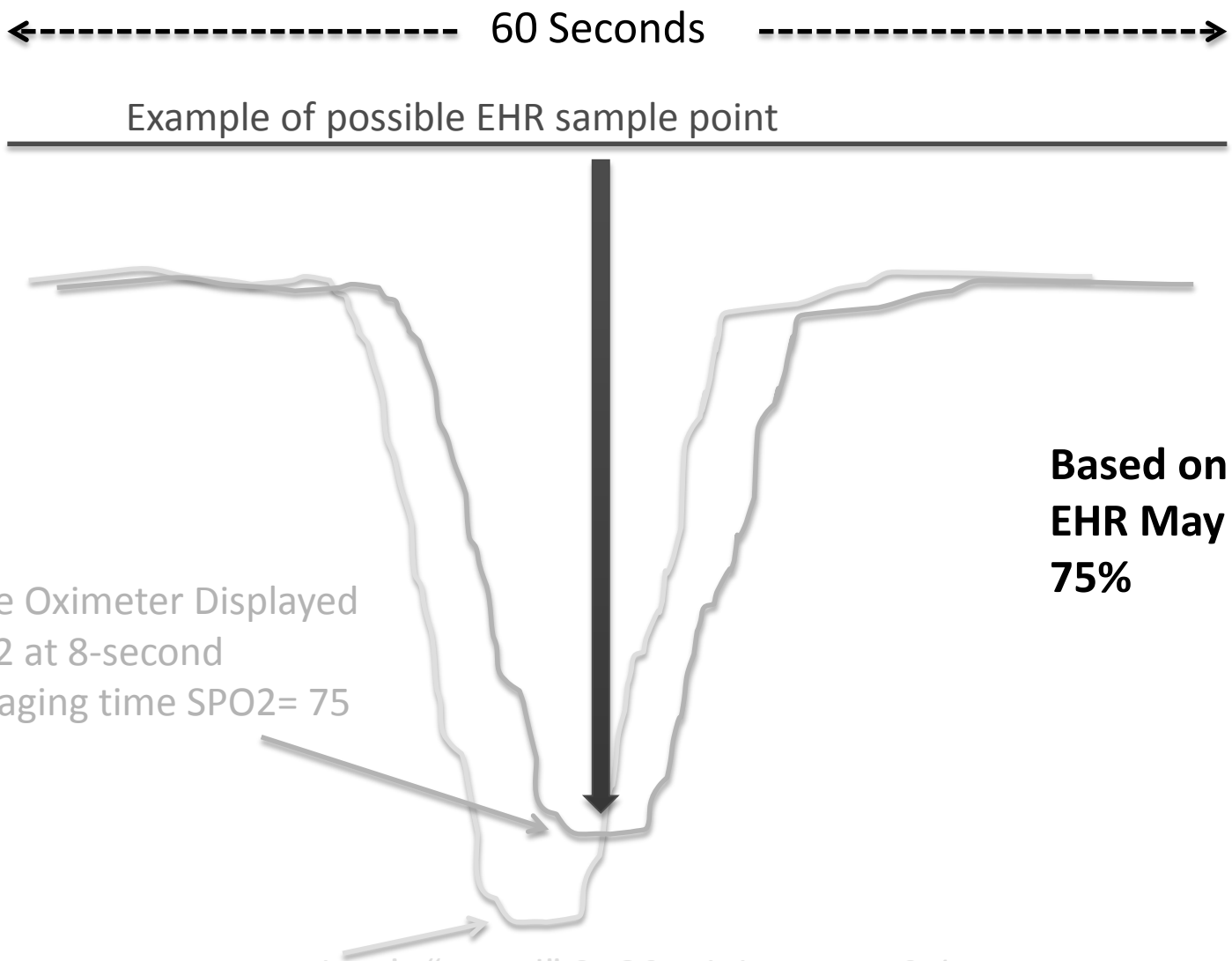
- 84% oxygen saturation detected by bedside physiological monitor
- Not recorded in permanent record

No evidence of low SpO_2 in EHR (blue ticks along top)

Julian M. Goldman, MD / MGH

MD PnP
Getting connected for patient safety

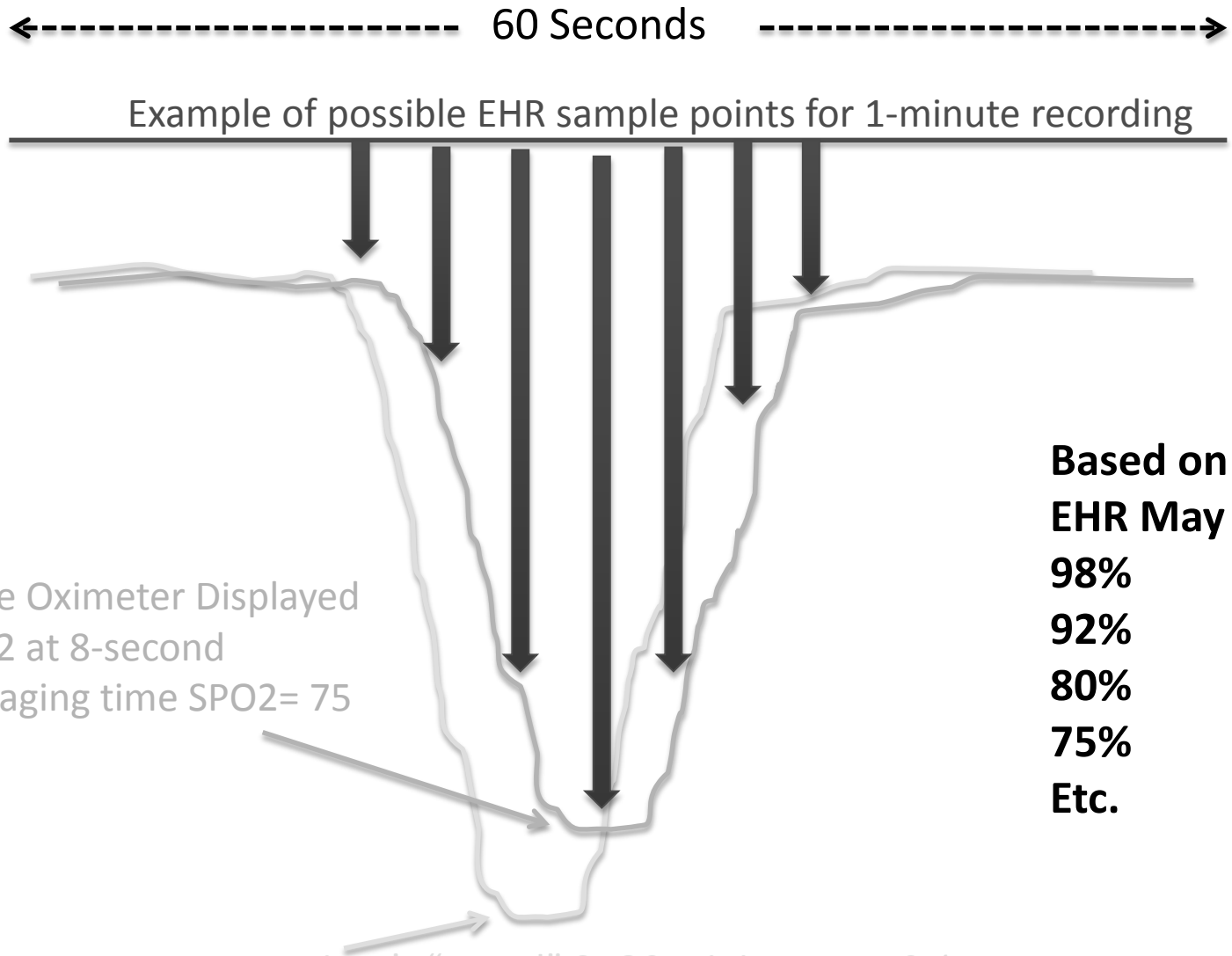
EHR data – 1 point collected



Based on this example, EHR May record SpO2 as: 75%

MD PnP™
Getting connected for patient safety™

Sources of variation in EHR documentation d/t Data Sampling



Based on this example, EHR May record SpO2 as:
98%
92%
80%
75%
Etc.

MD PnP™
Getting connected for patient safety™

GARBAGE
IN
GARBAGE
OUT

The Future is Now!

The Future

- Requirements Requirements Requirements
- Consider the System
- Re-think Architecture
- Open Communication across vendors
- Design the System to be a learning System
- Learning System (black box recorder)
- Regulatory Considerations
- Modeling of data using a patient/data-centric approach.

Functional Elements of the Integrated Clinical Environment

ASTM standard F2761-2009

Published January 2010

Clinician

Integrated Clinical Environment (ICE)

ICE Supervisor

External Interface

Network Controller

Data Logger

ICE Interface

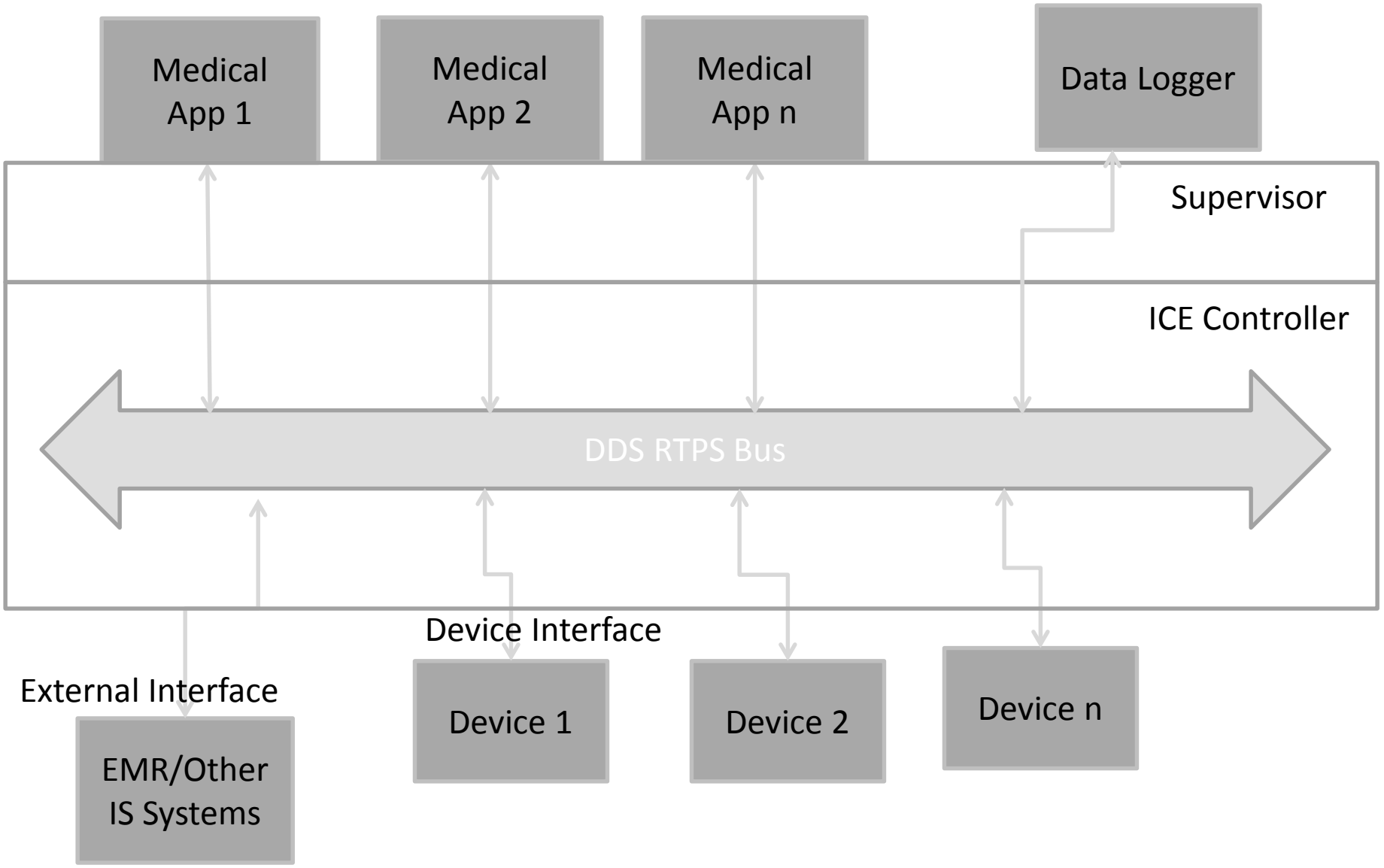
Medical Device

ICE Interface

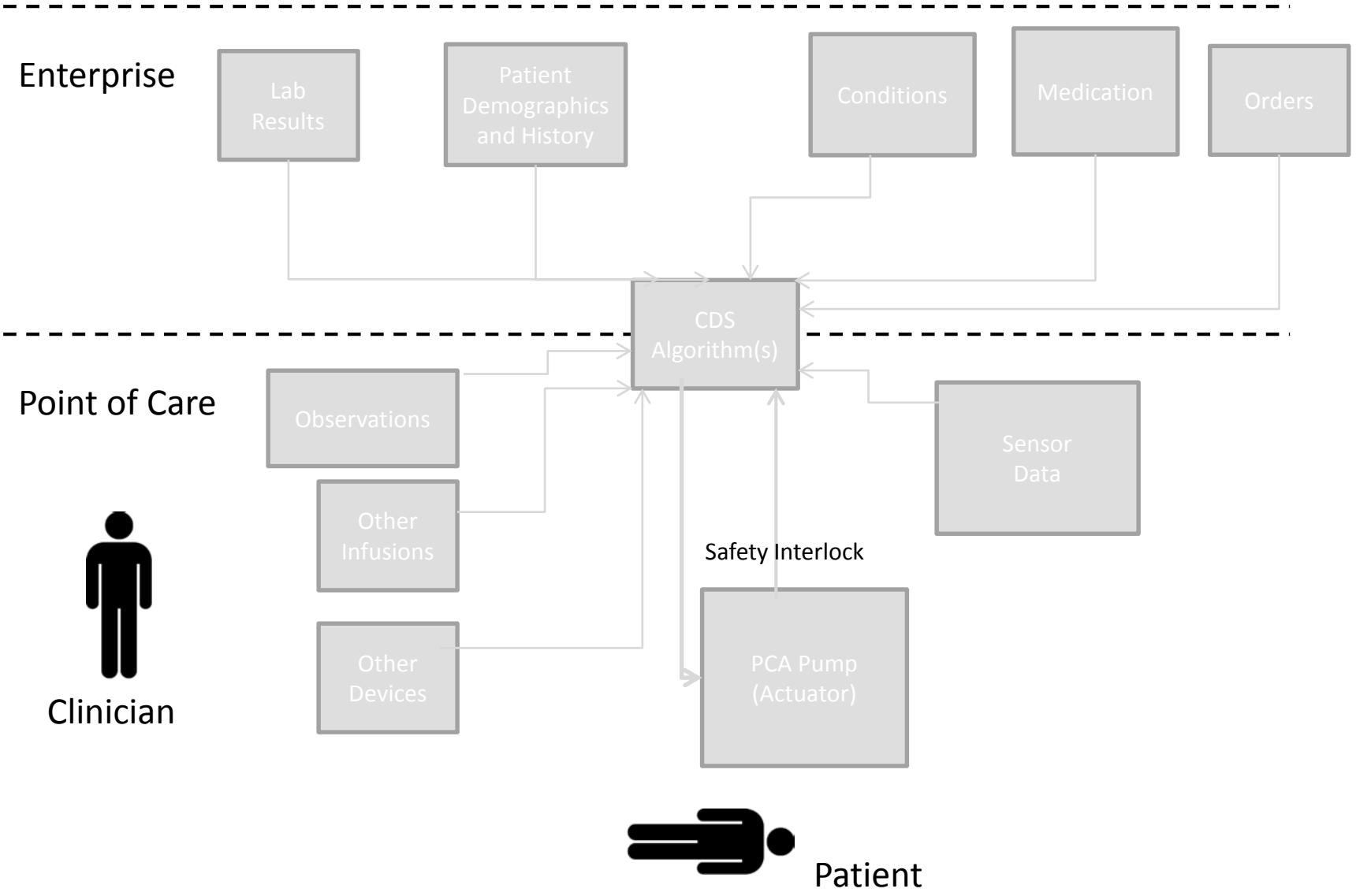
Other Equipment

Patient

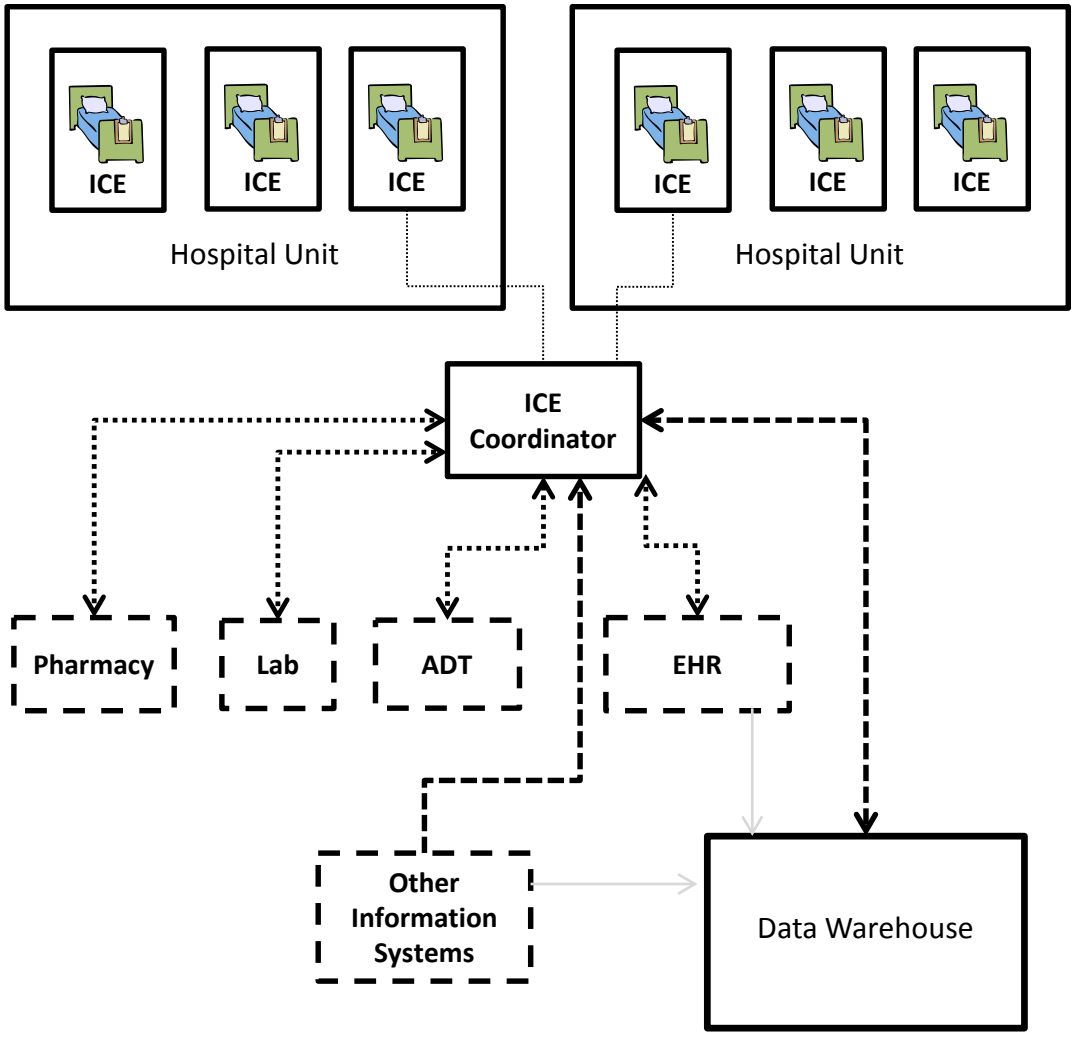
Data-centric Approach



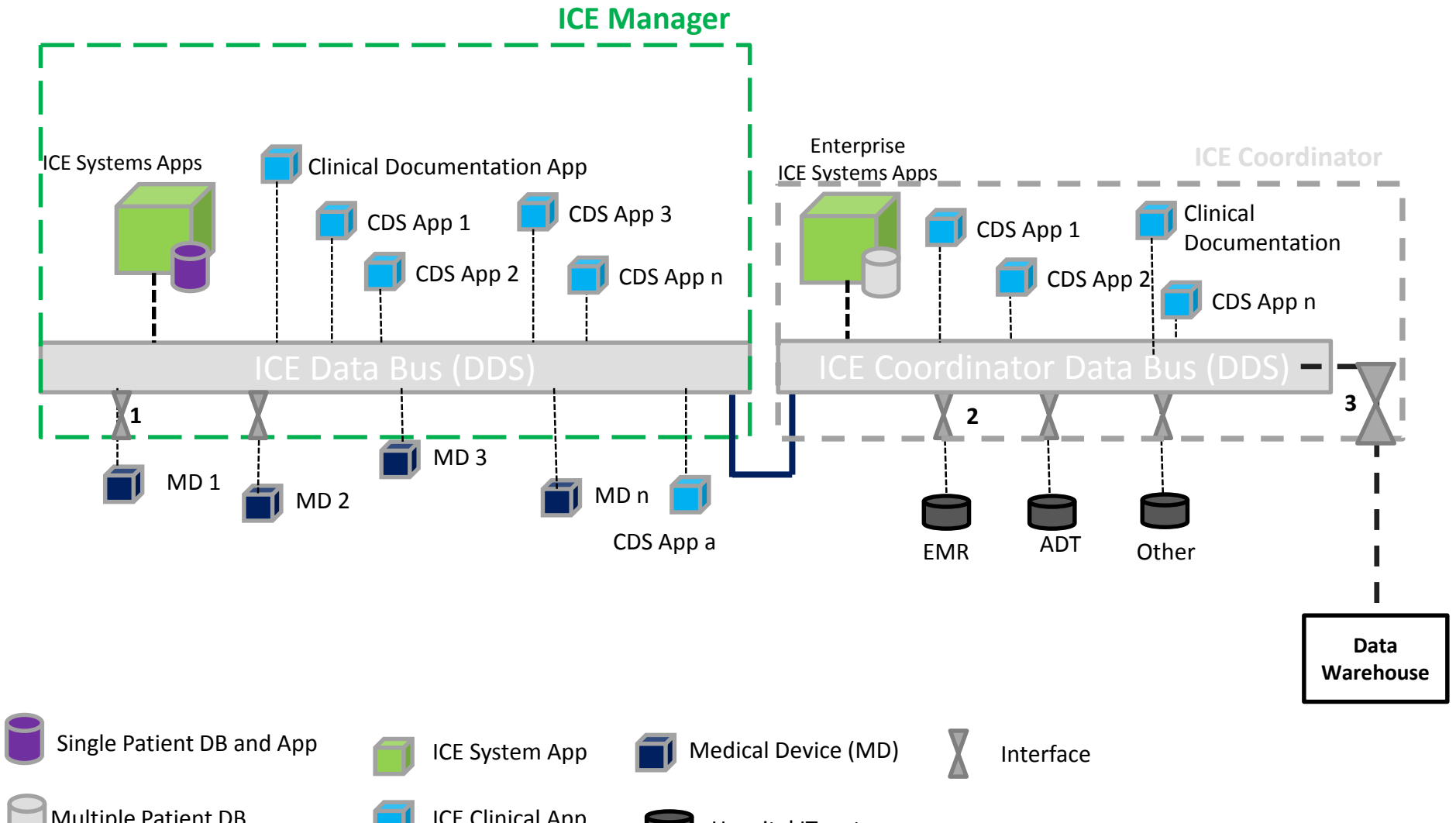
Smart PCA System App

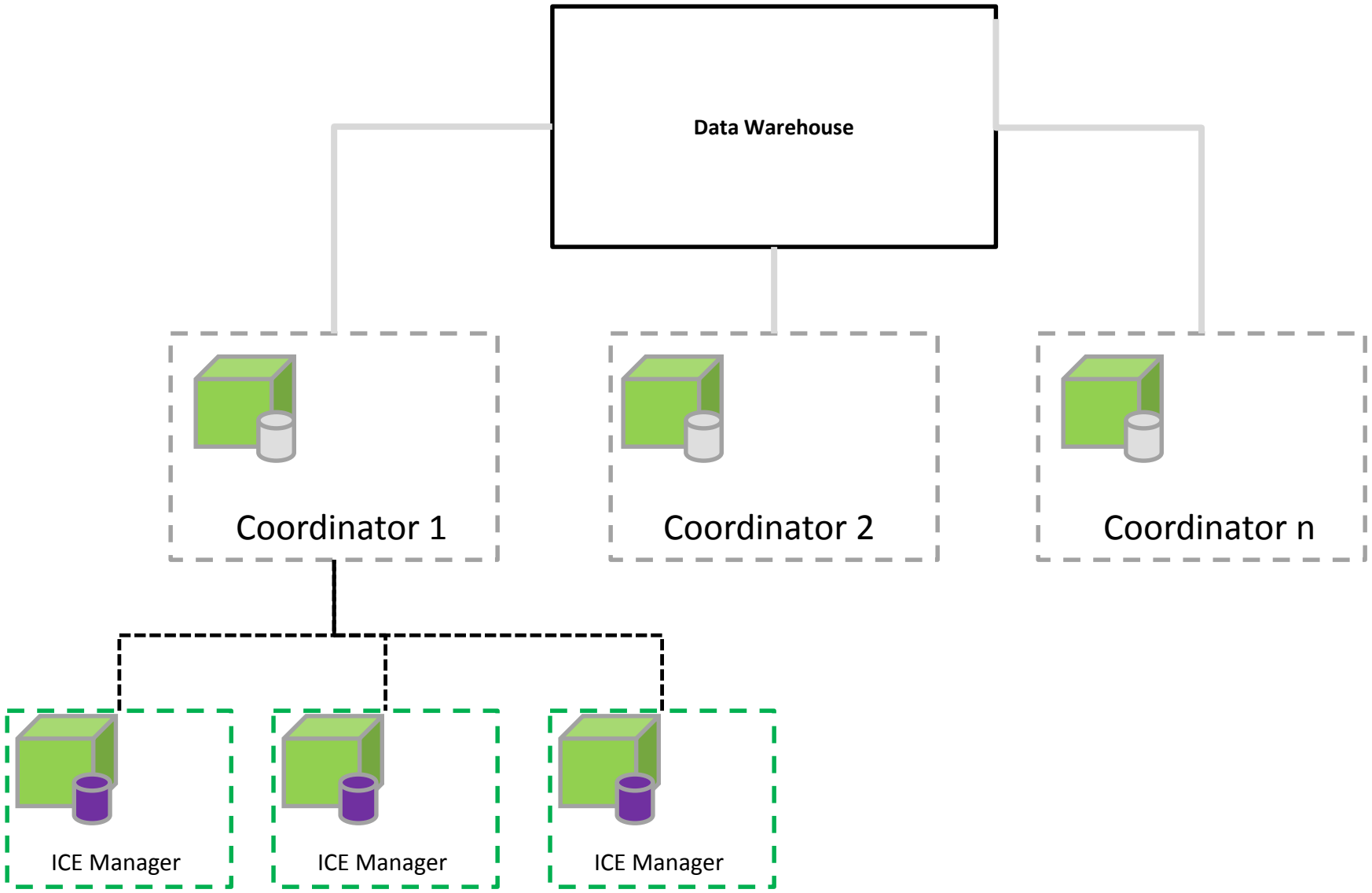


ICE System within Hospital IT Systems



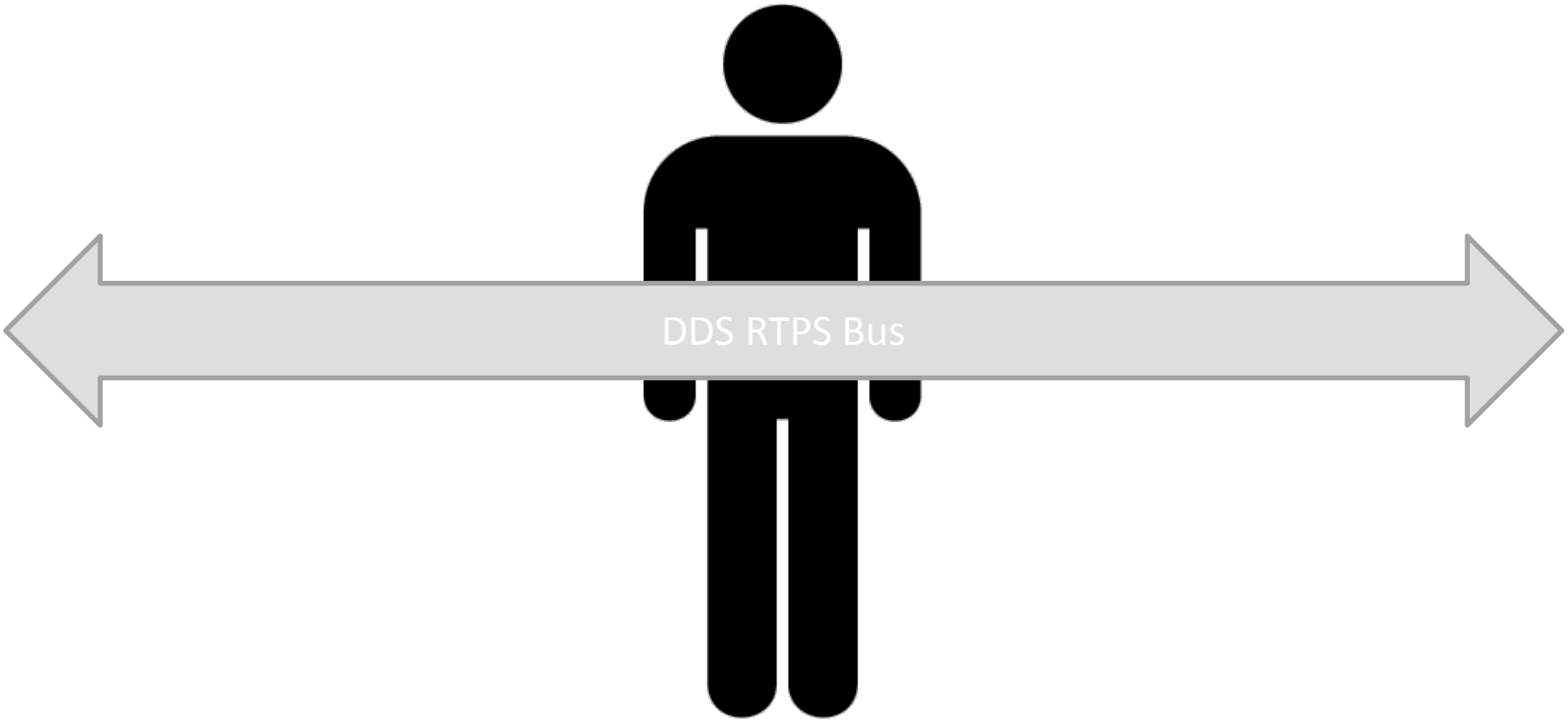
Architectural Diagram



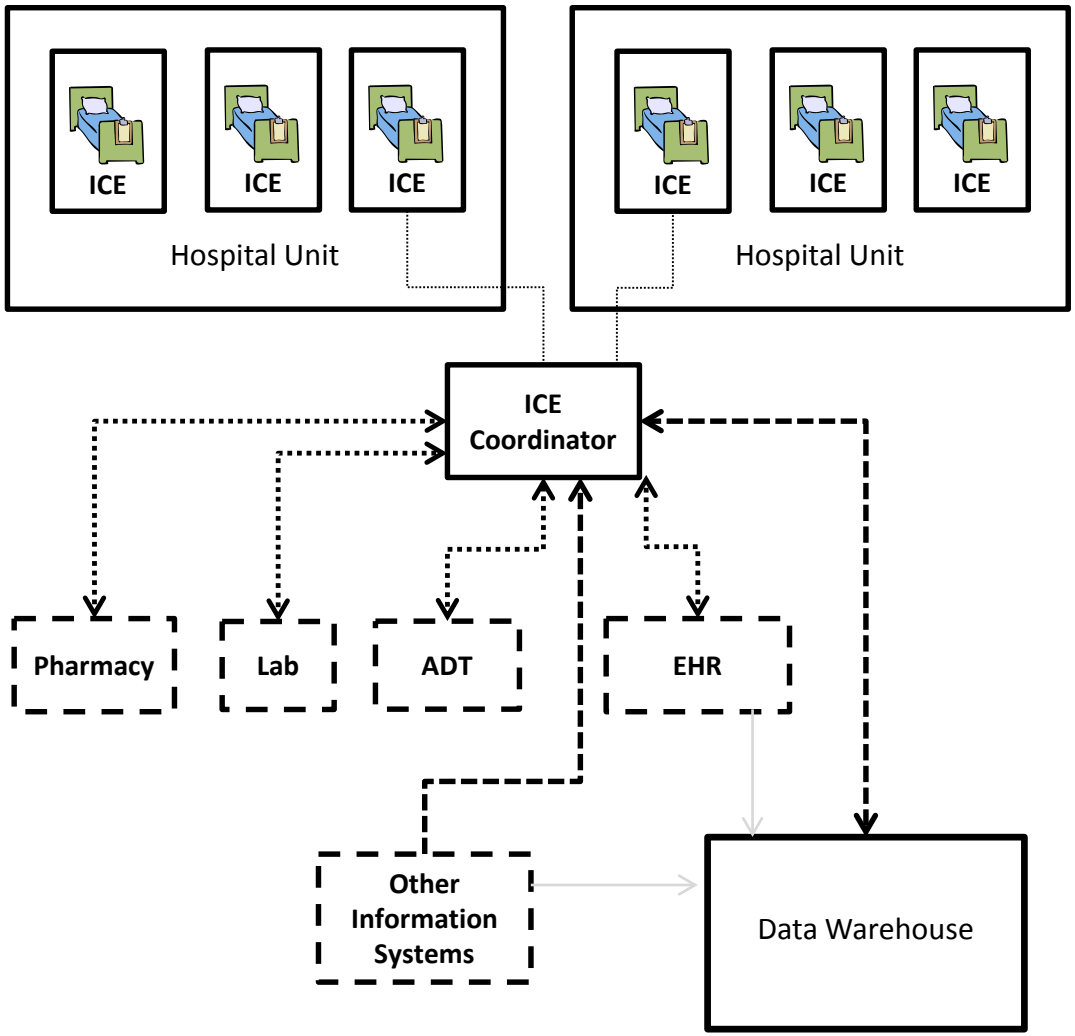

Data Warehouse
Coordinator 1
Coordinator 2
Coordinator n
ICE Manager
ICE Manager
ICE Manager

Patient Information Model

- System of Systems model based on the patients data.



ICE and Analytics



Categories of Analytics

Real Time Analytics
Patient Specific CDS

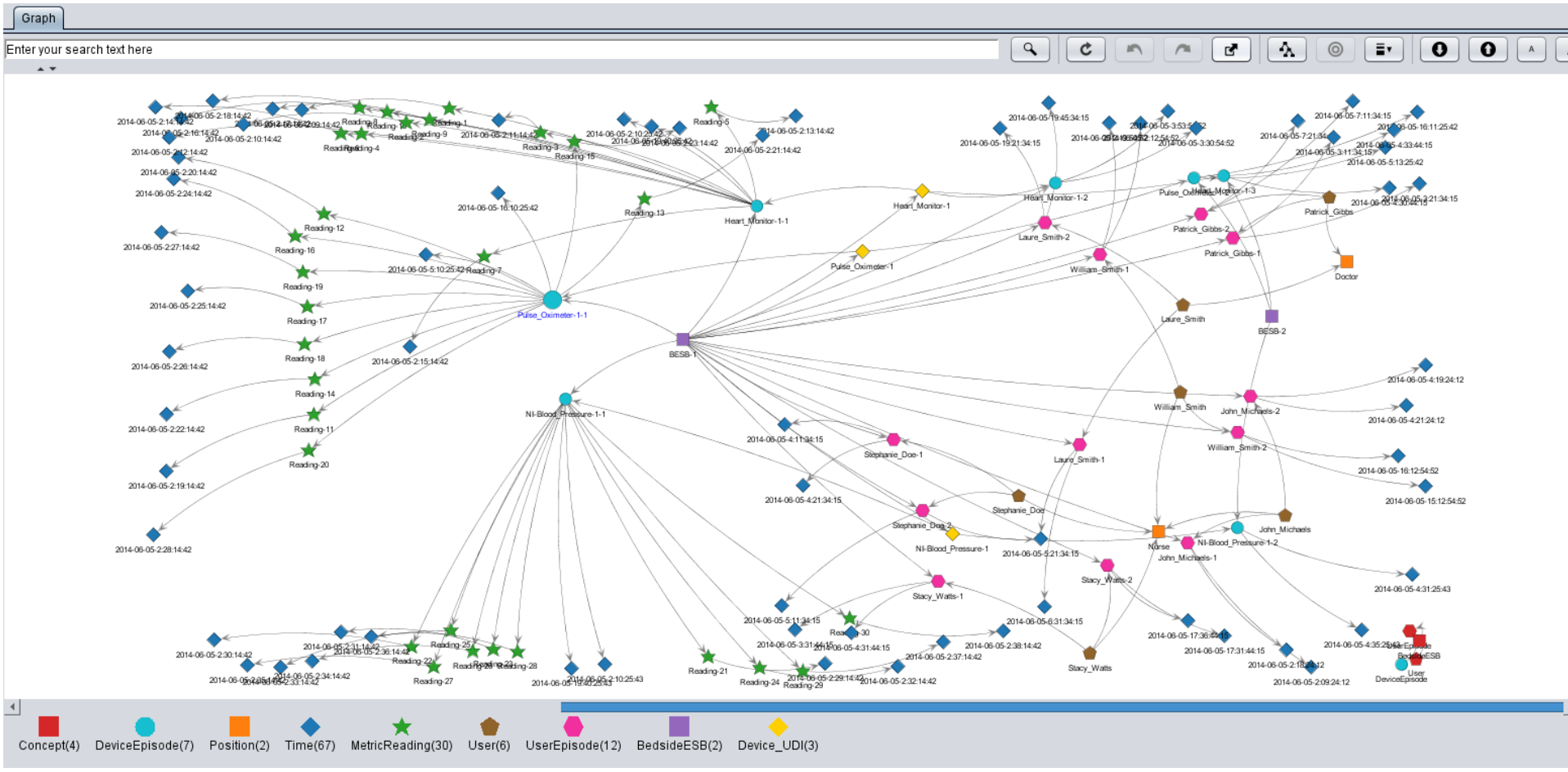
Unit Level Analytics

Hospital and Hospital Systems Analytics

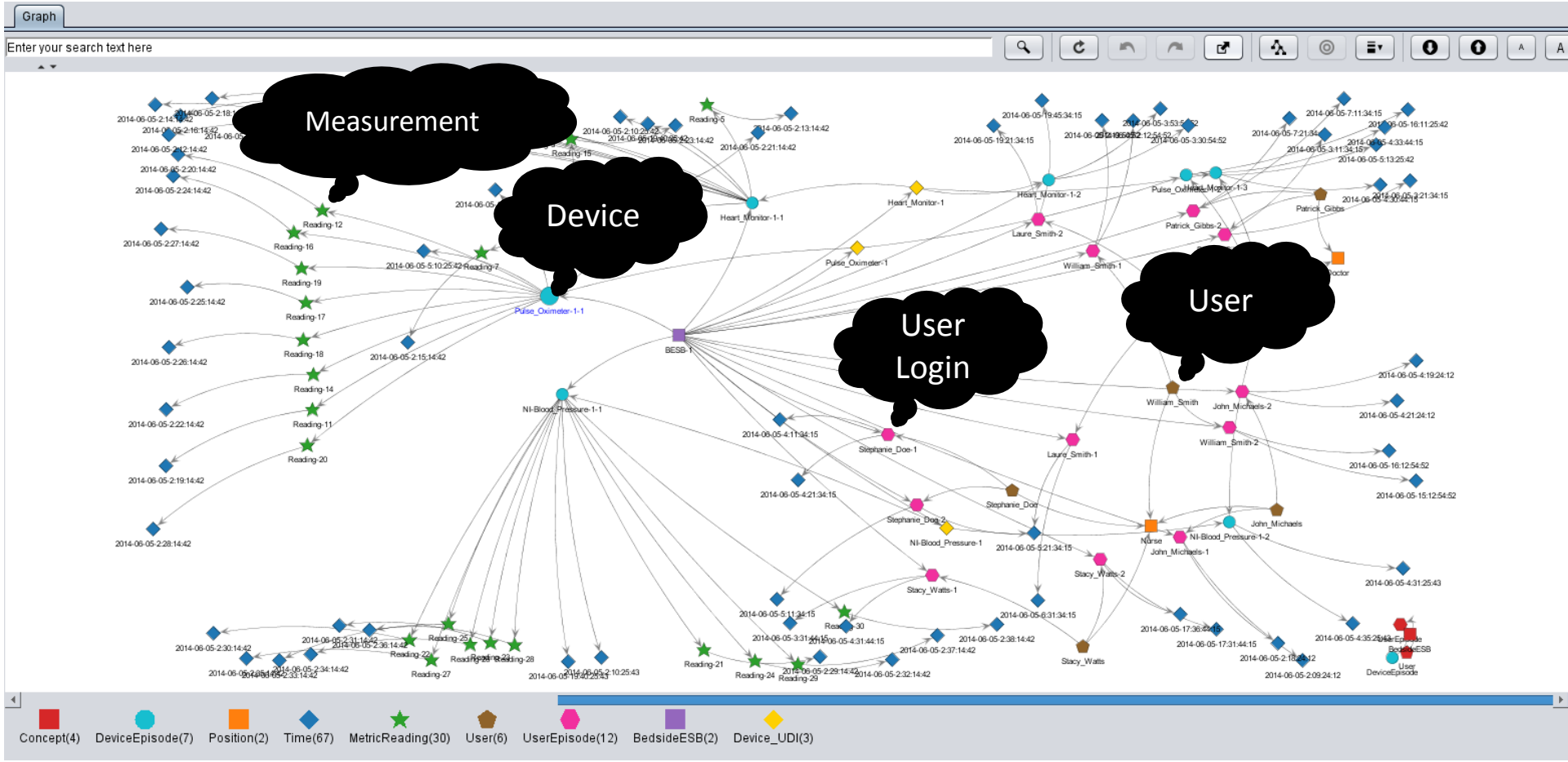
Clinical Studies and Outcomes Analytics

Real Time

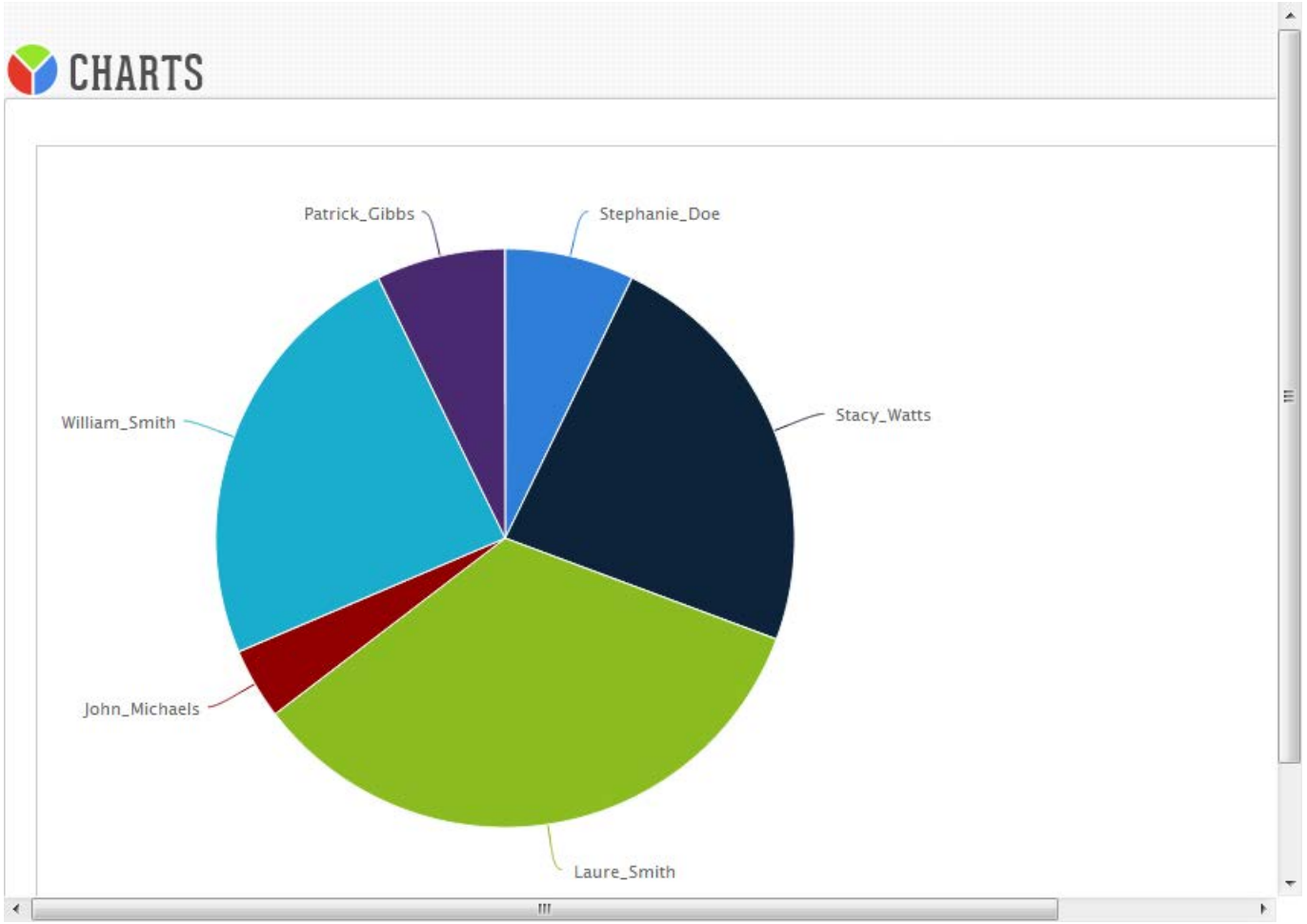
Long Term & Retrospective


Graph
Enter your search text here
Concept(4)
DeviceEpisode(7)
Position(2)
Time(67)
MetricReading(30)
User(6)
UserEpisode(12)
BedsideESB(2)
Device_UDI(3)

Relationships of Data



Clinical Staff Patient Care



Questions??

tracy@docboxmed.com
www.docboxmed.com

DOCBOX