

# Bluetooth beyond Digital Contact Tracing



HERALD

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Linux Foundation Public Health TAC Chair 2022

<https://heraldprox.io/>

**LF** PUBLIC HEALTH

# Agenda

- › Bluetooth LE during SARS-CoV-2
- › Bluetooth MESH and Gateways
- › Hospital deployment benefits
- › Q & A

# The Herald Project's Mission

- › To help healthcare app developers
- › To create applications that pass proximity and message data reliably, accurately, and securely
- › To improve human health outcomes

Herald and Bluetooth LE during SARS-CoV-2

# The Herald API

Herald, an exposure notification library, provides reliable Bluetooth communication and range finding across a wide range of mobile devices, making exposure notification and other use cases highly effective with regular and accurate information.

Herald is a VMware Inc. originated opensource project, donated to LFPH.

More than 97% of phones worldwide can use the Herald Protocol. This can be used to power a range of healthcare use cases, both for individuals and within healthcare facilities.

Herald is used within the Australian Government's COVID-19 app, and the Alberta Canada governments COVID-19 app, Operation Outbreak's STEM app, and by commercial companies including FaceDrive Health (Canada) and Proximos (UK).

# The Herald API's value

- › Consistent across devices
  - › Supports iOS, Android, and wearables, and provides a simplified high-level API
- › Wide device support
  - › Supports iOS and Android devices back to Bluetooth 4.0's release in 2010
  - › Wearable opensource hardware and software implementation too
- › Multi-protocol support
  - › The Herald API is an abstraction layer above the underlying communication mechanism
  - › This includes Protocol and Payload (E.g. GAEN, OpenTrace) as well as technology
  - › Today supports Bluetooth Low Energy and MESH as the underlying technology, but could support NFC, and UWB in future with no API change to the developer

- › What the Herald API provides

- › A multi-device API

  - › Reliable Bluetooth LE

- › Detect

  - › Nearby Herald devices

- › Exchange

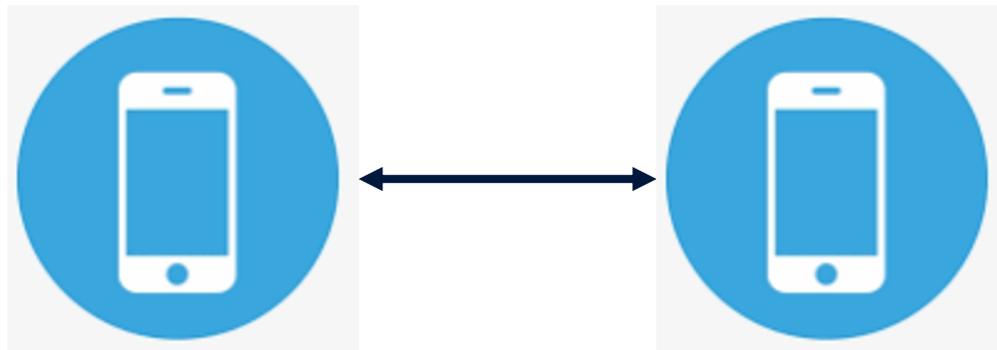
  - › Application Payload data

- › Measure

  - › RSSI / distance regularly

- › Analyse

  - › Exposure and Risk



- > The Herald API's use in Digital Contact Tracing
- > Sensor API, Analysis API and Exposure API, with more in future
- > Device to Device risk estimation
  - > Android & iOS
  - > Wearable devices (C++)
- > Social Mixing Score shown to users
- > Automated venue beacon check-in and check-out
  - > Venue Diary kept on user's phone

giffgaff 17:15 40%

Your Venue Check-in history

Adam's Office	2345
29 Dec In: 15:28 Out: 17:15...	
Adam's Landing	5678
29 Dec In: 15:29 Out: 17:14...	
Adam's Bedroom	3456
29 Dec In: 15:29 Out: 15:47	
Adam's Kitchen	1234
29 Dec In: 15:30 Out: 15:58	
Adam's Pond	6789
29 Dec In: 15:44 Out: 15:47	
Adam's Kitchen	1234
29 Dec In: 16:22 Out: 16:28	
Adam's Kitchen	1234
29 Dec In: 17:13 Out: 17:15...	
Adam's Pond	6789
29 Dec In: 17:13 Out: 17:15...	

15:09

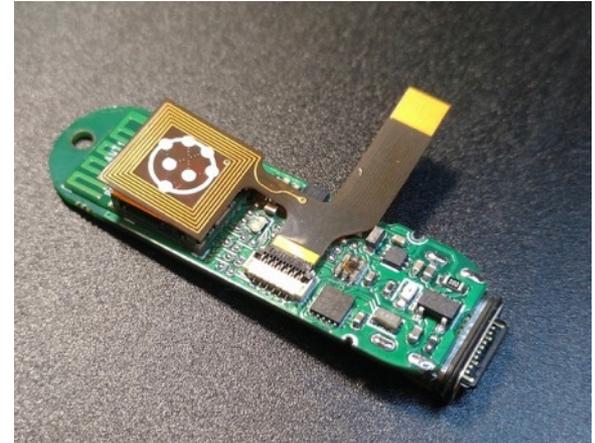
iPhone X (iOS 14.0.1)

PAYLOAD : MOJdTg

Detect	Read	Measure	Share	Visit
16	35	7292	0	0
0	0	65	70	63
16	0	21	84	94
32				
24h	12h	4h	1h	30m
15m	5m	1m		

**DETECTION (1)**

I3bFYw [read] (1106 15:09:41)



# Herald with Bluetooth MESH and LE Gateways

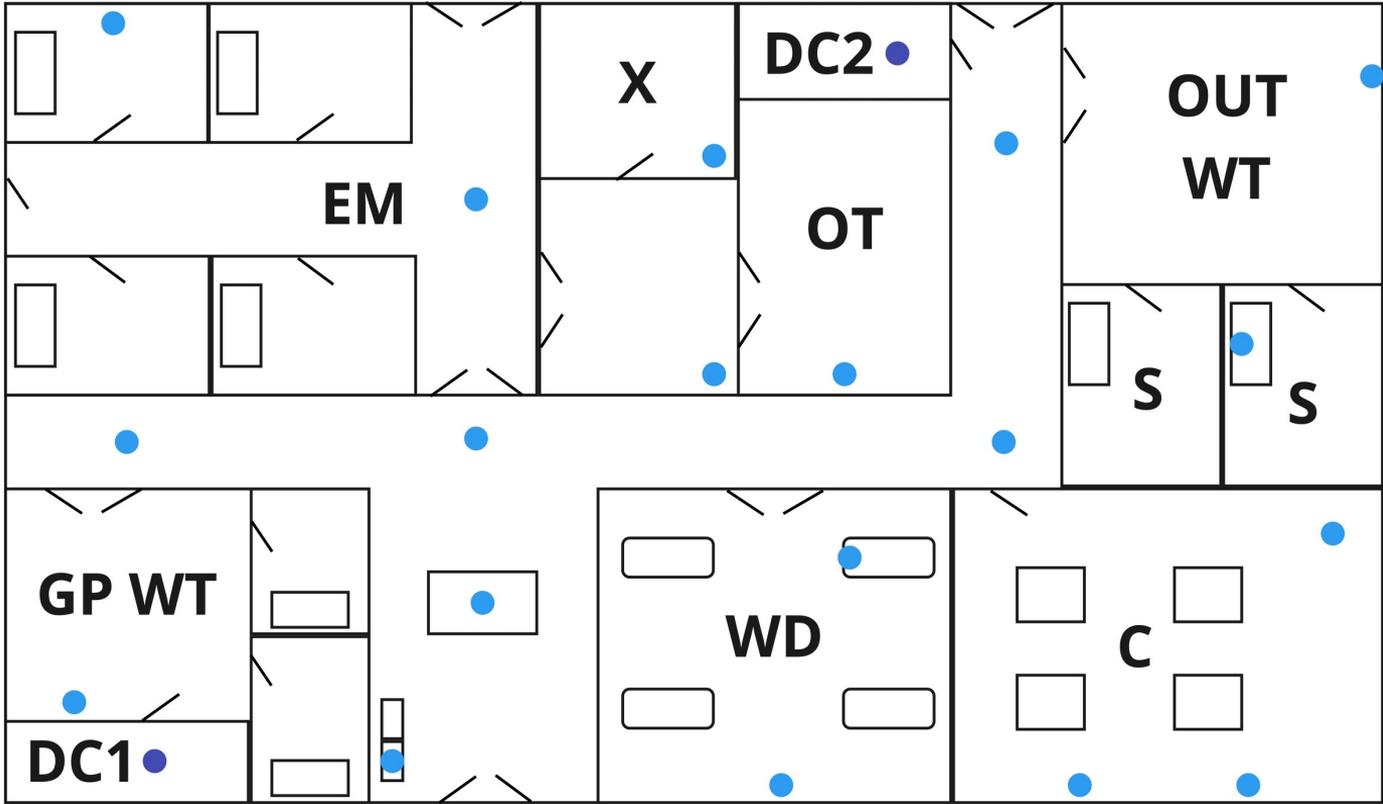
# Bluetooth MESH in Hospitals



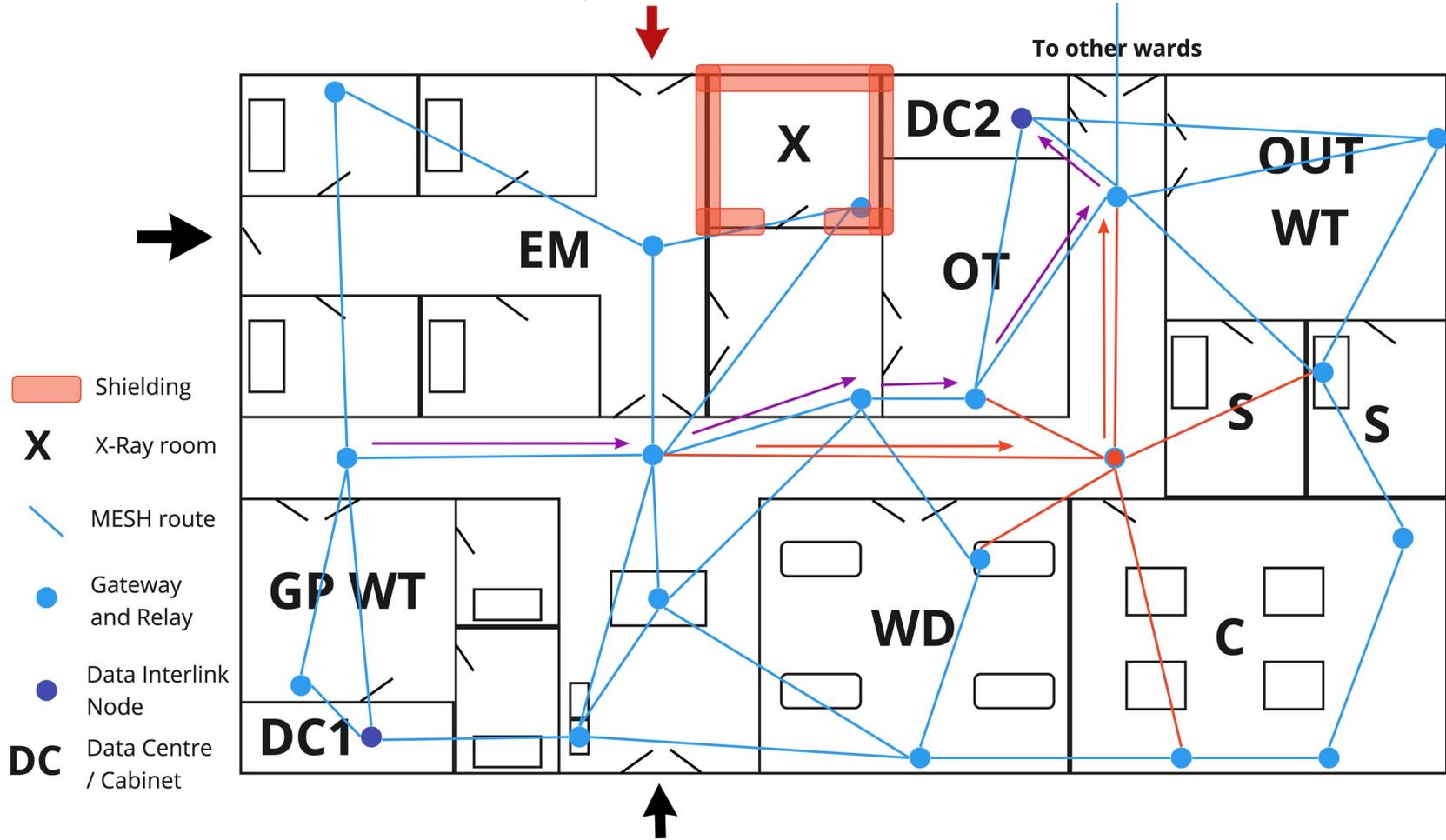
To other wards



- EM** Emergency Department
- X** X-Ray room
- C** Cafe
- DC** Data Centre / Cabinet
- WT** Waiting room
- S** Specialist
- OT** Operating Theatre
- WD** Ward



# Bluetooth MESH in Hospitals



# Hospital Deployment Benefits

# Use Case: Context rich hospital pagers

Saving ~2 full time staff worth of effort per hospital

Specialists within carry pagers in case other areas in the hospital - such as A&E or GP drop-in clinics - need consults.

This just gives the number of the department who has paged. Calling them back and finding the individual, rather than department, who paged can take 10 minutes.

A Herald Bluetooth-MESH secure and reliable hospital network can provide more information, instantly, from anywhere in the hospital as it doesn't rely on external radio networks. It can also tell the originator that the specialist is on their way.

This saves 10 minutes per page. Multiplying this out over 24 hours is the equivalent of 2 full time staff.



# Use Case: Navigating around a complex environment

Finding your way, and making your campus easy to navigate for visitors

A Bluetooth Mesh network within your campus can provide location facilities to places that GPS cannot reach. E.g. Hospitals.

Bacons transmit their location, and a simple mobile app uses this to triangulate its position.

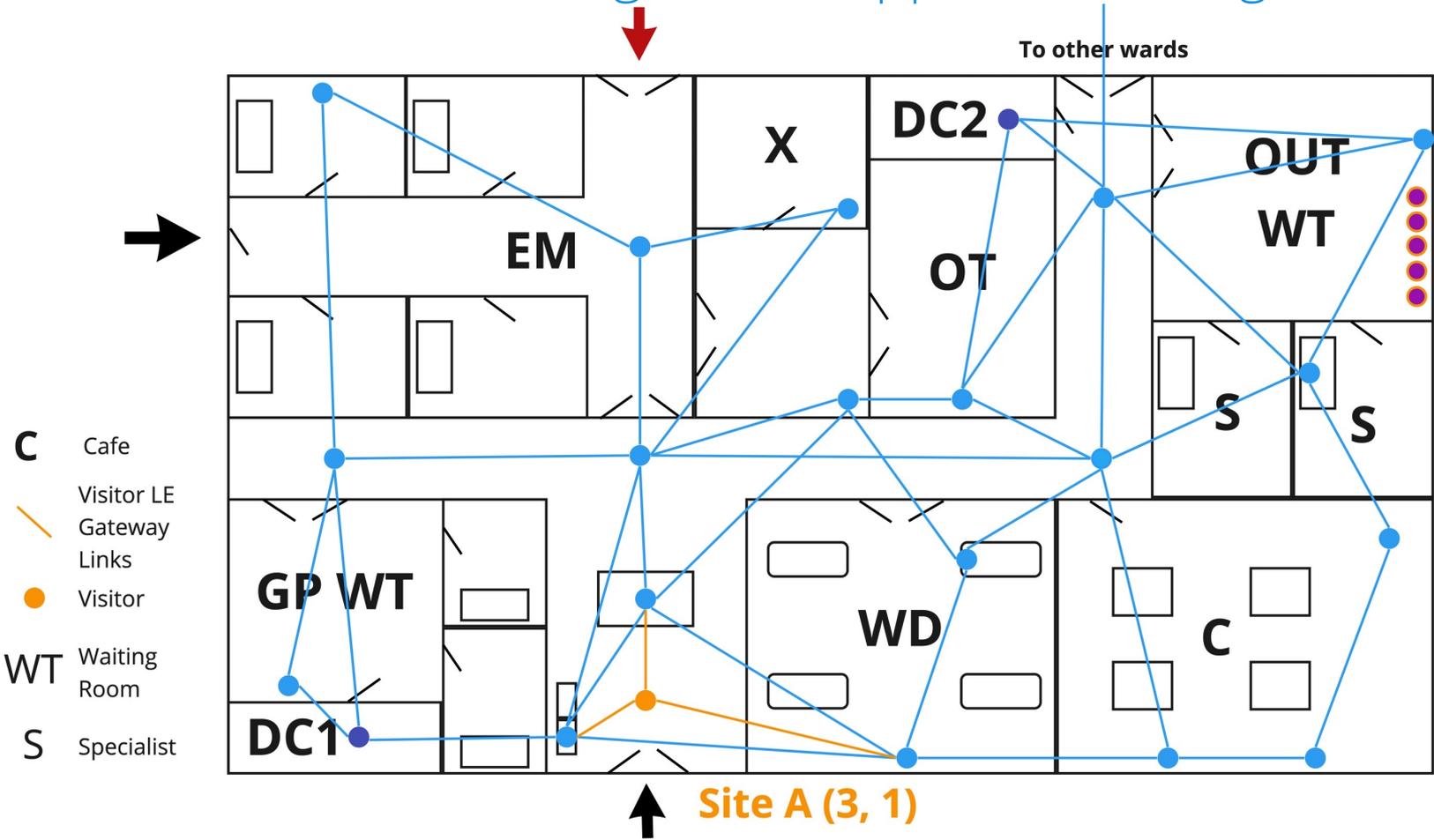
A local map and a searchable list of areas can be downloaded over the same local Mesh network.

Visitors' privacy is preserved, as the operations occur on their own phone.

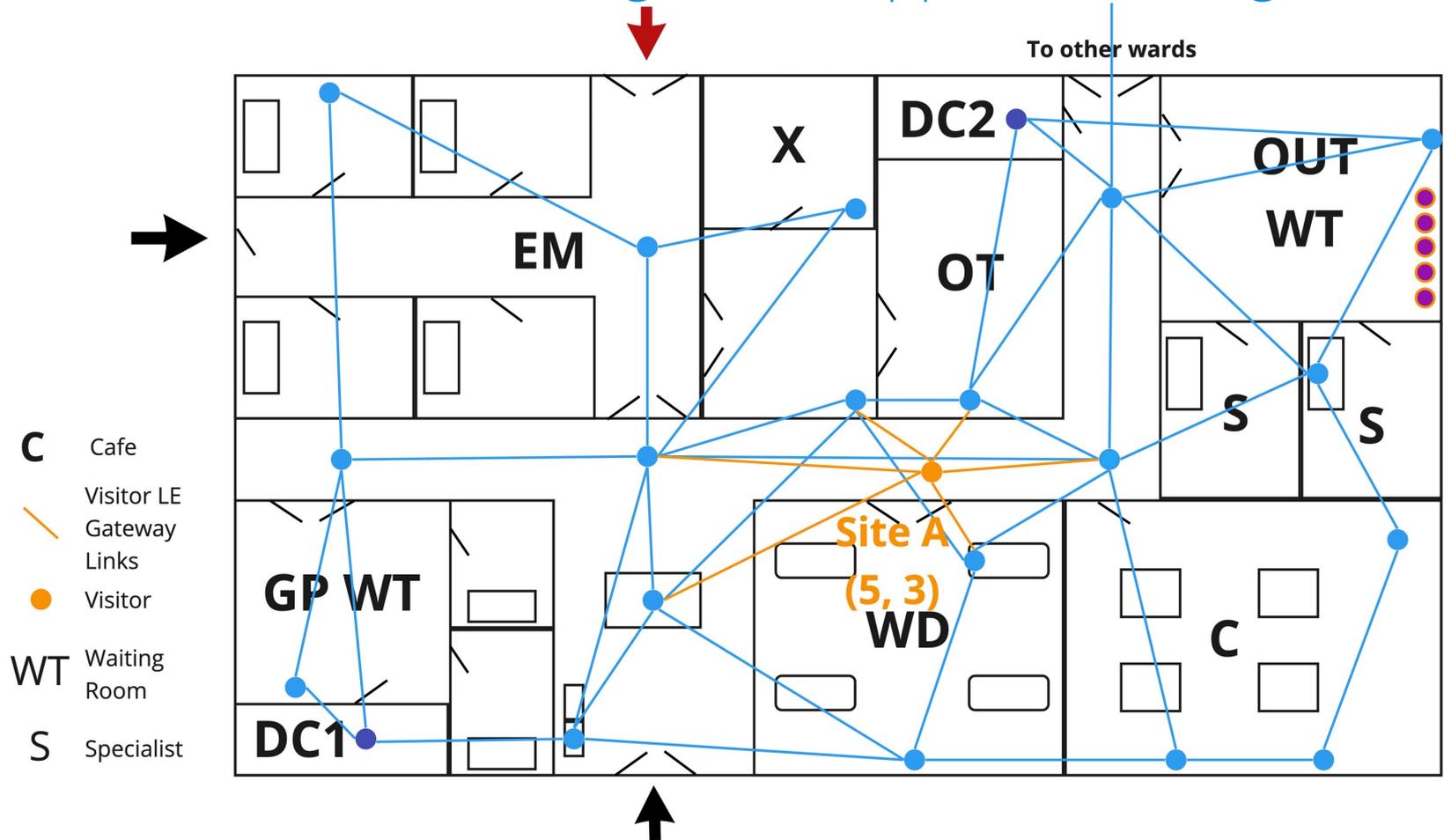
Unattributed visitor location and density data could be captured - useful in emergency evacuation or visitor safety.



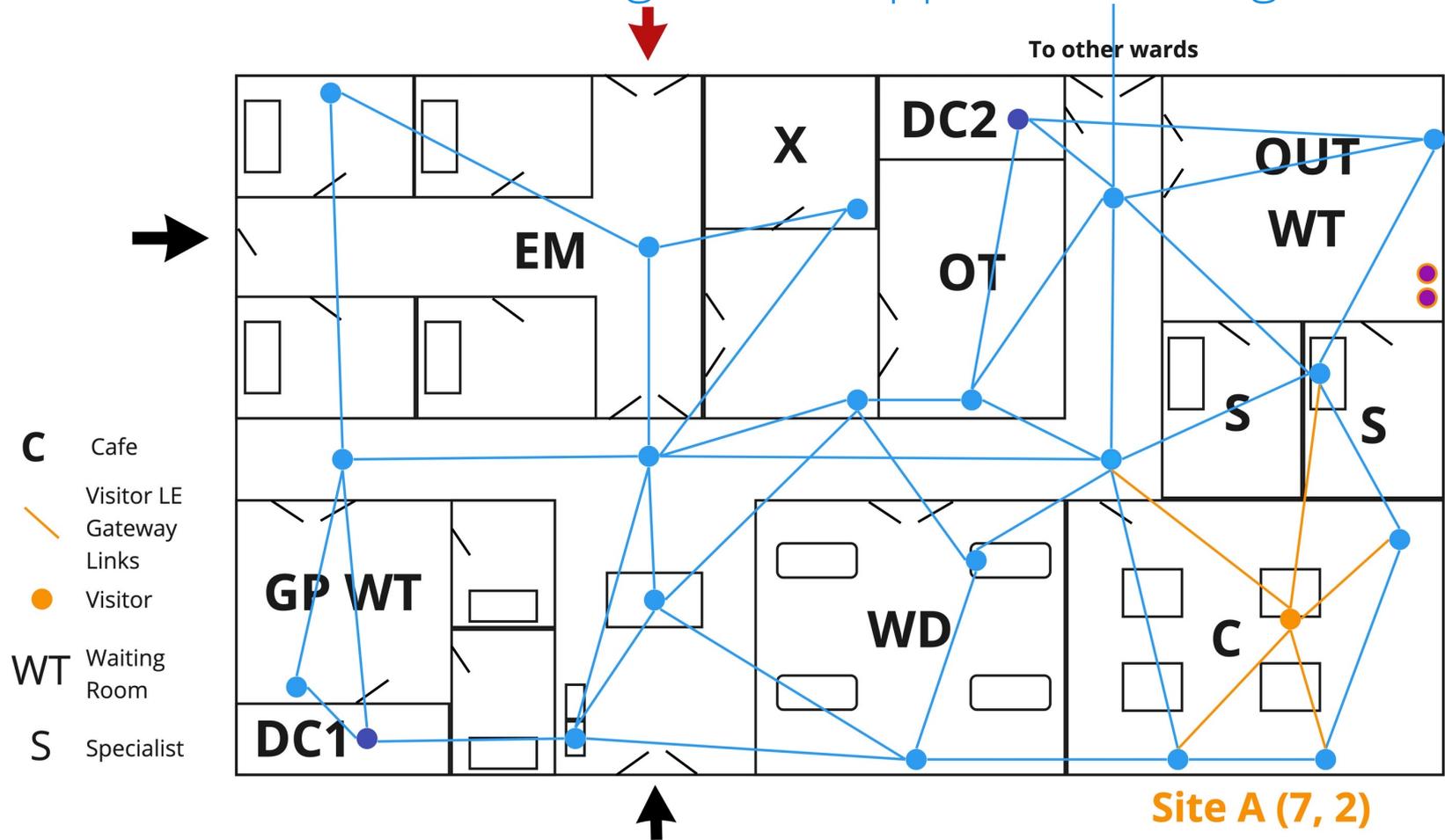
# Bluetooth MESH for Navigation & Appointment Mgmt



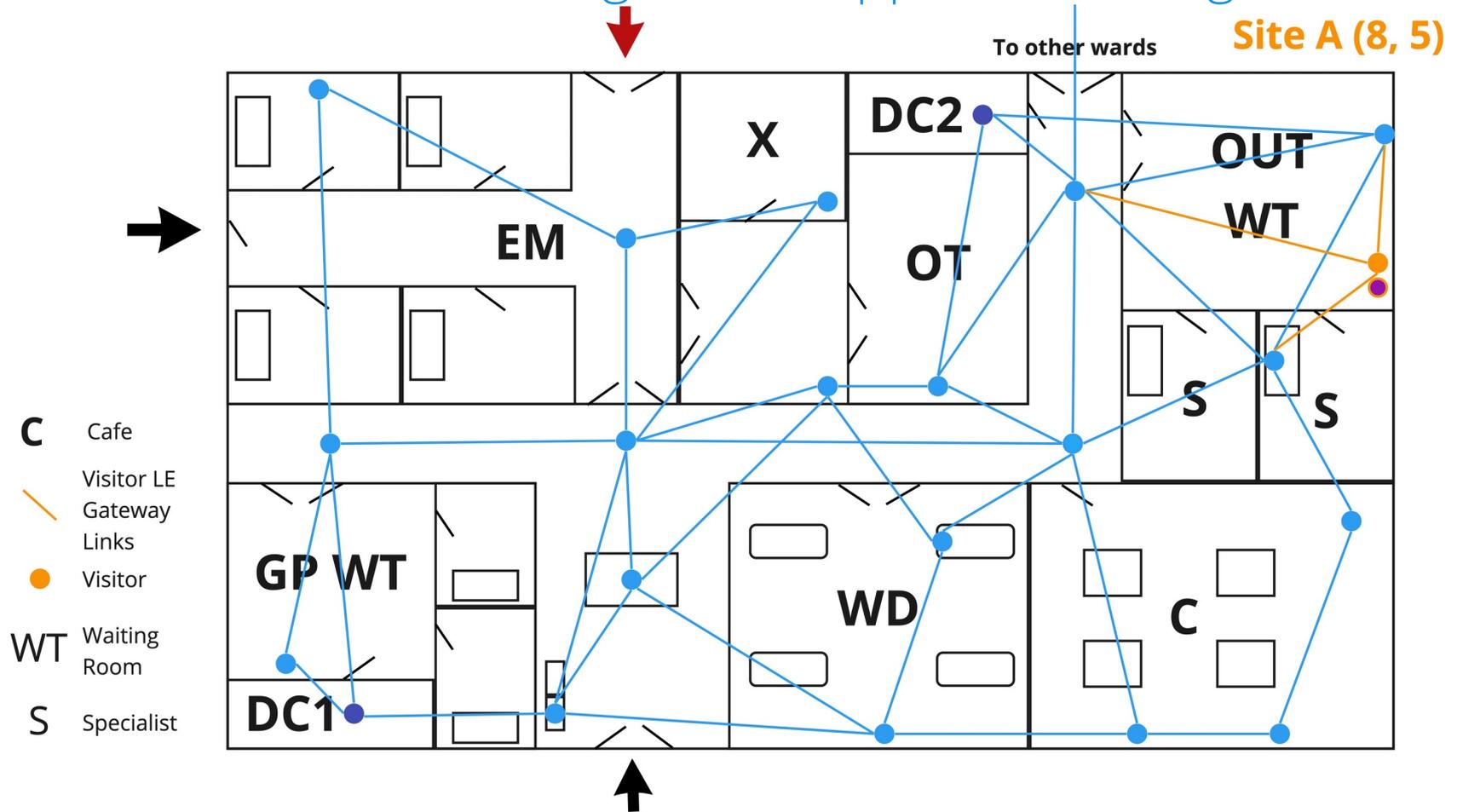
# Bluetooth MESH for Navigation & Appointment Mgmt



# Bluetooth MESH for Navigation & Appointment Mgmt



# Bluetooth MESH for Navigation & Appointment Mgmt



# Use Case: Locating hospital equipment

Making best use of equipment, and getting scarce resources to patients quickly

It's relatively easy to lose even bulky equipment during busy operations in hospitals.

Having an inexpensive tracker attached to medical equipment could allow free and unused equipment to be located quickly.

A virtual map could show items location, highlighting those that are nearest or in areas not used for patient treatment.

Could help locate syringe drivers, ventilators, and other vital equipment in a hurry.

Wouldn't require modification to the function of the devices, and so there's no extra medical device approvals needed.



# Use Case: Supporting assisted living

Help monitor the health of residents and spot warning signs

Assisted living residents live independently but may need additional health monitoring.

A Herald powered wearable can monitor heart rate, blood oxygenation, and skin temperature. Accelerometers can also monitor movement and detect falls.

Data can be shared in real-time via a low-cost Bluetooth MESH connection, or uploaded to a GP's system for in-person review.

In a care home setting, a Bluetooth MESH could also detect if people leave site - a useful safety mechanism for those with dementia.



Upcoming releases

# Upcoming releases

- › Herald API v2.1 – Feb 2022
  - › Exposure Notification and Risk API (Released in Beta-2 in Dec 2021)
  - › Bluetooth MESH Gateways & Relays with Data Models (In testing now)
  - › Self-calibration for Social Mixing Score and Proximity (In testing now)
  - › Location calculations within a MESH environment
- › Herald API v2.2
  - › Our first full wearable release, with opensource hardware fully integrated
  - › Daylight, Temperature, Heart Rate, Blood Oxygenation, Accelerometer sensors
  - › Low-cost, mass producible, eHealth wearable that can be deployed rapidly

Q & A