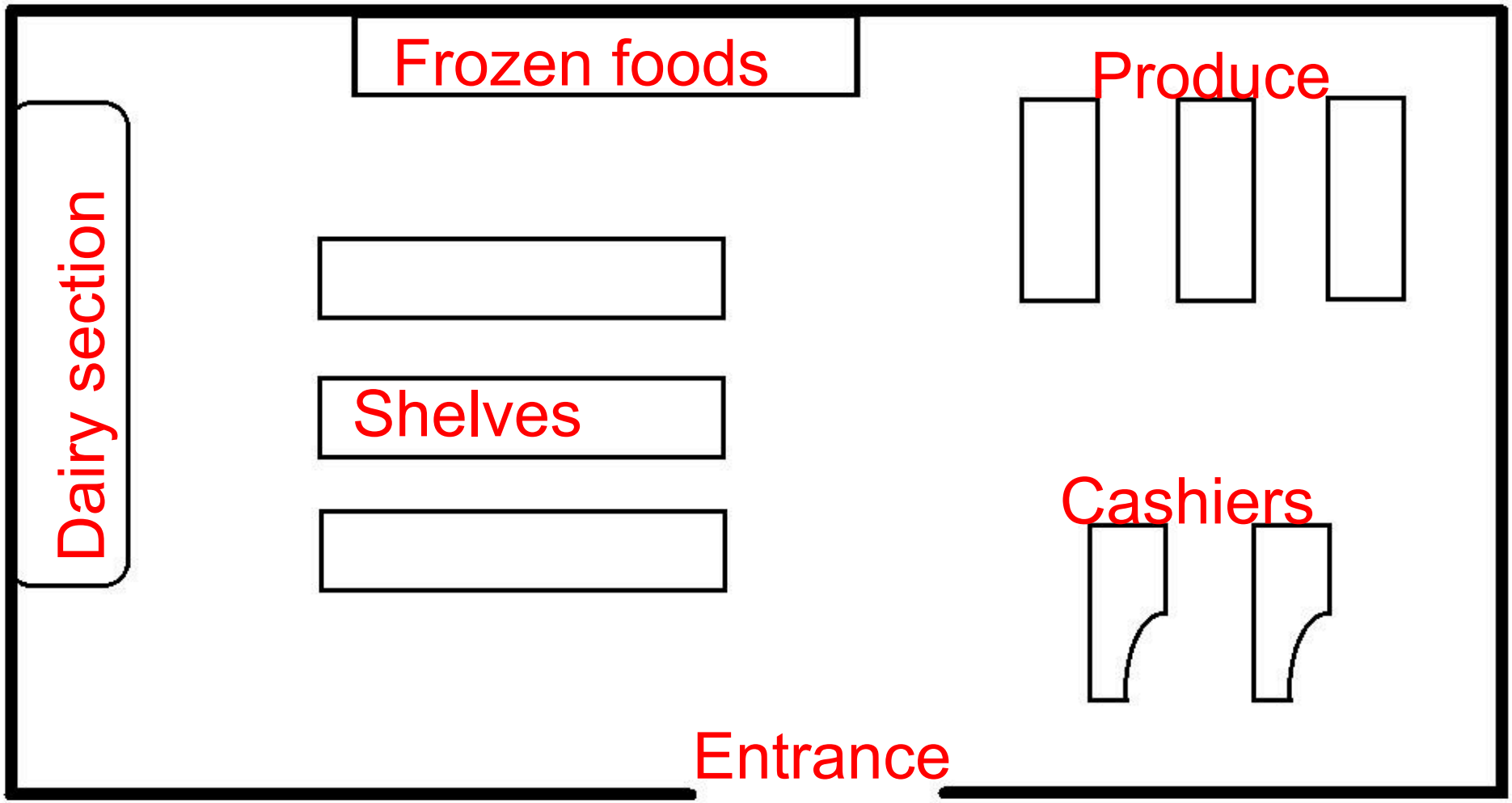
Indoor Location: Sensor Technologies for 2015 and Beyond

Bruce Krulwich
Grizzly Analytics

Example Retail Site

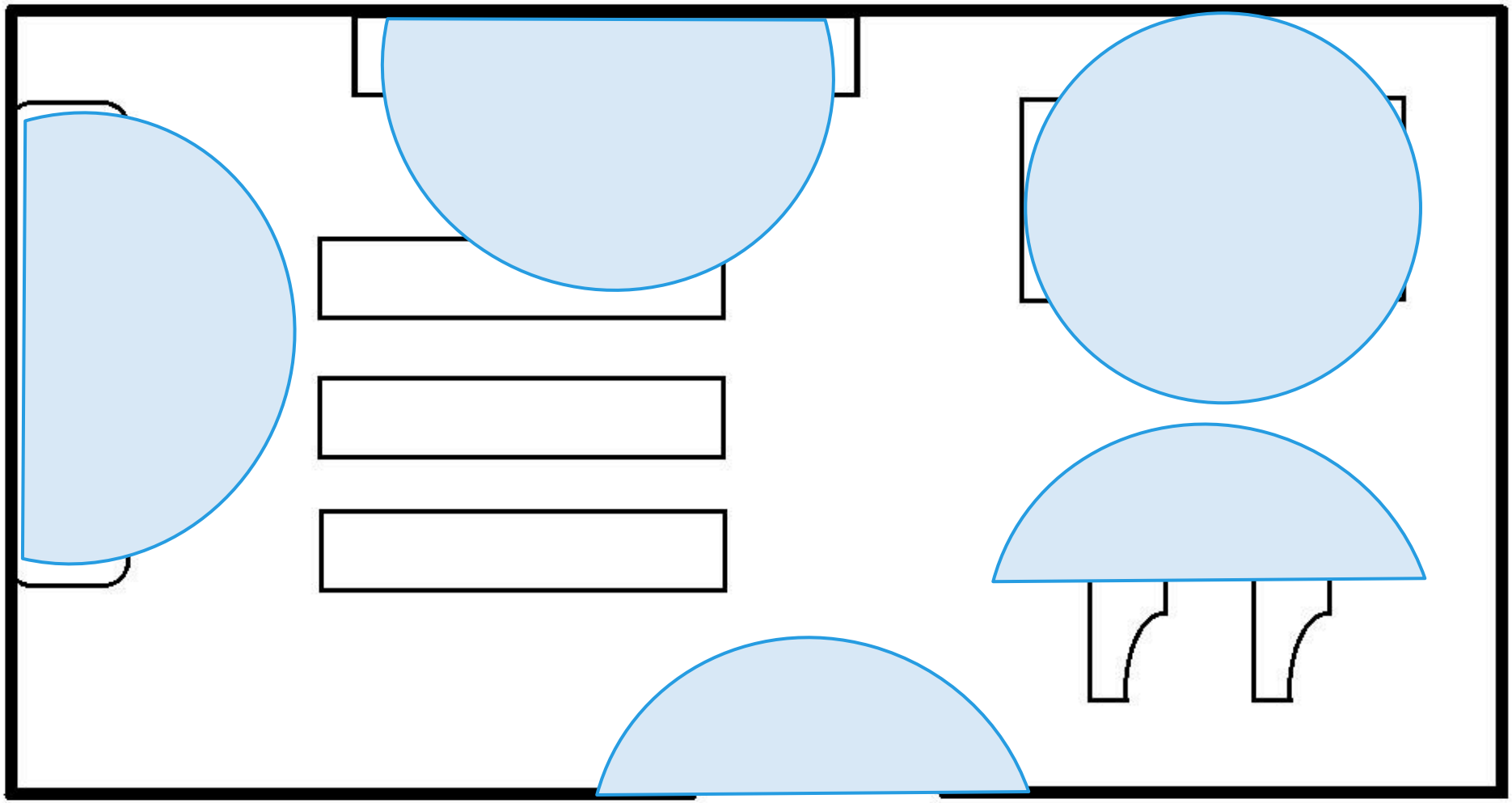


Proximity vs. Location

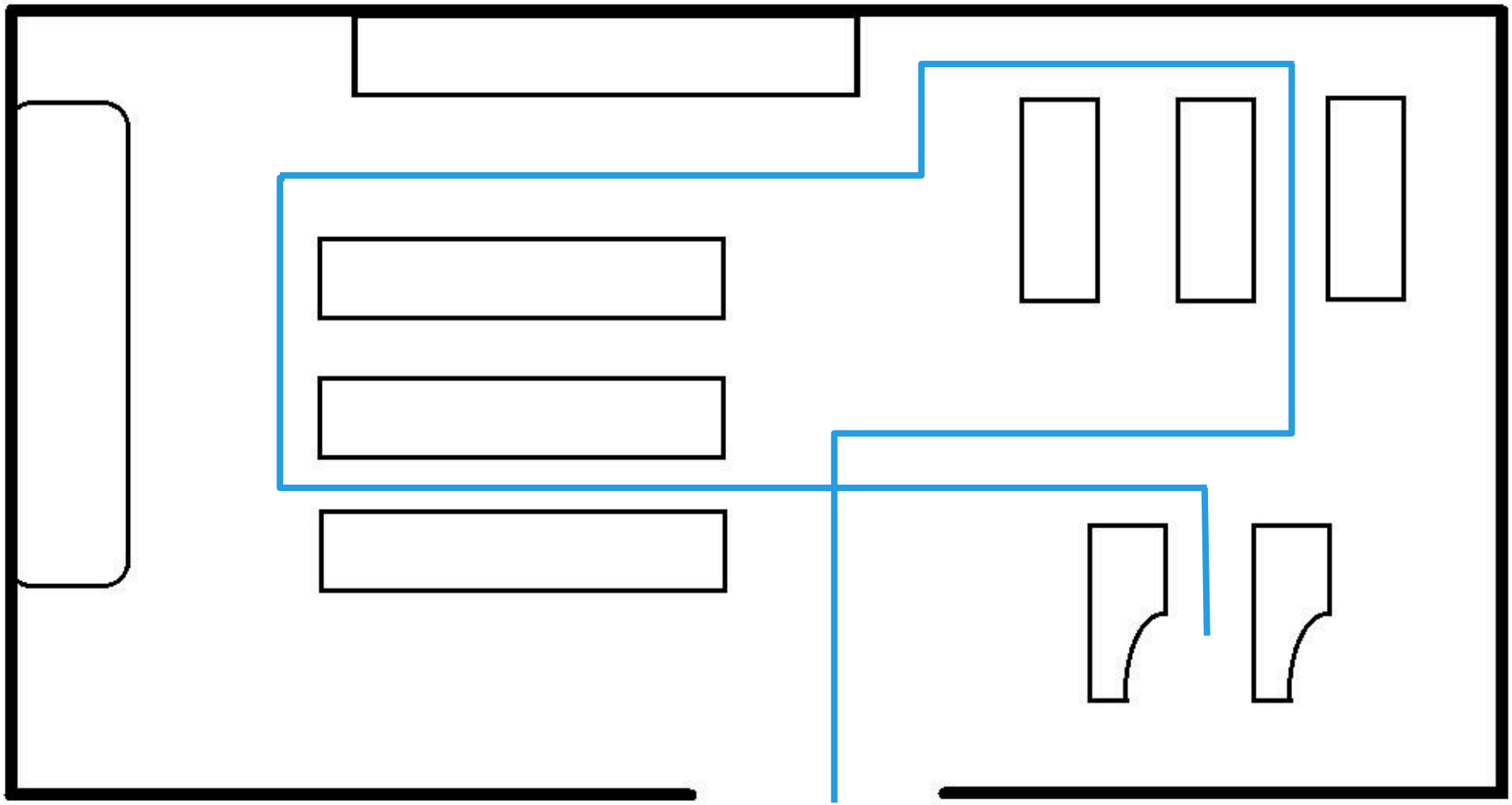
Proximity determines when someone is near a particular place (beacon)

Location tracks everywhere they go

Proximity



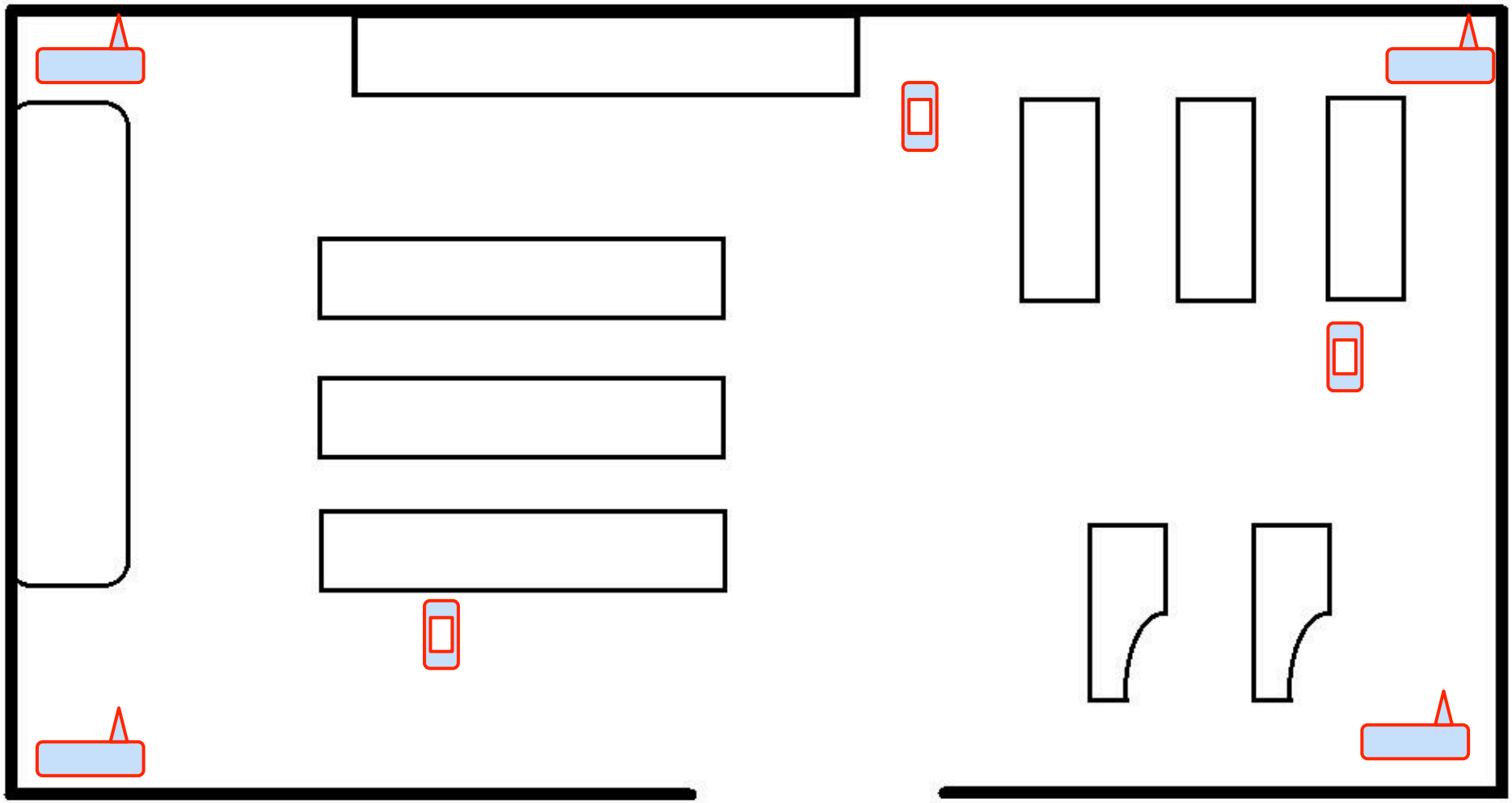
Location



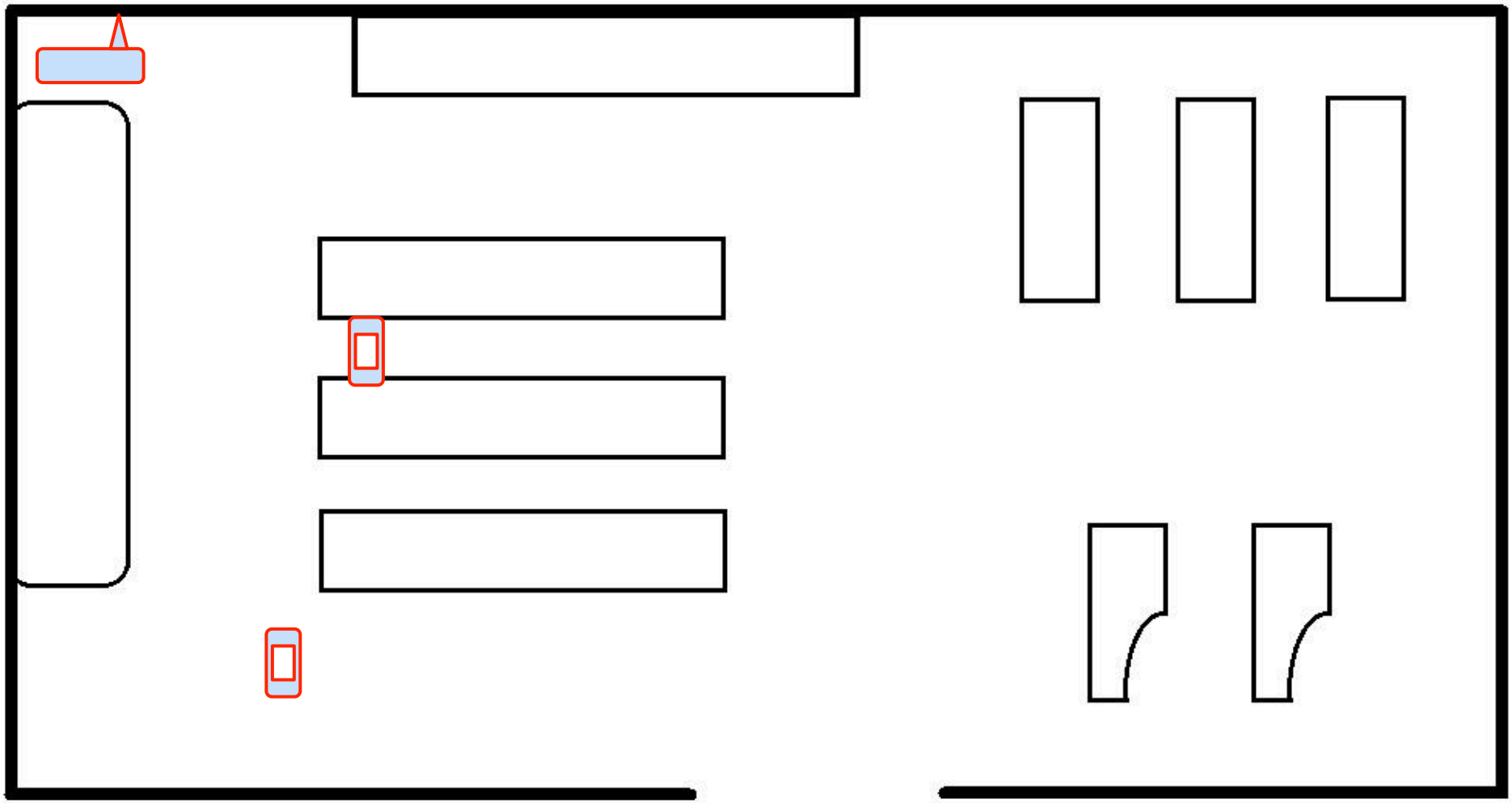
Many Indoor Location Technologies

- Wi-Fi
- Bluetooth (BLE)
- Sensor fusion (motion sensing)
- Visual
- Lighting
- Magnetic fields
- Map constraints
- Network-side
- Ultrasonic sound

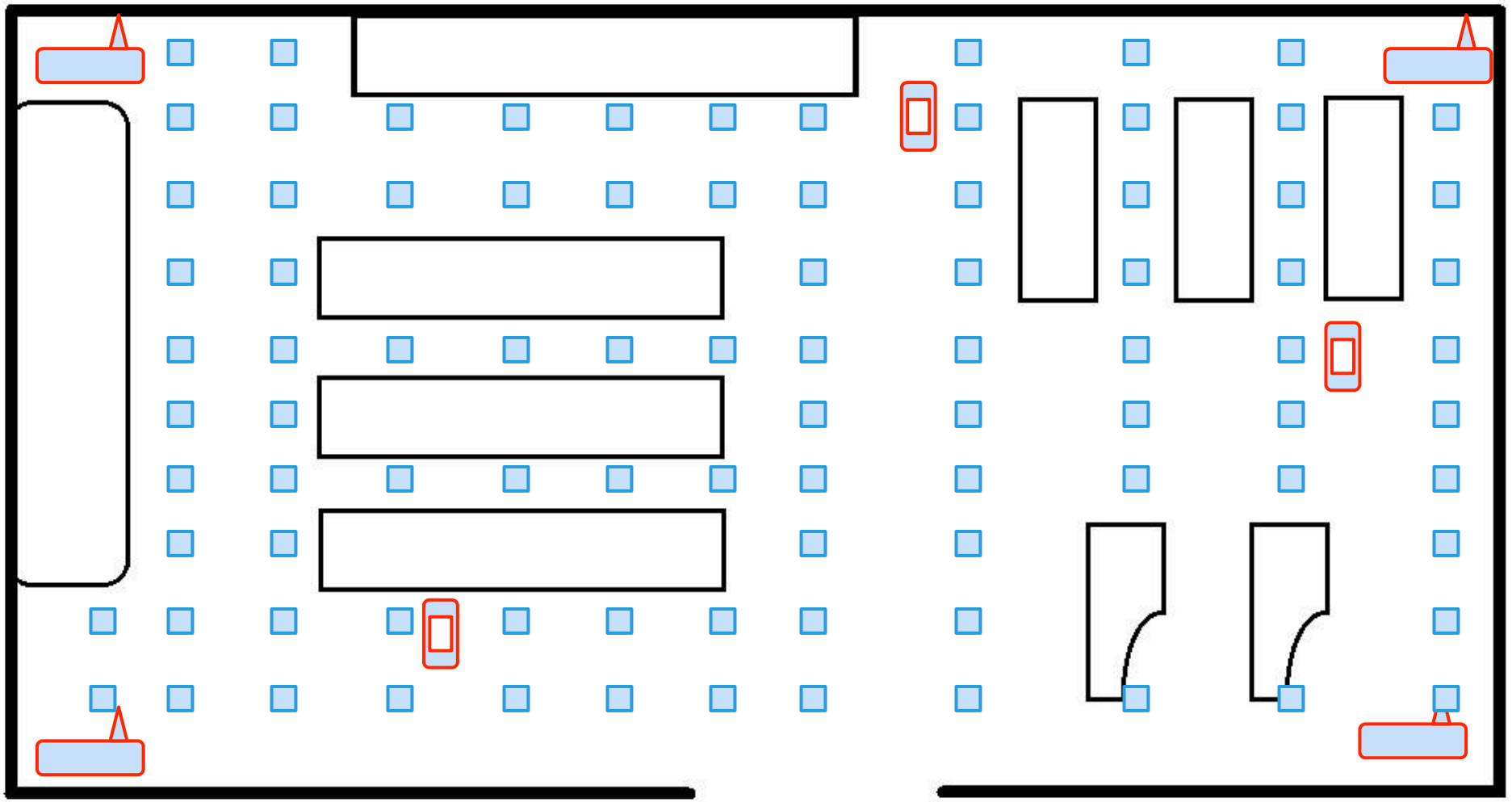
Wi-Fi



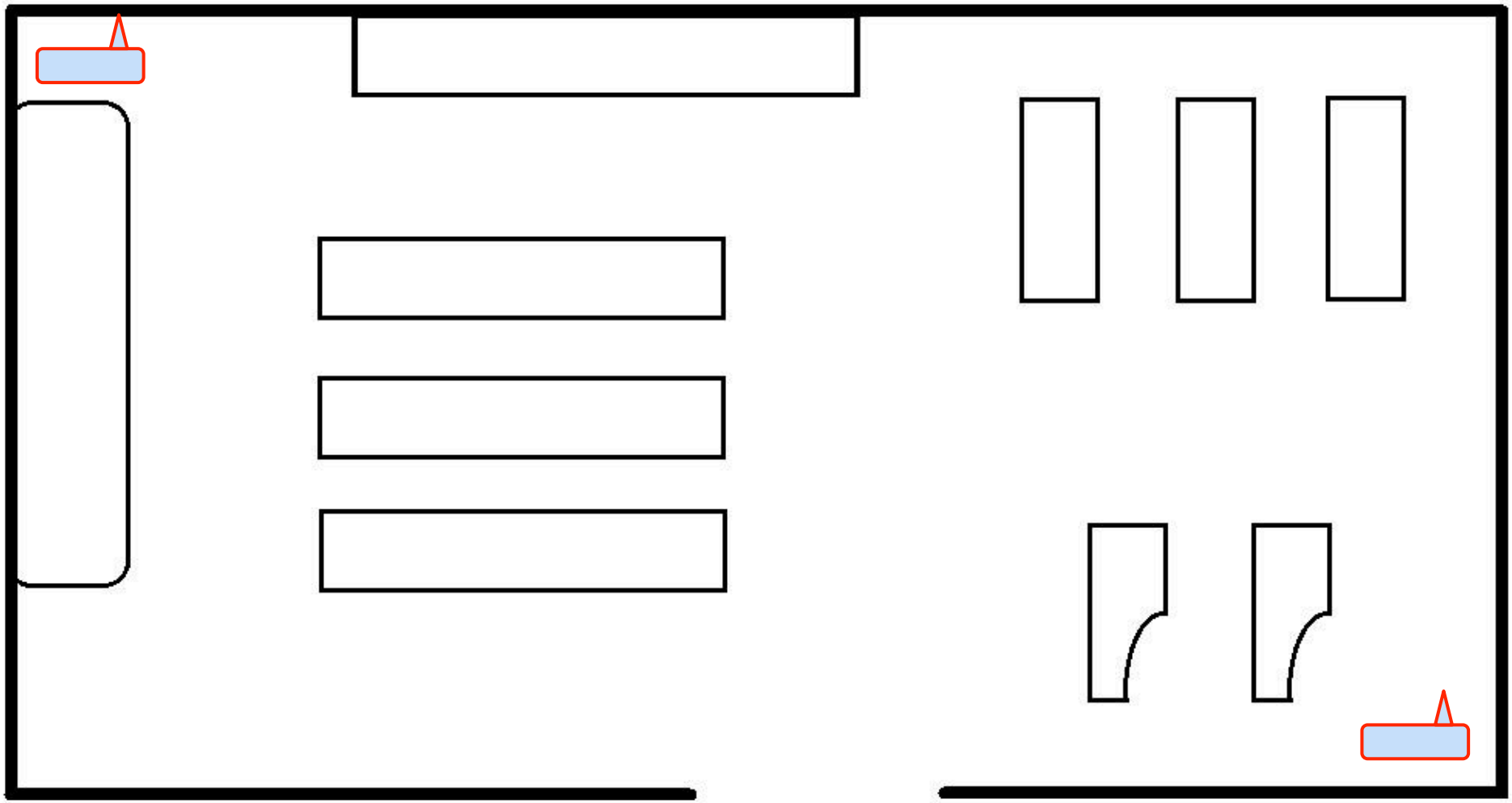
Challenge of Wi-Fi



Fingerprinting

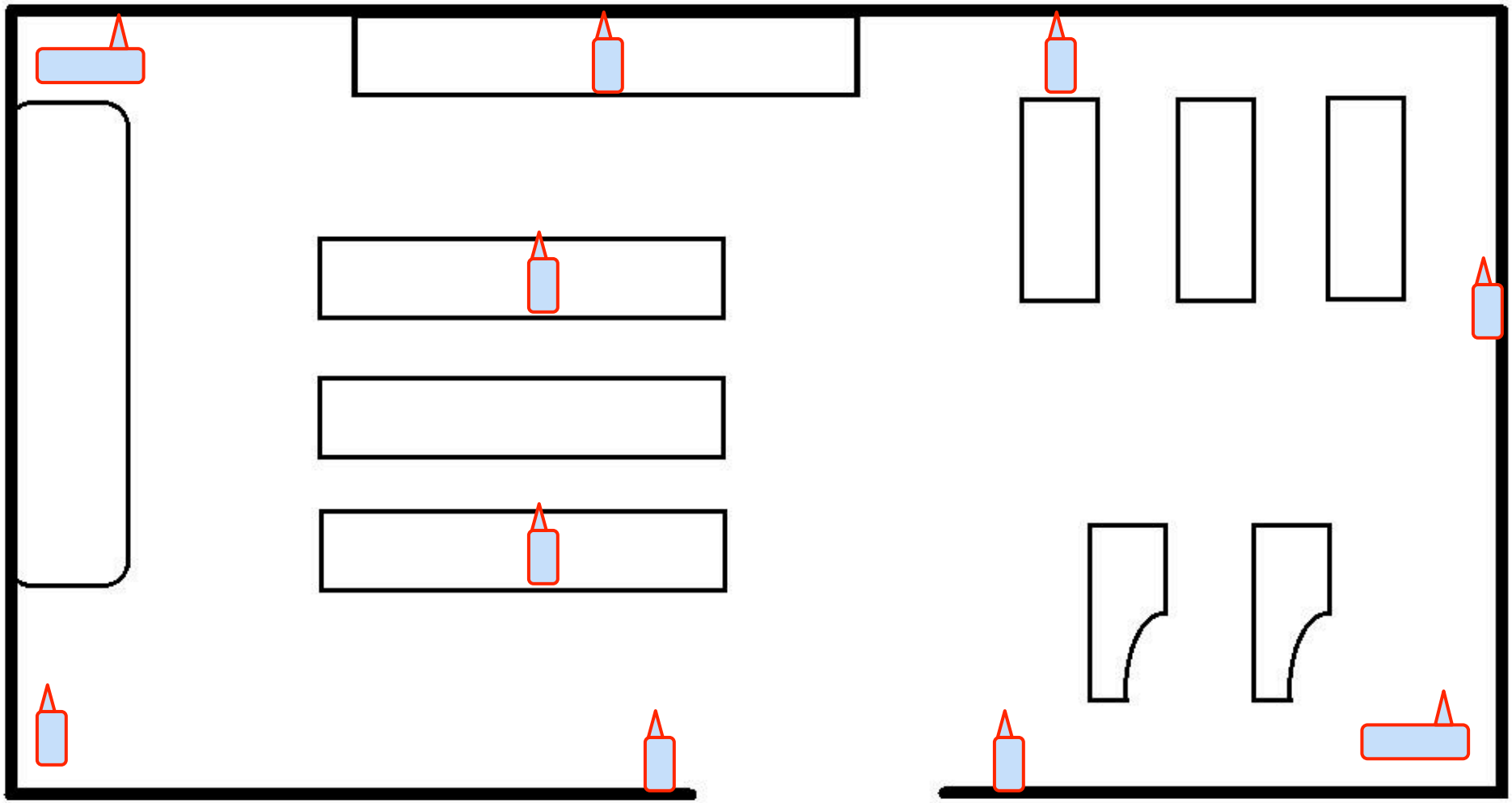


Not enough coverage



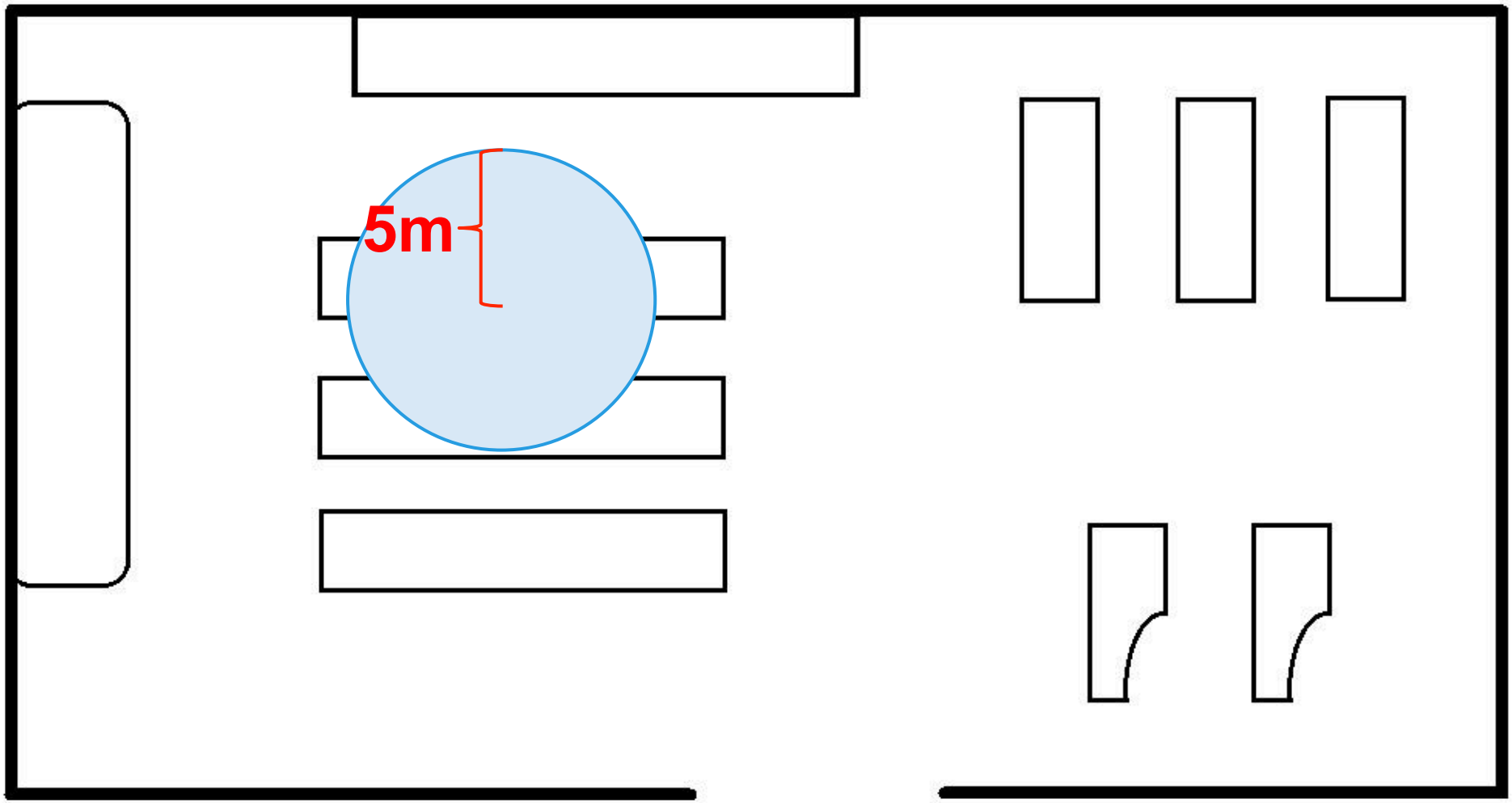
Bluetooth Beacons

GRIZZLY ANALYTICS

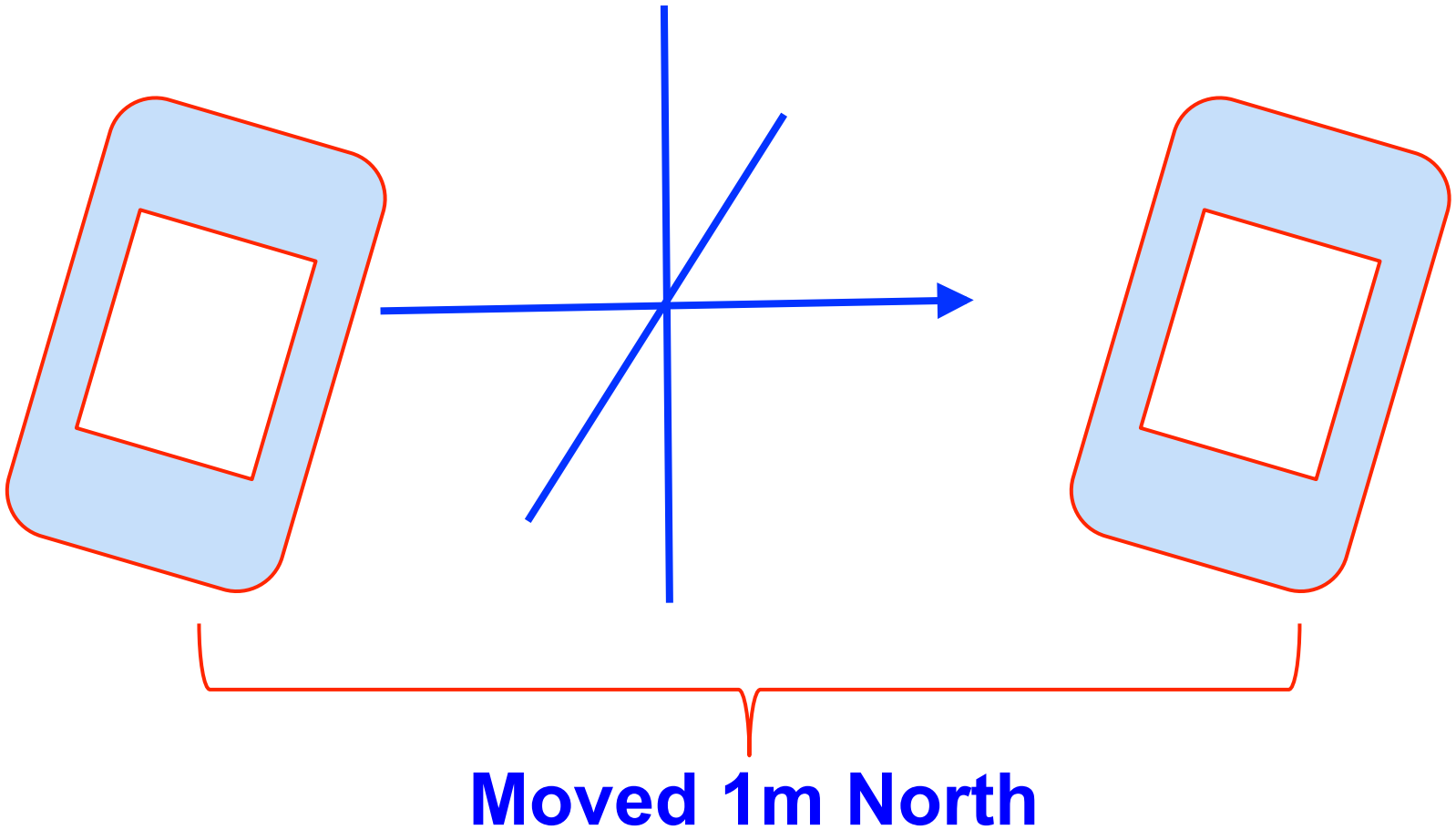


Challenge: Accuracy

GRIZZLY ANALYTICS

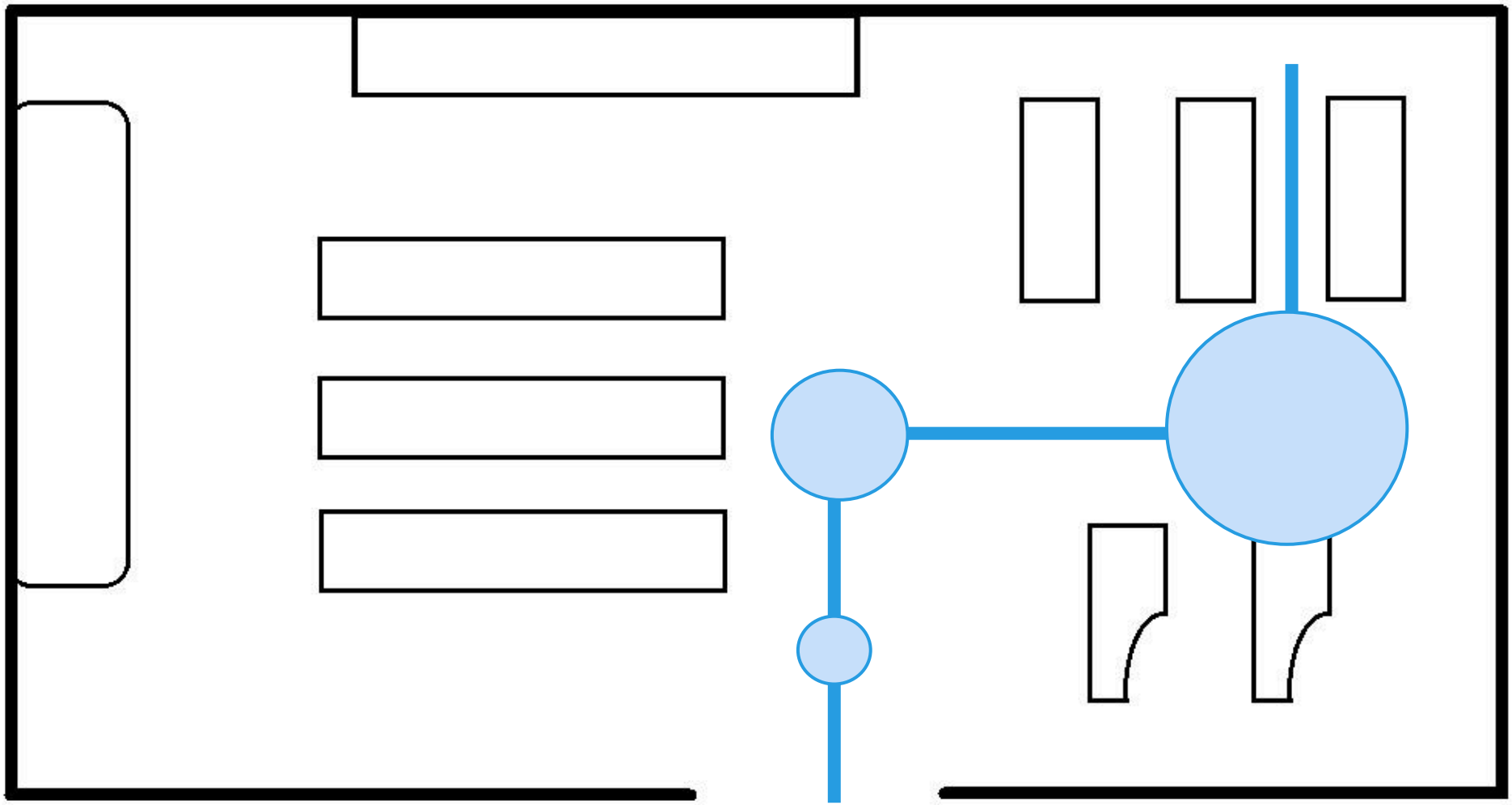


Sensor Fusion: Motion Sensing



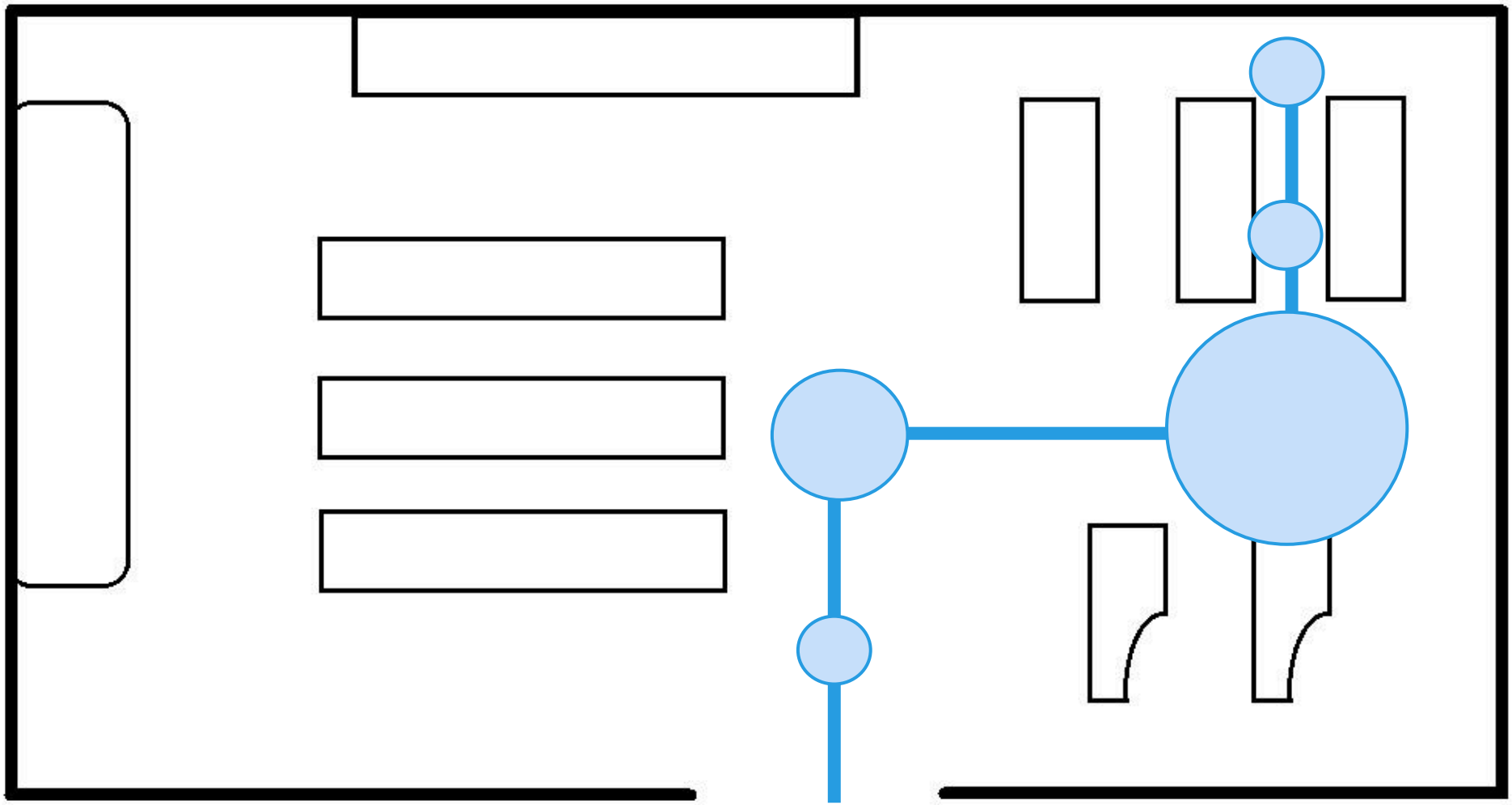
Sensor Fusion Challenge: Drift

GRIZZLY ANALYTICS

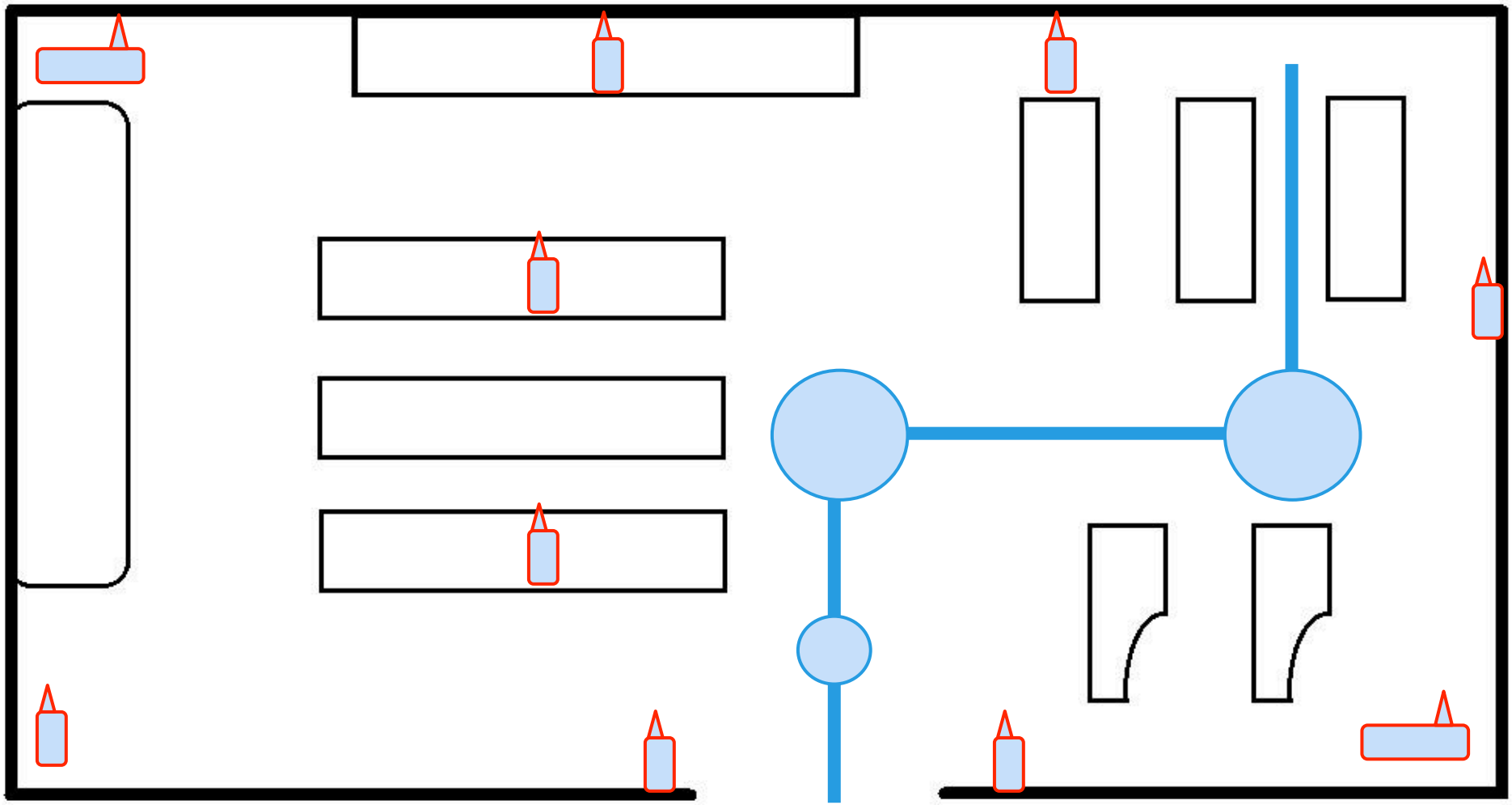


Sensor Fusion with Maps

GRIZZLY ANALYTICS



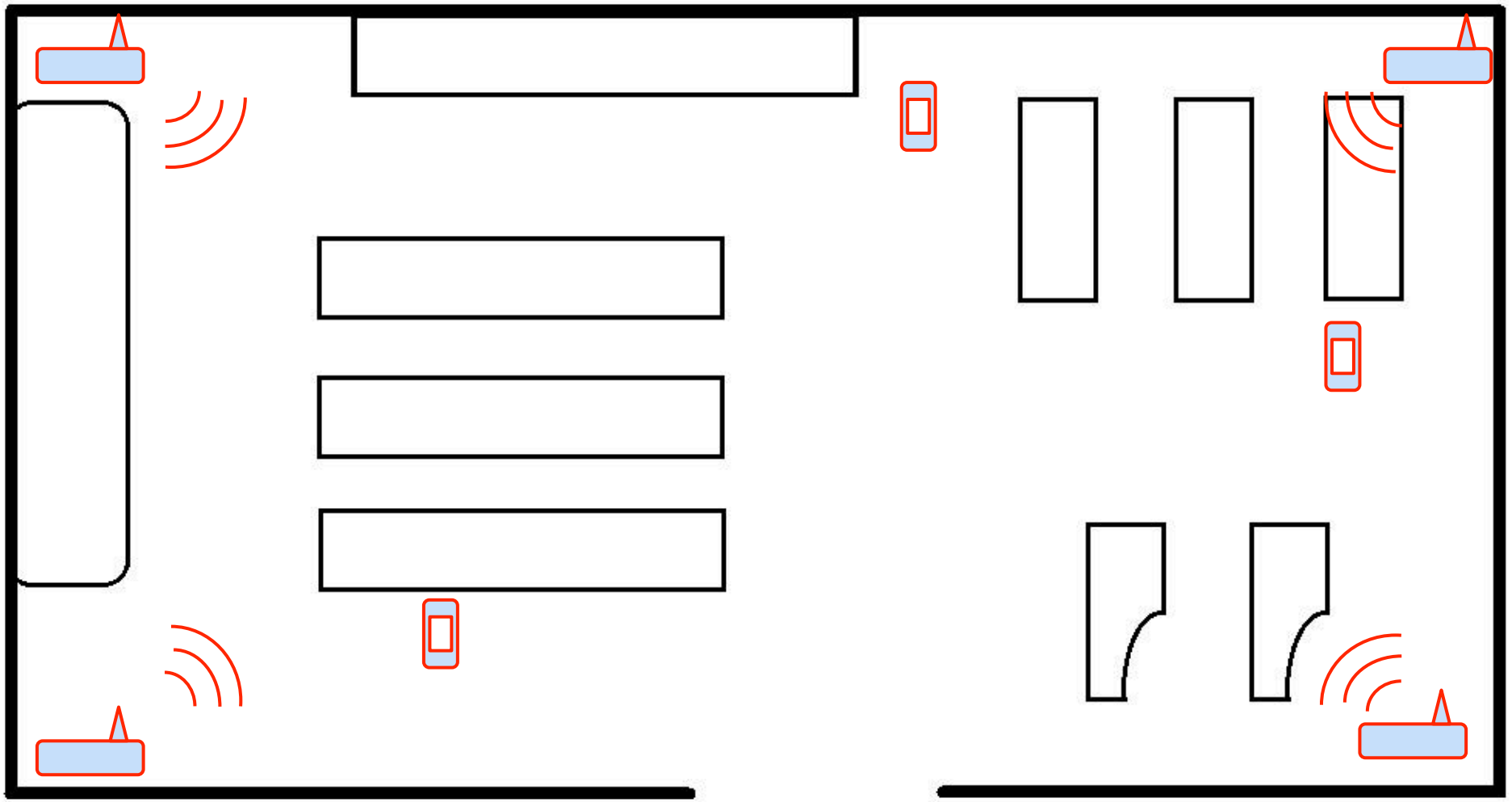
Combining Methods



What We've Seen

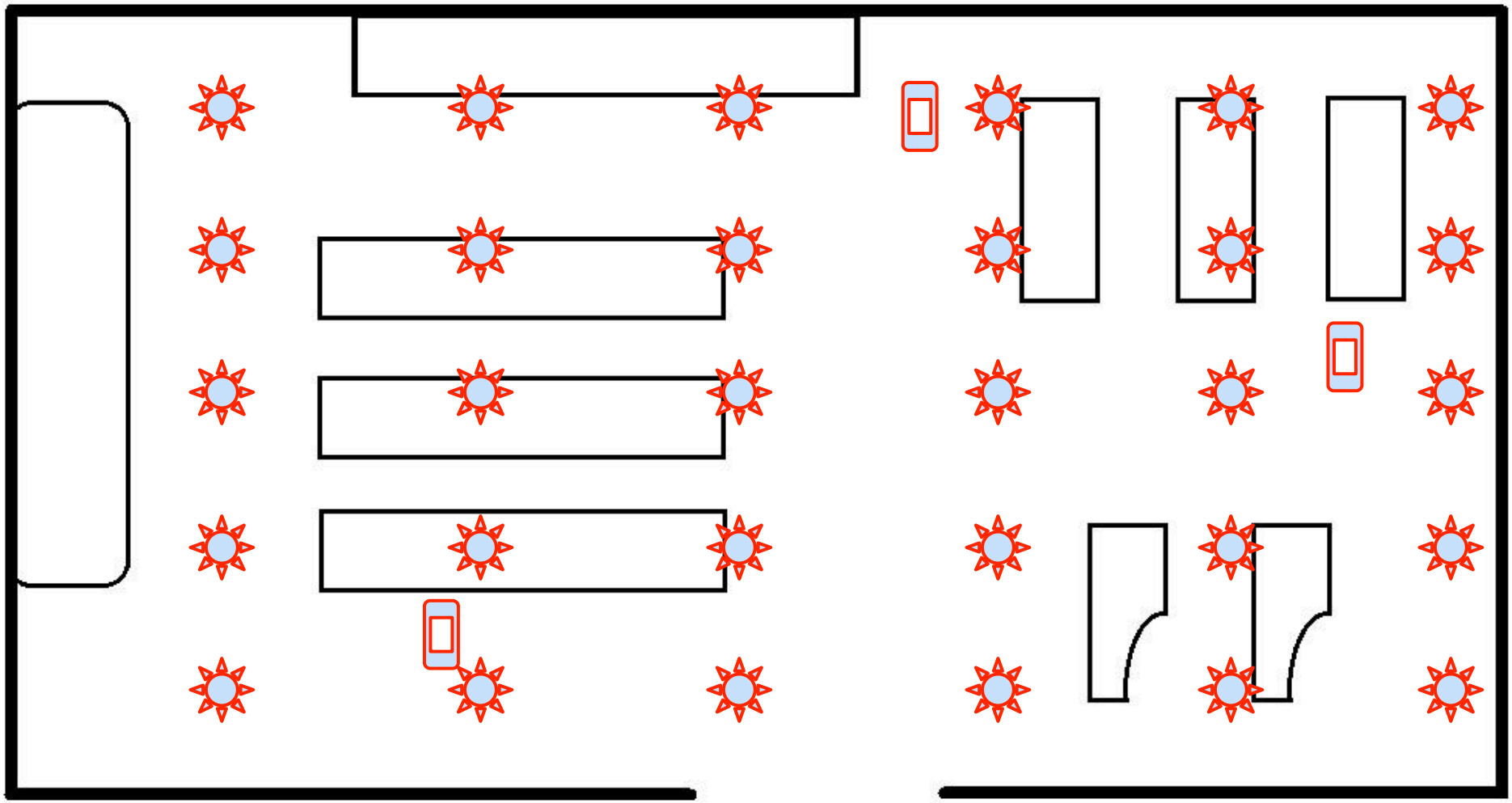
Tedious fingerprinting
BLE beacons: Require deploying them
Accuracy: A challenge
All methods: Require running app on phone

Network Tracking Phones

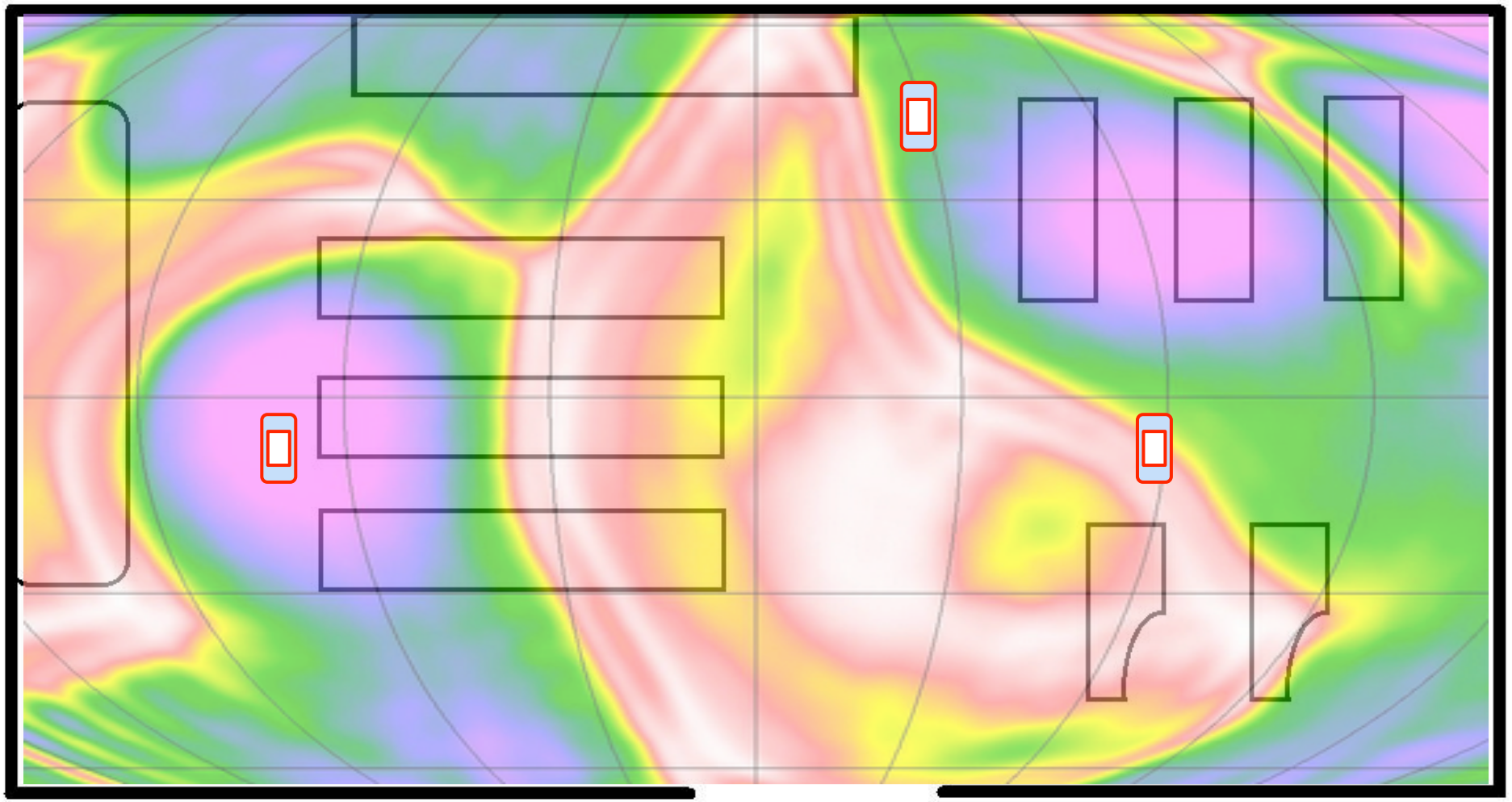


Smart Lighting

GRIZZLY ANALYTICS



Magnetic Fields



Other Technologies

GRIZZLY ANALYTICS

- SLAM: Automatic fingerprinting
- Improved motion sensing accuracy
- Visual methods using phone camera
- Ultrasonic sound
- Advanced Bluetooth or Wi-Fi
- Advanced radio

Tradeoffs

- Accuracy
- Cost
- Speed of update (latency)
- Effort in customization (fingerprinting)
- New infrastructure - installing beacons
- 2D or 3D
- Need to run application
- Tracking vs privacy
- Range
- Android, iOS, others
- Maintenance

What's Next in Indoor Location Technologies

What We've Seen: Tradeoffs

- Accuracy
- Cost
- Effort in customization (fingerprinting)
- New infrastructure - installing beacons
- 2D or 3D
- Need to run application
- Tracking vs privacy
- Range
- Android, iOS, others
- Maintenance

What's Coming Next in Indoor Location

GRIZZLY ANALYTICS

SITE-SPECIFIC

- Easier deployment
- Wide differences in cost and accuracy
- Stronger analysis of user movement
- Back-end integration

UNIVERSAL

- Works anywhere
- No site preparation
- Less accurate than site-specific
- Focus on app integration, phone features

For Retail This Means….

Knowing who stands in front of which products

Knowing which ads bring people in, and what they do when they're in the store

Truly understanding your customers

Communicating with customers when they're exactly at the right place

The Future is Almost Here

At least six companies are delivering sub-meter accuracy on smartphones.

At least ten companies are developing self-configuring indoor location systems

At least five companies are working on cutting edge methods not discussed today

Wrapping Up

We've seen a lot of technologies, and (hopefully) understood them a bit better

We've seen a lot of tradeoffs between different approaches

A lot of things that really matter to getting what you want out of the systems

Even more coming soon….