Streamlining Patient Flow by Leveraging Real-Time Location Data via Direct Integration with Epic EHR

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What is a Real Time Location System?

RTLS is a technological solution for tracking in *real time* the *location and status* of assets and people within a healthcare facility.
How Real Time Location Systems Work?

RTLS collects location information **automatically** (no manual data entry) and **continuously** (always on)

**Tags** (badges) are attached to items (assets, supplies, instruments) and worn by people (patients, nurses, technicians, transporters)

**Readers and Middleware** collect location data and transmit them through middleware to software applications

**Software** applications visualize data (map views, dashboards) and provide actionable information (notifications, reports)
It Takes a Village

Internal Partners
- IS/IT
- Operations
- Finance
- Clinical staff & providers

External Partners
- Centrak – hardware provider
- Infinite Leap – OR work, Cancer Center installers and system first line support
- Cetani – software developer; asset management, workflow, alert notification, reporting
Design Considerations

1. Patient & Staff Workflow
   - Waiting Rooms
   - Exam Rooms
   - Nurse Stations
   - Med Rooms
   - Entry/Exit

2. Asset Management
   - Soiled Rooms
   - Clean Rooms
   - Corridors
   - Alcoves

3. Staff Duress
   - Hallways
   - Patient Rooms
   - Public Areas
STOP!
It Is NOT just Technology

- Technology – you need to deploy technologies to support operational excellence
- Process – you need to apply operational data to drive continuous process improvements
- People – you need to nurture a culture of change
RTLS Solution Design Process

1. Initial conversations to gather high level objectives
2. Stakeholder interviews to assess current state and future vision
3. Historical data gathering
4. Real-time systems architecture review and design
5. Organize stakeholder feedback by common strategic theme
6. Innovation identification
7. Develop solution requirements
8. Complete and deliver the real-time Scope and Value Assessment
EHR + RTLS = EHR²

<table>
<thead>
<tr>
<th>EHR</th>
<th>EHR+RTLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status updates are entered ad hoc, typically between appointments (fragmented, non-factual data)</td>
<td>Status updates are entered continuously (full and actual view of patients’ status and interactions)</td>
</tr>
<tr>
<td>System relies on manual data entry (error-prone)</td>
<td>System is updated without a human intervention (accurate data)</td>
</tr>
<tr>
<td>System does not provide contextual information (with whom patient was interacting, for how long, where, what type of medical equipment was used during patient care)</td>
<td>System delivers context and resource awareness (through tracking staff-patient interactions)</td>
</tr>
<tr>
<td>System takes away time from a direct interaction with the patient (low patient satisfaction scores)</td>
<td>System gives back time to providers and allows providers to be present “in-the-moment” with a patient (increased patient satisfaction)</td>
</tr>
<tr>
<td>System focuses on clinical outcomes as a top priority. Patient satisfaction is not taken into an account</td>
<td>System enables real-time notifications and alerting for improved patient safety and patient experience</td>
</tr>
<tr>
<td>System provides a limited data set for process improvement</td>
<td>System offers rich historical data for process improvement</td>
</tr>
</tbody>
</table>
1. Wayfinding / Routing

7 VMC Identified RTLS Use Cases
• Wayfinding/Routing
2. Asset Locating and Par Level Management

7 VMC Identified RTLS Use Cases

- Wayfinding/Routing
- Asset Locating and Par Level Management
3. Asset Loss

7 VMC Identified RTLS Use Cases

- Wayfinding/Routing
- Asset Locating and Par Level Management
- Asset Loss
4. Patient Wait Time Management

7 VMC Identified RTLS Use Cases

- Wayfinding/Routing
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- Patient Wait Time Management
5. Patient Flow Phases of Care

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6. Staff Safety/Duress

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7. Time Studies for Process Improvement

7 VMC Identified RTLS Use Cases

- Wayfinding/Routing
- Asset Locating and Par Level Management
- Asset Loss
- Patient Wait Time Management
- Patient Flow Phases of Care
- Staff Safety/Duress
- Time Studies for Process Improvement
Evolution of RTLS at Vidant Medical Center

• First used as a passive “finding” system
  – Pull up location via map or list view of facility when you need something and can’t find it
  – Use cases 2 & 3

• Next, heads up display of location
  – Epic OpTime leverage system to show where patient is physically located (assumes location defines the workflow)
  – Still cases 2 & 3, but on people now
Finally, active patient management system

- Heads up display gives staff visibility into real and current process times for patients
- System can notify when care times not being met
- Notifies valet when the patient visit is over and vehicle is needed
- Allows daily, weekly, monthly reporting of process times by clinic type, provider, etc.
- Use cases 1, 4, 5 and 7 above
RTLS in the ORs
RTLS-Enabled Patient Flow
System Architecture – Future State

- RTLS Tag associated to OR Patient
- OR RTLS Sensory Network (Centrak)
- Centrak Server
- EPIC Servers
- Epic
- InInLeap
- InInLeap EV Integration Server
- InInLeap Notify App Server
- 3rd Party Communications Provider
- Physician Notifications by SMS Text

Outbound RTLS Message Stream

- Bi-Directional HL7 via internet (SOAP XML over HTTP)
- EPIC RTLS Message Specifications:
  - PRG_RMM01001UV
  - PRG_RMM01002UV
  - PRG_RMM01003UV
  - PRG_RMM01007UV

OptTime Application
- Patient location updates will be utilized for updating case tracking events

ADT Registration
- IFP Interactive Form Sheet
- Worker RTLS Tag Field
  - Associates RTLS to patient record
The primary project objective was to smoothly transition OR documentation and patient status updates directly into Epic OpTime, while ensuring data accuracy and simplicity for staff.

To support this goal, HL7 standards for Patient Administration, also known as ADT - Admit, Discharge, and Transfer, were utilized.

There are three HL7v3 message types being leveraged, as they relate to an RTLS tag interface during a patient encounter:

- Associate Patient Tag
- Broadcast Patient Location Changes
- Disassociate Patient Tag

These messages allow for automatically documenting case tracking events within Epic EHR.
The New Process in Practice

• When the patient registers, the staff uses a scanner to read the barcode on the side of the patient badge, which associates the RTLS ID, and thereby the patient themselves to the Patient Record in Epic HER (this new process eliminated errors and increased efficiency for staff, who previously relied on manual keyboard entry).

• As a patient moves through the surgical workflow, the RTLS system broadcasts location updates and publishes patient location changes on Staff Status Board within Epic OpTime. Staff appreciate this ease of visibility into the overall flow as well as at the individual patient level. These patient status updates are also delivered in HIPAA compliant and family-friendly ways via a Family View Board.

• After the patient has received care and is ready to depart, the badge is placed into a location-enabled drop box, which sends the message that the badge is no longer with the patient. This outbound “Disassociate Patient Tag” message, updates the last location to a status of “Completed,” closing patient encounter. Placing badges in a drop box also allows for faster redistribution, reducing the number of patient badges that need to be purchased to support patient volume.
RTLS in the Cancer Center
Vidant Cancer Care at Greenville
Vidant Cancer Care at Greenville

• New 430,000 sq. ft. cancer center opened March 26th that co-located:
  – 4 oncology clinics encompassing 60 outpatient exam and treatment rooms
  – 1 infusion center that has 48 infusion chairs and 12 private infusion rooms
  – 1 radiation oncology joint venture that includes a Cyberknife, 2 Trubeam linear accelerators, 1 Varian Edge and a Gamma knife
  – 2 inpatient floors that house 96 oncology beds
    • 2nd floor – Surgical Oncology
    • 4th floor – Medical Oncology
  – Retail pharmacy
Cancer Clinics are multi-functional areas and swing from one clinic type to another depending on day of week.

Encompass Surgical Oncology, Medical Oncology, Sickle Cell, Gynecologic Oncology clinics with multiple disease types seen in each clinic.

- Maximizes utilization of space but creates enormous complexity for RTLS because location usually drives function.
Logistics in the New Cancer Center

Increased space and co-location of oncology services creates many positive benefits and some negative ones:

— Positive:
  • One stop shop for patients
  • Less travel between modalities in a given day
  • Enhanced partnership between providers

— Negative:
  • Greater likelihood for waiting if flow isn’t carefully managed
  • Poorer communication within departments due to expanded geography
Most recent evolution is to drive workflow automatically
- Through Cadence (scheduling) interface know why the patient is here
- Through ADT interface and RTLS know who is here today and where they are
- Through interaction of ADT, Cadence and RTLS information we can know where the patient is, where they need to be for efficient care times, how long they spent in each step and how much time was delivered by each type of care giver
- Process times are a mix of time spent in a location (when location determine care step) and interaction times when the location is used by multiple care givers (clinics)

Drive patient experience through:
- Automatic notification of increased wait times and time between caregivers
- Notification to Valet of patient’s impending need for vehicle by using tag removal to send valet ticket #
### VMC-INFUSION SERVICES

#### Patient Workflows

- **Current Patients**: All Patients
- **Future Appointments**: Off
- **Active Patients**: Off

#### TI Patients

<table>
<thead>
<tr>
<th>Tag ID</th>
<th>Current Area</th>
<th>Time at Current Area</th>
<th>Provider</th>
<th>Waiting</th>
<th>Fast Track</th>
<th>Infusion</th>
<th>Start Time</th>
<th>Total LOS</th>
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</thead>
<tbody>
<tr>
<td>2030720</td>
<td>CCI Green Flow step 2b - Infusion in 1A</td>
<td>5m 16s</td>
<td>DARLA KULES</td>
<td>32s</td>
<td>6m 16s</td>
<td>1h 02m 23s</td>
<td>12:00 PM</td>
<td>1h 17m 41s</td>
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<tr>
<td>2034138</td>
<td>CCI Corridor near Provider Work area 12P</td>
<td>54s</td>
<td>Ola Olabi</td>
<td>9m 00s</td>
<td>5m 59s</td>
<td>2h 03m 02s</td>
<td>9:00 AM</td>
<td>2h 17m 41s</td>
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<td>2035238</td>
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<td>4m 31s</td>
<td>Maria Ramirez Perez</td>
<td>25s</td>
<td>16m 35s</td>
<td>44m 57s</td>
<td>11:00 AM</td>
<td>1h 17m 41s</td>
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<tr>
<td>2035655</td>
<td>CCA Exam 4B</td>
<td>4m 15s</td>
<td>Abdul Naseem</td>
<td>5m 09s</td>
<td>30m 11s</td>
<td>4h 37m 02s</td>
<td>10:40 AM</td>
<td>2h 17m 41s</td>
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<tr>
<td>2034193</td>
<td>ARU E1H</td>
<td>5m 38s</td>
<td>MAHYSH MIZAFFAR</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2030214</td>
<td>CCI Green Flow step 2b - Infusion in 1A</td>
<td>1h 04m 10s</td>
<td>Pratik W Jokar</td>
<td>7m 27s</td>
<td>5m 01s</td>
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<td>11:05 AM</td>
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<tr>
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<td>1h 20m 00s</td>
<td>MAHYSH MIZAFFAR</td>
<td>19m 13s</td>
<td>5m 16s</td>
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<td>1h 47m 41s</td>
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<td>1x 13</td>
<td>13m 15s</td>
<td>4h 25s</td>
<td>1h 21m 20s</td>
<td>10:00 AM</td>
</tr>
</tbody>
</table>
### VMC-MEDICAL ONCOLOGY CLINIC

**Map**
- (All Maps)
- (Ship)
- (Off)
- (On)

**Future Appointments/Acute Patients**
- Tree Display
- Time Display

<table>
<thead>
<tr>
<th>Tag #</th>
<th>Current Area</th>
<th>Time at Current Area</th>
<th>Provider</th>
<th>E/Waiting</th>
<th>MDA</th>
<th>SW</th>
<th>Nurse</th>
<th>APP</th>
<th>Follow</th>
<th>Doctor</th>
<th>Check out</th>
<th>Start Time</th>
<th>Total LOS</th>
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</thead>
<tbody>
<tr>
<td>181889</td>
<td>CCC 1860C Waiting</td>
<td>11m 59s</td>
<td>Malvina Varela</td>
<td>3m 56s</td>
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<td></td>
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<td></td>
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<td>1h 16m 35s</td>
</tr>
<tr>
<td>202159</td>
<td>CCC 601T</td>
<td>11m 55s</td>
<td>Elizabeth Ann Geisinger</td>
<td>10m 30s</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10:00 AM</td>
<td>2h 16m 25s</td>
</tr>
<tr>
<td>201200</td>
<td>CCC 601T</td>
<td>11m 59s</td>
<td>Shomard Bibbs</td>
<td>4m 24s</td>
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<td>1h 50m 25s</td>
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<tr>
<td>203021</td>
<td>CCC 601T</td>
<td>4m 21s</td>
<td>Andrew Campbell McCall</td>
<td>3m 21s</td>
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<td></td>
<td>11:00 AM</td>
<td>1h 16m 25s</td>
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<tr>
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<td>CCC 601T</td>
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<td>Malvina Varela</td>
<td>3m 49s</td>
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<td></td>
<td></td>
<td></td>
<td>10:15 AM</td>
<td>2h 51m 25s</td>
</tr>
</tbody>
</table>
Process Times based on Interactions

Workflow Dashboard

- **Summary**
  - Number of Visits: 1372
  - Average Duration: 2 hours 41 minutes

- **Average Time by Workflow Step**
  - Check out
  - Floor
  - APP
  - Doctor
  - Waiting
  - MGA
  - Notes
  - Check in

Average Visit Time: [Graph showing average times]
Interaction Times by Day – Medical Oncology
Patient Valet Requests

0 Requests

Valet #
Improvement Areas Through Leveraging RTLS

- Decreasing patient cycle time
- Converting non-value-added time to value-added time
- Adding more patient visits, improving patient access
- Increasing patient satisfaction
- Increasing resource utilization
- Driving an increase in an annual net revenue – equating to significant changes to the bottom line
Key to Success

• Have a clear vision and execution plan: invest in solution design, engage with an experienced partner

• Gain leadership support: leadership team was wearing badges 3 months before going live to increase awareness about the project and to alleviate any staff concerns

• Listen to patients and staff feedback: if something is inconvenient, it will not get adopted

• Measure results: think in advance what you want to measure and how will you measure it. Collect pre-implementation data points for benchmarking proposes
Q&A

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