ACCE
AMERICAN COLLEGE OF CLINICAL ENGINEERING

2025-2026 Educational Webinar Series

Patient Monitoring System Integration

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About the moderator

Priyanka Shah, MS

ECRI

Member, education committee

Priyanka Shah is a principal project engineer in the Device Evaluation group at ECRI where she performs medical device evaluations, investigates system failures, develops practical guidance for healthcare facilities, conducts accident investigations, and consults healthcare facilities on pre-purchase selection, and appropriate use of medical equipment, and health IT systems. She is the lead subject matter expert on physiologic patient monitoring, alarm management, EHR usability, and telehealth.

She has spoken on physiologic monitoring, usability of EHRs, cleaning and disinfection best practices at several regional and national conferences hosted by groups such as the Association for the Advancement of Medical Instrumentation (AAMI) Human Factors and Ergonomics Society (HFES) in Healthcare Symposium, and at the New Jersey/Delaware chapter of the Healthcare Information and Management Systems Society (NJ/DV HIMSS) annual convention.

Priyanka came to ECRI with a background in research engineering and program management. Priyanka holds a Master of Science degree in Biomedical Engineering from Purdue University and a Bachelor of Technology in Biomedical and Instrumentation Engineering from Ganpat University, India.

Logistics

❖All attendees have their microphones muted during the presentation.

❖Questions to the panelists must be submitted via the "Q&A" feature in Zoom at any time. They will be addressed at the Q&A portion.

❖If there is any urgent issue, please use the "chat" feature to communicate with the host/moderator.

❖Please remember to complete the webinar evaluation after attending. A link will be provided at the end.

About the Speaker

Nick A. Everson, MHM

Unit Head, HTM Networks

MAYO CLINIC

Nick Everson is currently the Unit Head of the Patient Monitoring Networks team for Mayo Clinic where he leads a team HTM Patient Monitoring Engineers. In his current role he manages the OS patching, software, and hardware upgrades for all Mayo Clinic hospitals in the US. His team also supports the local HTM Technicians with patient monitoring issues and lead the patient monitoring implementations for hospital expansion projects.

Session Description

Join this session to learn about Mayo Clinic's patient monitoring integrations!

We will be discussing 3 types of interfaces, their uses, Mayo Clini's initiative that standardized the enterprise patient monitoring system, and how "nice to have" features transition to "must have" features.

Introduction

- **Mayo Clinic Enterprise Patient Monitoring**
- **Inbound Interfaces**
  - Lab
  - ADT
  - Auto ADT
- **Outbound Interfaces**
  - HL7 Interfaces to the medical record
  - Wave strip exports to the medical record
  - High resolution data outbound
- **Other interfaces/connections**
  - Waveform Viewer link
  - Monitor Waveform Viewer
  - Single-patient viewer web
  - Multi-patient viewer application

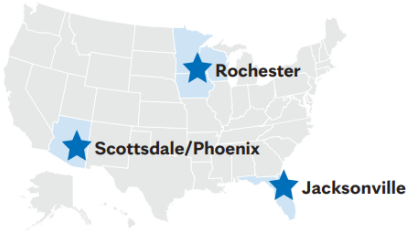
Introduction

- Locations in the United States

MAYO CLINIC

U.S. Locations

Mayo Clinic has major campuses in Rochester, Minnesota; Scottsdale and Phoenix, Arizona; and Jacksonville, Florida. The Mayo Clinic Health System has dozens of locations in Minnesota, Iowa, and Wisconsin.



MAYO CLINIC

★ Mayo Clinic main campus

MAYO CLINIC HEALTH SYSTEM

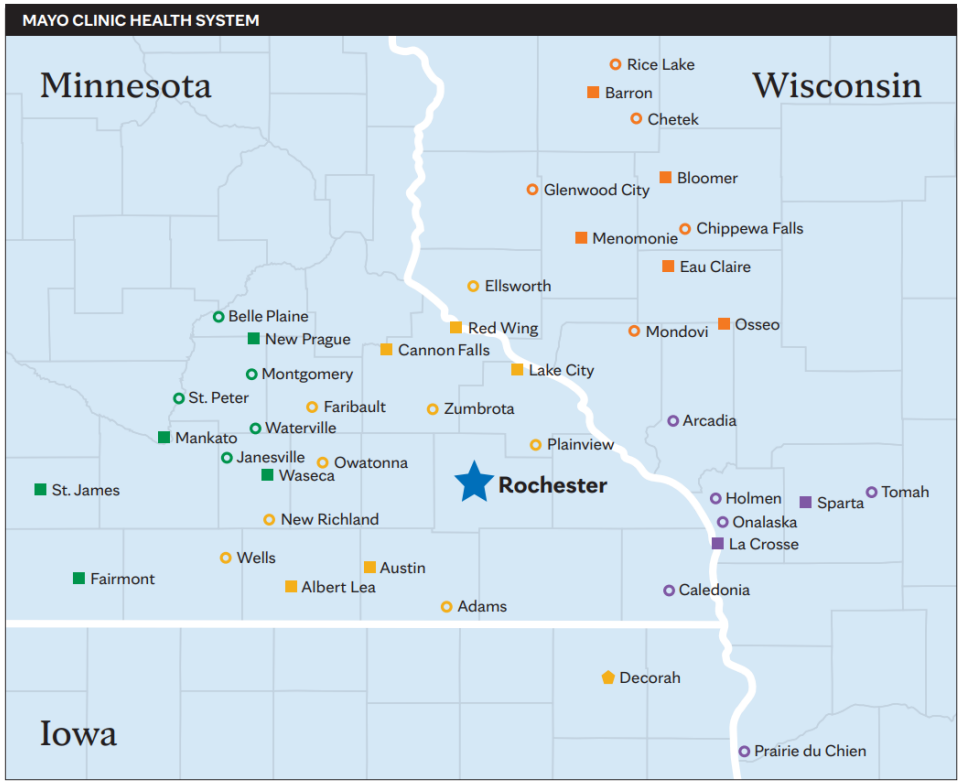
○ Clinic

■ Hospital and clinic

⬟ Physician and management services agreement

Colors indicate locations which operate under the same regional management structure.

- SW Minnesota
- SE Minnesota
- SW Wisconsin
- NW Wisconsin



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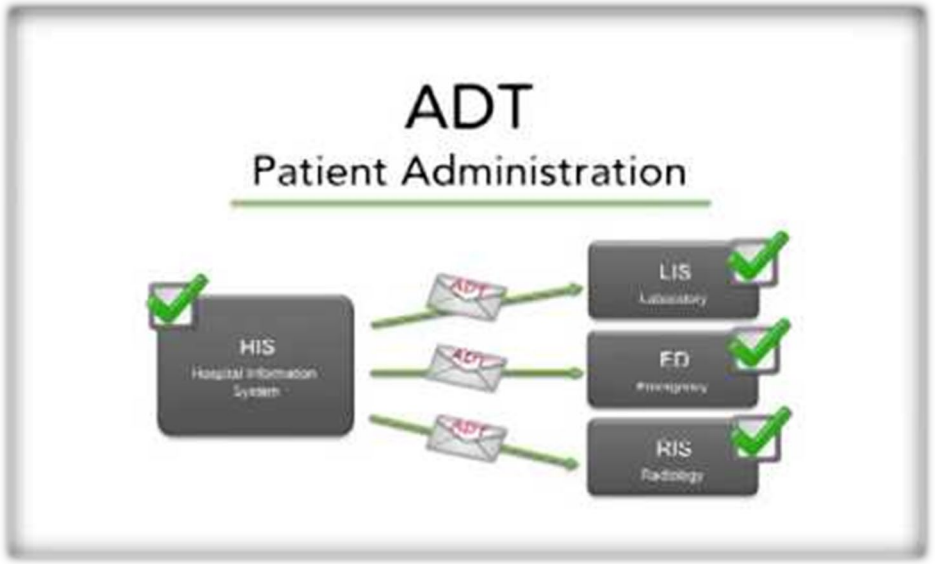
Introduction

- Leadership decision to standardize Mayo's patient monitoring system (2014)
  - Four larger and two smaller sites needed to change their patient monitoring vendors.
  - HTM Networks team involved in all upgrades
  - Major version upgrade in 2021
    - All new hardware (central stations and servers)
  - Final site installed in the Spring of 2022

Introduction

- Mayo Enterprise (US)
  - Over 5,200 bed licenses
  - More than 5,600 bedside monitors (including telemetry)
  - In excess of 500 PCs (central stations)
  - 80+ servers
  - 300+ network switches and 20+ network routers
  - 12 domains (systems) throughout the enterprise
    - 4 domains have been consolidated into 2
    - Plans are underway for 2 additional domains to merge into one
  - OS patching for PCs and servers is conducted quarterly
    - Latest vendor-approved OS patch versions are installed
    - The HTM Networks team collaborates with local HTM technicians to reduce downtime for each unit

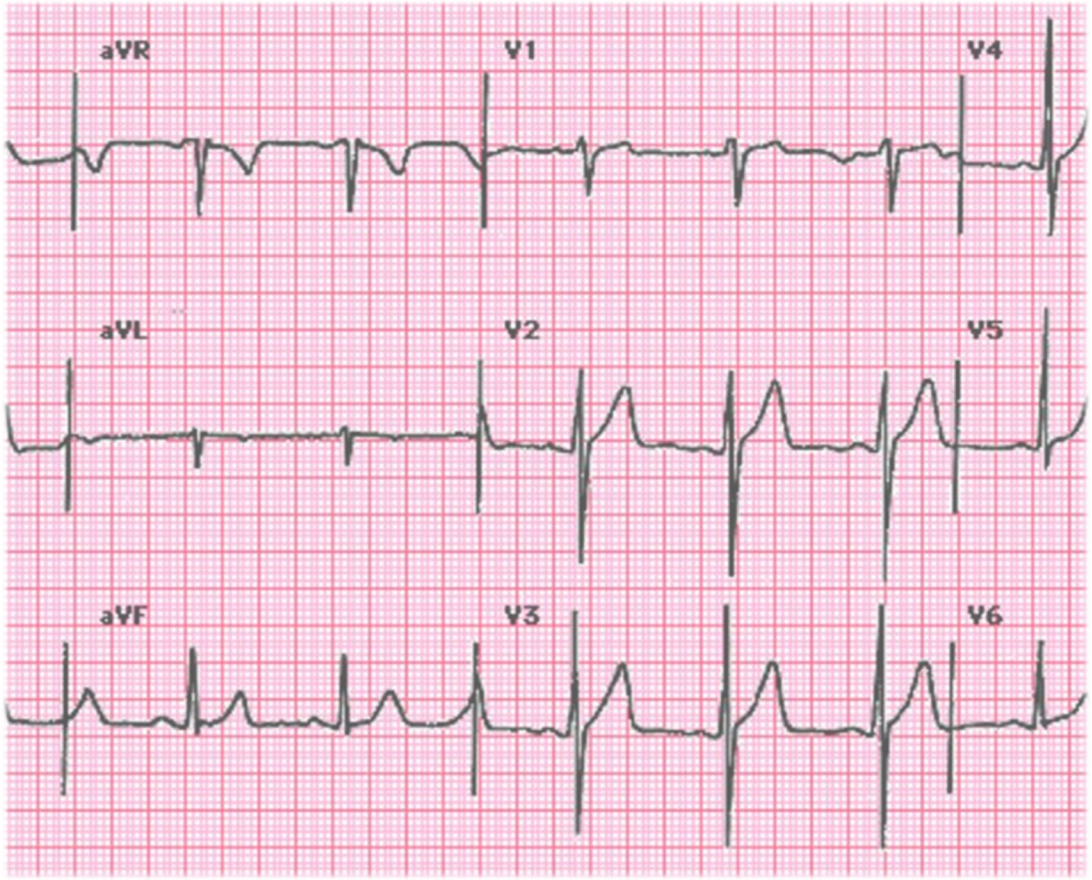
Inbound Interfaces



- Introduction
  - Pros
    - Efficiency and accuracy
  - Cons
    - Implementation costs and disparate equipment
- Lab
  - Not integrated into the Mayo Clinic patient monitoring system
- ADT and Auto ADT
  - Early interfaces were resistant to adoption
    - I can type the patients name in faster than I can look it up

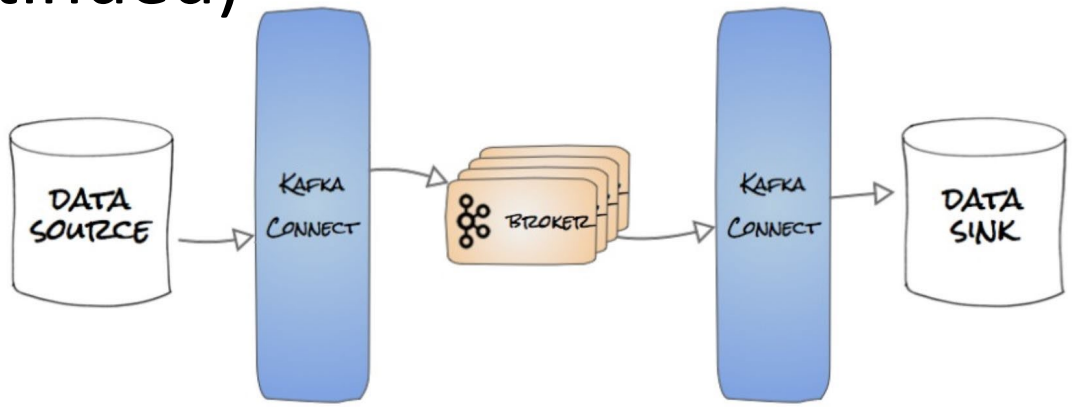
Outbound Interfaces

- Wave strip export
  - PNG file with associated metadata
    - Other hospitals use PDF files
  - Enabled across the enterprise
    - Standardized parameters for saving wave strips to the EHR
    - It took a few years for all sites to adopt/implement the workflow
- High resolution data export
  - 500 samples per second waveforms
  - High storage requirements



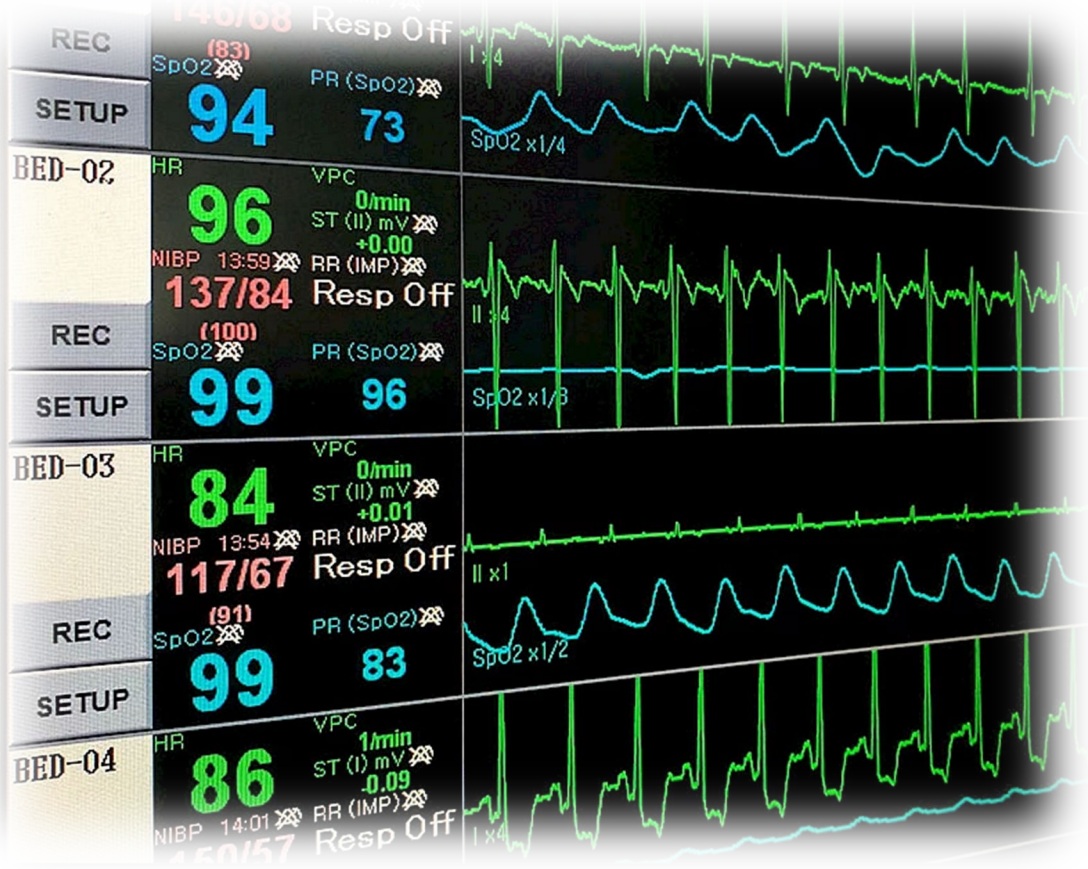
Outbound Interfaces

- High resolution data export (continued)
  - Not real-time data
    - Primary purpose is for research
  - At end-of-life
- High Fidelity Data Export (HFDE)
  - Initial versions sent data to the vendor cloud only
  - Latest version offers a Kafka interface
    - This will allow Mayo to send the HFDE to their own cloud solution
  - Mayo Clinic's goal – send HFDE from every patient monitor



Other Interfaces/Connections

- Single patient viewer (web)
- Multi-patient viewer (thick client)
- Mobile patient viewer (Android/iOS application)
- EPIC Waveform Viewer
  - Uses a well-formed url to view patient waveforms/data via the Philips single-patient viewer web application
  - Any centrally monitored bed is viewable across the enterprise
- EPIC Monitor Waveform Viewer
  - Microsoft Edge component to view waveforms in the EPIC application

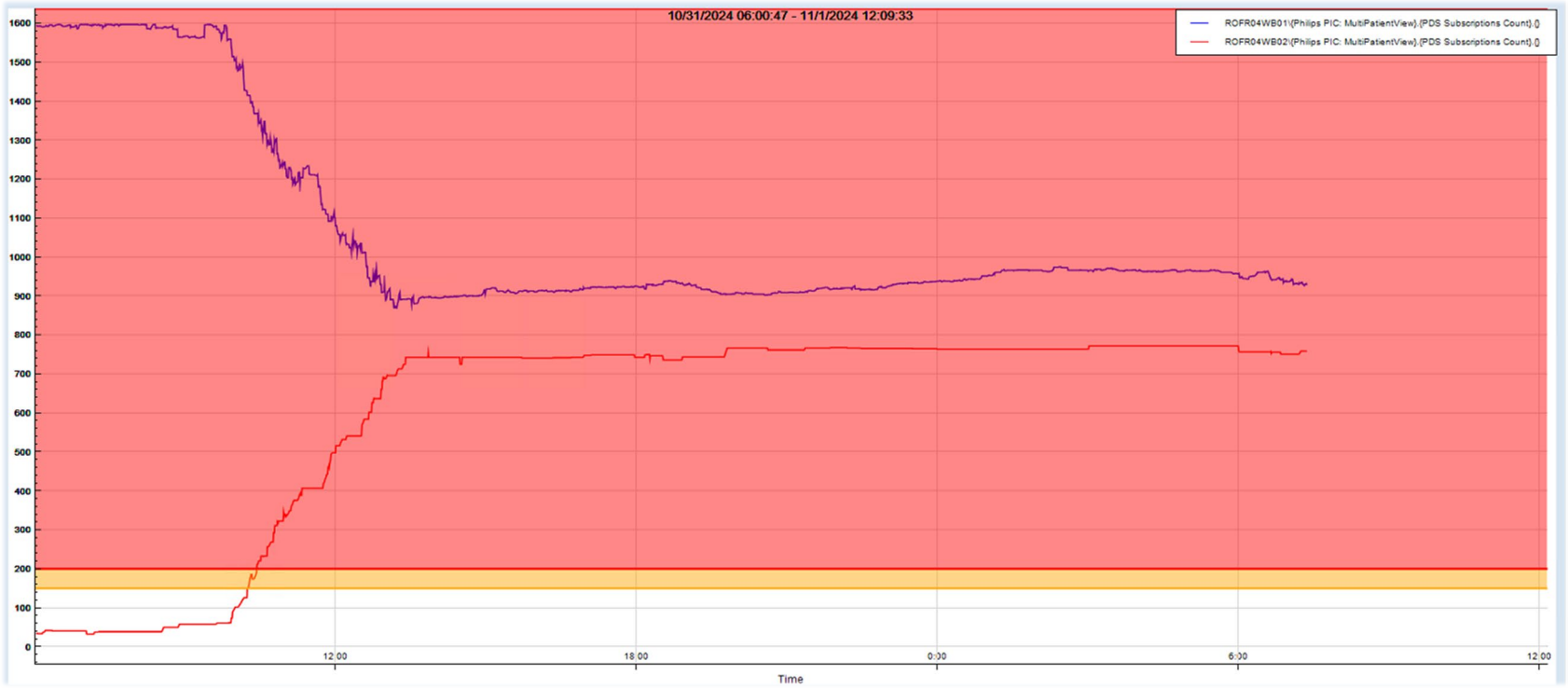


Examples

- Consolidating systems
  - Greater flexibility for our Central Monitoring Unit
  - Maximum number of beds/patients per system = 1600 (950)
    - Be cognizant of other system limitations (Bed Assignment Failed)
    - Monitor and respond to issues quickly
    - Work with your vendor to help identify issues
    - Work with your vendor to solve the issues as quickly as possible

Examples

- Find system logs, performance monitors, etc that show the root cause and the resolutions



Examples

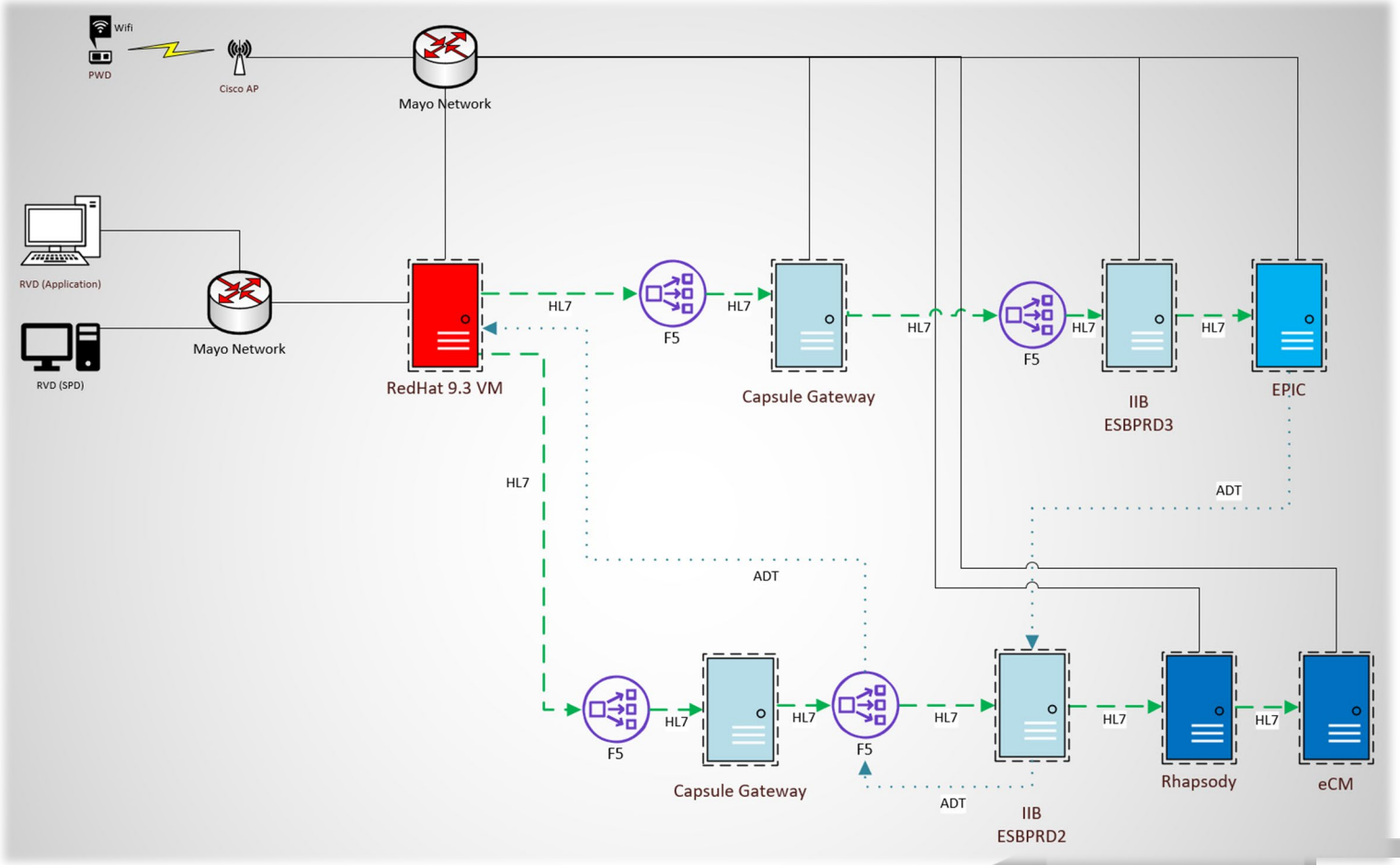
- System upgrades
  - Know who or what is using your patient monitoring system
  - Engage all groups involved
    - Clinical teams
    - EHR teams
    - IT teams
    - Informatics Teams
    - etc

Examples

- Pilots that become permanent
  - Different methods of interfacing and integration
  - Different technical requirements
  - Adds complexity to the overall EHR integration
  - Limited support
    - Often reverts to the vendor without identifying an internal support model
  - Support model planning

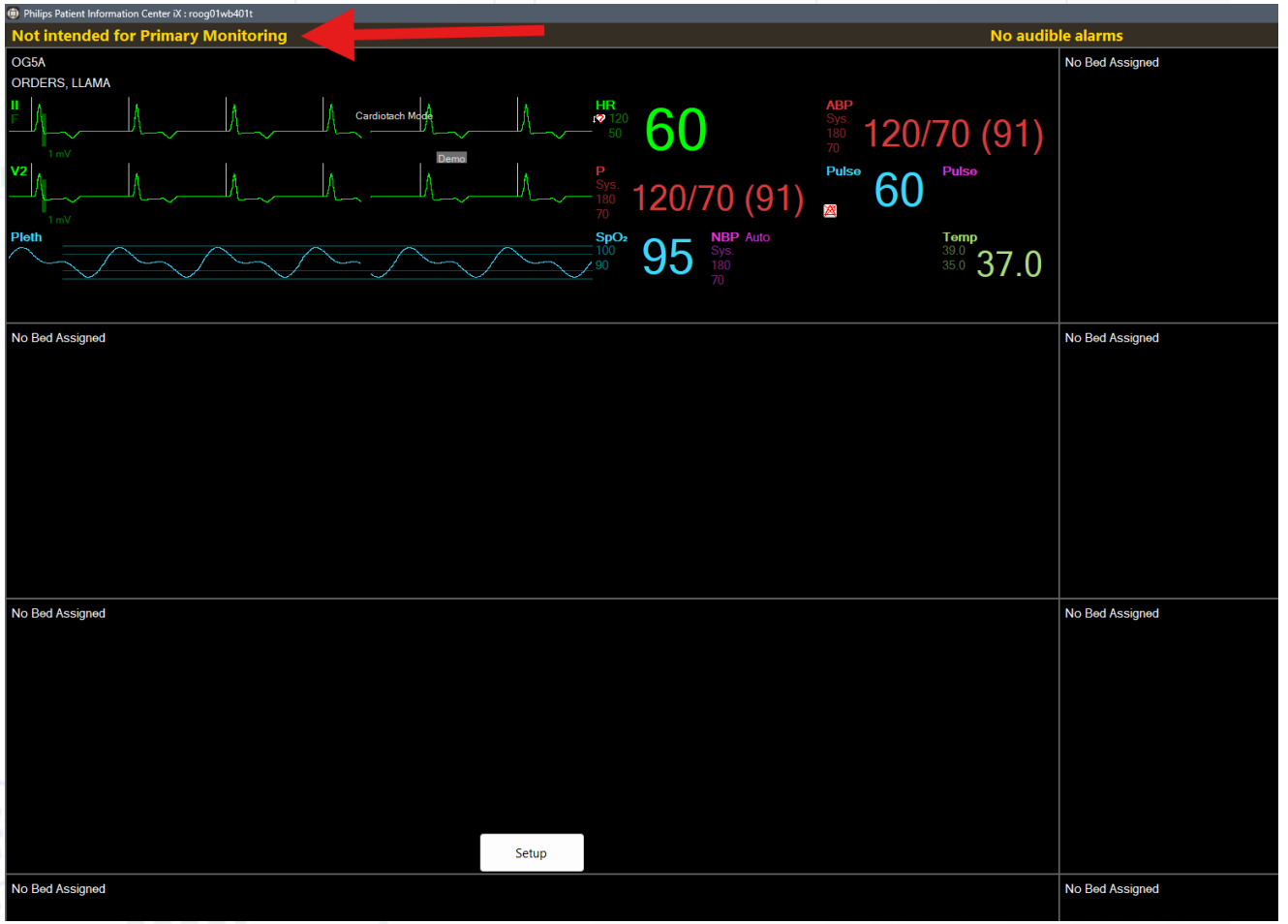
Examples

- Sotera Digital
  - Visi Mobile
- Pilot Installation on SUSE Linux
  - Unsupported by the data center
  - Upgrade to data center supported version RHEL
- Neither tech team had “ownership” (HTM/IT)
  - No complete system diagram



Examples

- Nice to have features become must have resources
  - Philips multi-patient and single patient viewer
  - EPIC links to the single patient viewer
  - Other integrations from EPIC that are unknown.



Conclusion

- Make connections with your Interface, EPIC (EHR), Informatics, IT, and HTM (CE, Biomed) teams
- Define each teams responsibilities
- Start as early as possible
- Plan, plan, plan
- Test
- Test
- Test

Thank You

Any question?

Please type your questions to the Zoom Q&A window

Please complete the online evaluation form at
https://www.surveymonkey.com/r/ACCE_session1