

Indoor Tracking

(An example of integrating IoT into ArcGIS)

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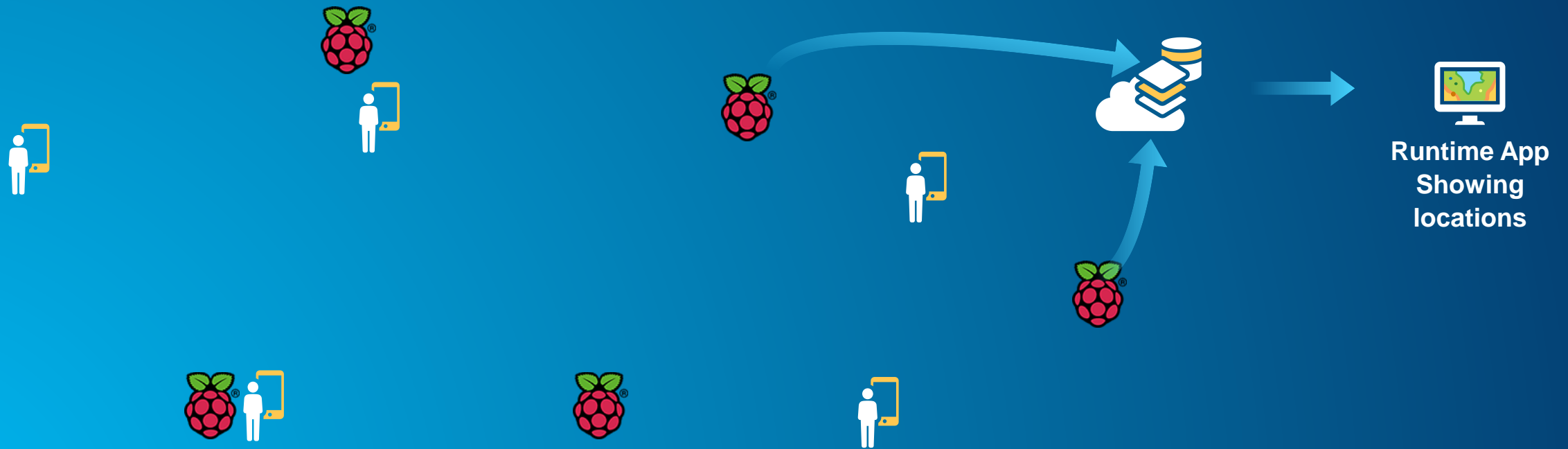


Indoor Tracking

- **Fun stuff with IoT!**
- **How do I find someone?**
- **Raspberry Pi**
- **Data collection from IoT into ArcGIS**
- **Visualize using ArcGIS Runtime**
- **Live demo and someone could get hurt!**

Goal : Indoor GPS?

- I want to find Eric, Morten, Rex, Mike, Will, Tyler...
- A network of devices listening to Bluetooth signals
- Each sends the signal levels received to a feature service
- All signal levels are post processed to visualise locations in a Runtime app



A closer look at the Raspberry Pi!

- It's a small computer!
- 1.2GHz Quad-Core ARM Cortex-A53 (64Bit)
- Powerful GPU : OpenGL ES 2.0
- 1Gb Memory
- Boots from SD card : Linux or Windows 10 IoT
- 4 USB ports
- WiFi and Bluetooth
- HDMI port
- Network port
- GPIO



GPIO : The interface to the outside world

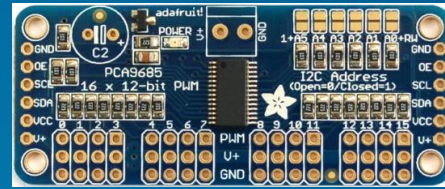
- General Purpose Input / Output pins
- Interface with data collection sensors:
 - GPS
 - Temperature
 - Light
 - Compass
- Control motors or servos
- GSM communications
- And endless more things

Pin#	NAME		NAME	Pin#
01	3.3v DC Power	⬇	DC Power 5v	02
03	GPIO02 (SDA1 , PC)	⬇	DC Power 5v	04
05	GPIO03 (SCL1 , PC)	⬇	Ground	06
07	GPIO04 (GPIO_GCLK)	⬇	(TXD0) GPIO14	08
09	Ground	⬇	(RXD0) GPIO15	10
11	GPIO17 (GPIO_GEN0)	⬇	(GPIO_GEN1) GPIO18	12
13	GPIO27 (GPIO_GEN2)	⬇	Ground	14
15	GPIO22 (GPIO_GEN3)	⬇	(GPIO_GEN4) GPIO23	16
17	3.3v DC Power	⬇	(GPIO_GEN5) GPIO24	18
19	GPIO10 (SPI_MOSI)	⬇	Ground	20
21	GPIO09 (SPI_MISO)	⬇	(GPIO_GEN6) GPIO25	22
23	GPIO11 (SPI_CLK)	⬇	(SPI_CE0_N) GPIO08	24
25	Ground	⬇	(SPI_CE1_N) GPIO07	26
27	ID_SD (PC ID EEPROM)	⬇	(PC ID EEPROM) ID_SC	28
29	GPIO05	⬇	Ground	30
31	GPIO06	⬇	GPIO12	32
33	GPIO13	⬇	Ground	34
35	GPIO19	⬇	GPIO16	36
37	GPIO26	⬇	GPIO20	38
39	Ground	⬇	GPIO21	40

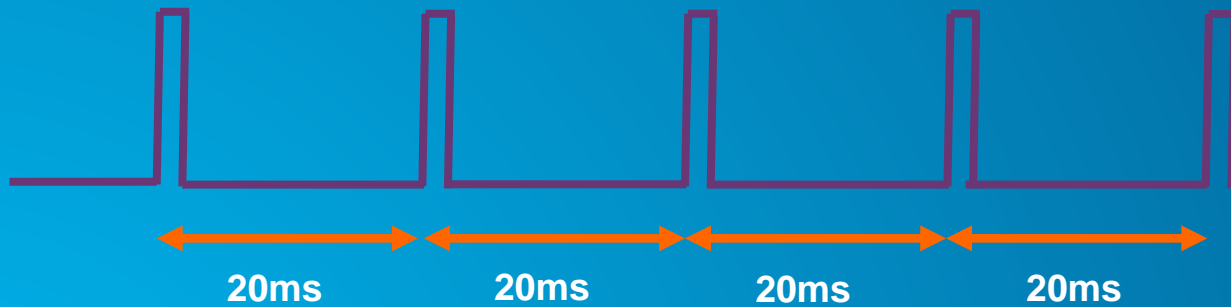
rev. 1
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<http://www.element14.com>

Controlling servos



- Spindle can be controlled to angle the control arm
- 0 – 180degrees
- PWM signals
- Vary pulse width length between 1 and 2ms



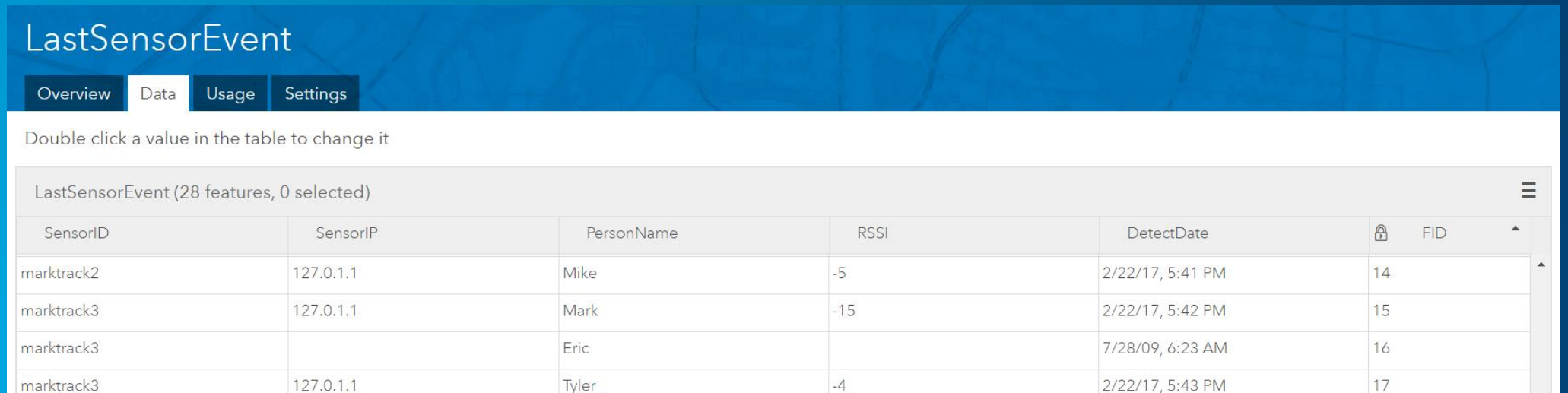
Bluetooth



- **View Bluetooth enabled devices**
- **Most are not discoverable**
- **All I need is the Mac address**
- **For each person I want to track (from their Mac address)**
 - **Connect**
 - **Read RSSI**
 - **Disconnect**

Writing data into ArcGIS Feature Services

- Feature service in ArcGIS online
- Access achieved via:
 - Rest API
 - Runtime SDK (.Net is supported on Windows 10 IoT)



The screenshot shows the ArcGIS online interface for a feature service named 'LastSensorEvent'. The interface includes a navigation bar with tabs for 'Overview', 'Data', 'Usage', and 'Settings'. Below the navigation bar, there is a message: 'Double click a value in the table to change it'. The table displays 28 features, with 0 selected. The table has the following columns: SensorID, SensorIP, PersonName, RSSI, DetectDate, a lock icon, and FID. The data rows are as follows:

SensorID	SensorIP	PersonName	RSSI	DetectDate	Lock Icon	FID
marktrack2	127.0.1.1	Mike	-5	2/22/17, 5:41 PM	14	
marktrack3	127.0.1.1	Mark	-15	2/22/17, 5:42 PM	15	
marktrack3		Eric		7/28/09, 6:23 AM	16	
marktrack3	127.0.1.1	Tyler	-4	2/22/17, 5:43 PM	17	

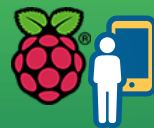
A dot on a map?

- Converting RSSI into a distance
- Range of signal strengths equate to given radius
- Varied for tested phones
 - iPhone 5s – stronger signals
 - Motorola Moto G – weaker signals

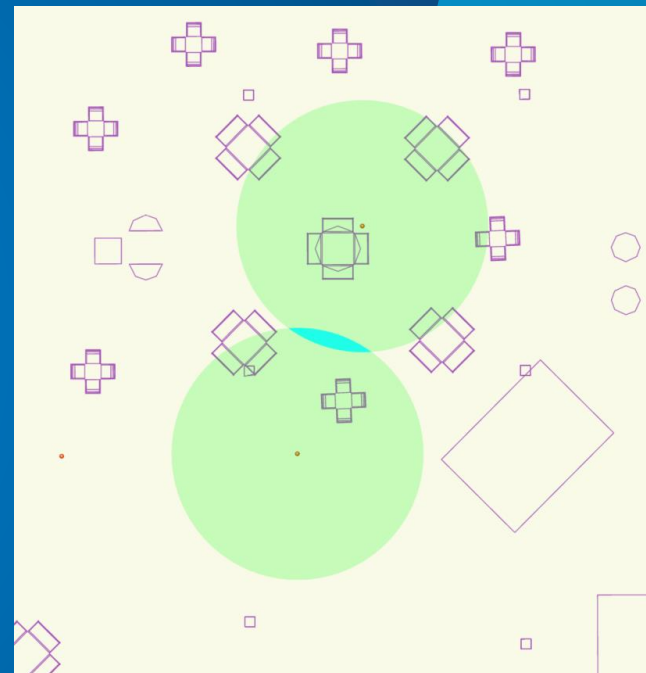


Signal strengths





Does it work?



IoT security?

- Internet of **insecure** Things
- Secure storage of data
- Intercepting remote sensor communications
- Privacy issues
- Access security of IoT devices
- Updating for new threats
- Physical security!!!!!!





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THE
SCIENCE
OF
WHERE