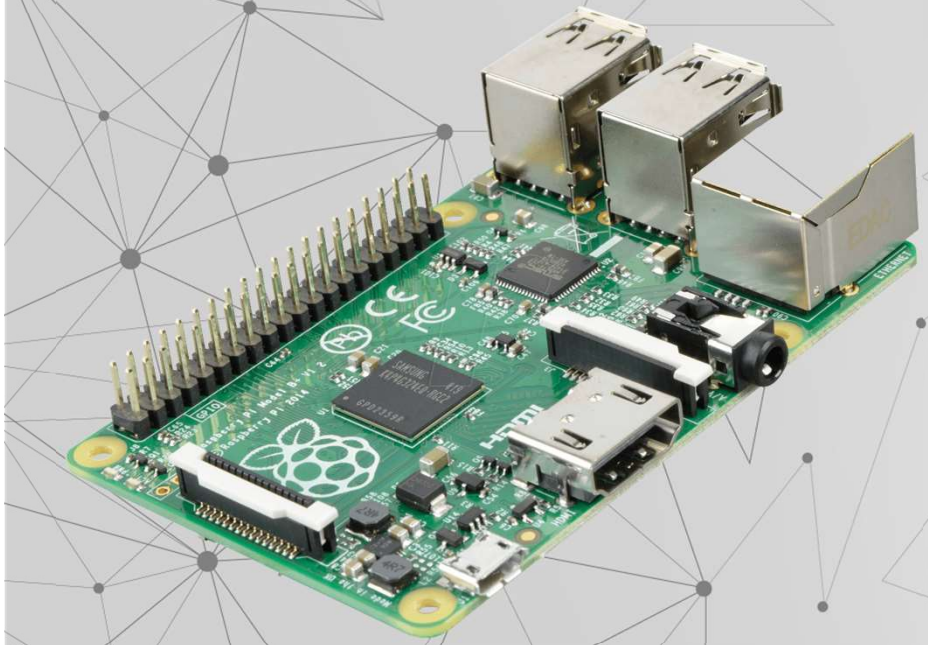
The MAHIVE Project

Building IoT Security

The Project

- Correlate physical and digital events for total security
- Focus on individual sensors which perform initial data collection
- Hub device to relay sensor information to MAHIVE server
- Modular system that can adapt to many situations or buildings

Project Objective



- Authenticate to a cloud based server using asymmetric encryption
- Establish encrypted communication
- Use JSON or TRDF to encode and send data
- Prove this concept is viable

Value

Track both cyber and physical threats at the same time

Easily scalable

Easy to integrate into already existing environments

Customers

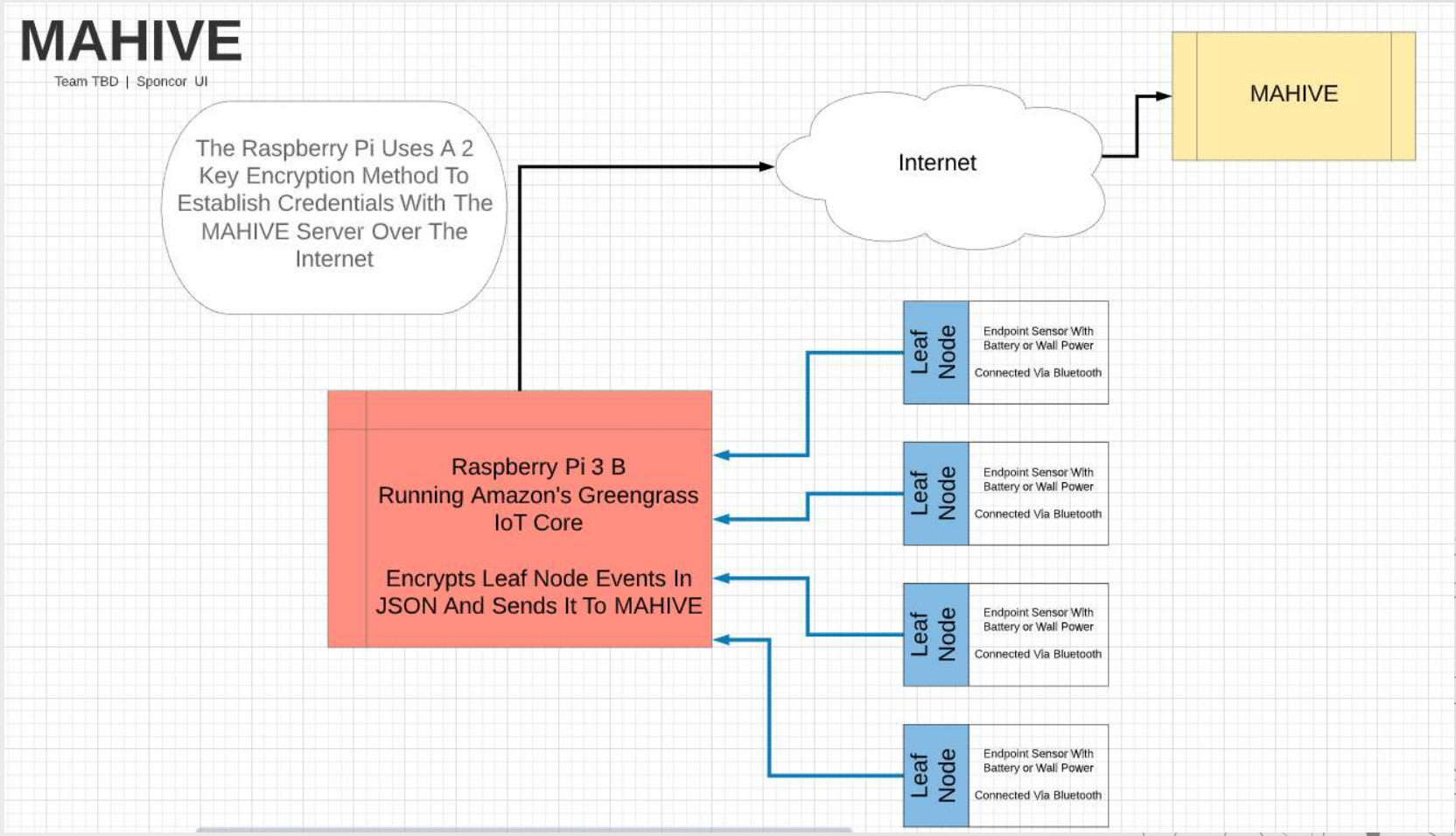
Who can use this?

Government SCIF centers
SOC and Server room
Hospitals, Prisons, and Military Bases
Secure nuclear facilities
INL, PNNL, Hanford, and more

Design Constraints

- Design must be low-cost
  - No elaborate, costly solutions (goal for sensors: <$50)
- Design must use off-the-shelf parts/boards
  - Raspberry Pi, etc.
  - Use simple sensory parts readily available online
- Sensors should be able to run off battery power
  - Board should have low power consumption
  - Interrupts rather than polling
- Sensor device should be small & easily placed inside building

Flow Diagram



Costs and Budget

Indented Bill of Materials (BOM)			Manufacturing Plan							Cost	
Part No. or Assy No.	Description	Quantity	Make or Buy?	Source (or Fabrication Location)	Fabrication Technique (if appl.)	Is the Drawing Avail.?	Is the Material Avail.?	Who will lead (Name)?	Target Completion Date	Unit Cost ($)	Extended Cost ($)
Hub device	Raspberry Pi	1	Buy	Amazon.com		Yes	Yes	Tristan	1-Feb	$38.98	$38.98
Part 1	Case	1	Buy	Amazon.com			Yes			$6.50	$6.50
Part 2	SD card	1	Buy	Amazon.com			Yes			$5.79	$5.79
Part 3	Power adapter	1	Buy	Amazon.com			Yes			$8.57	$8.57
Sensor	Esp32 DevkitC	2	Buy	Amazon.com		Yes	Yes	Jared	1-Apr	$7.33	$14.65
Part 4	Battery Pack	2	Buy	Amazon.com			Yes			$10.00	$19.99
Part 5	Door Sensor	1	Buy	Adafruit			Yes			$3.95	$3.95
Part 6	Light Switch	1	Buy	Moscow Building Supply			Yes			$4.10	$4.10
Part 7	Breadboard	2	Buy	Amazon.com			Yes			$2.00	$4.00

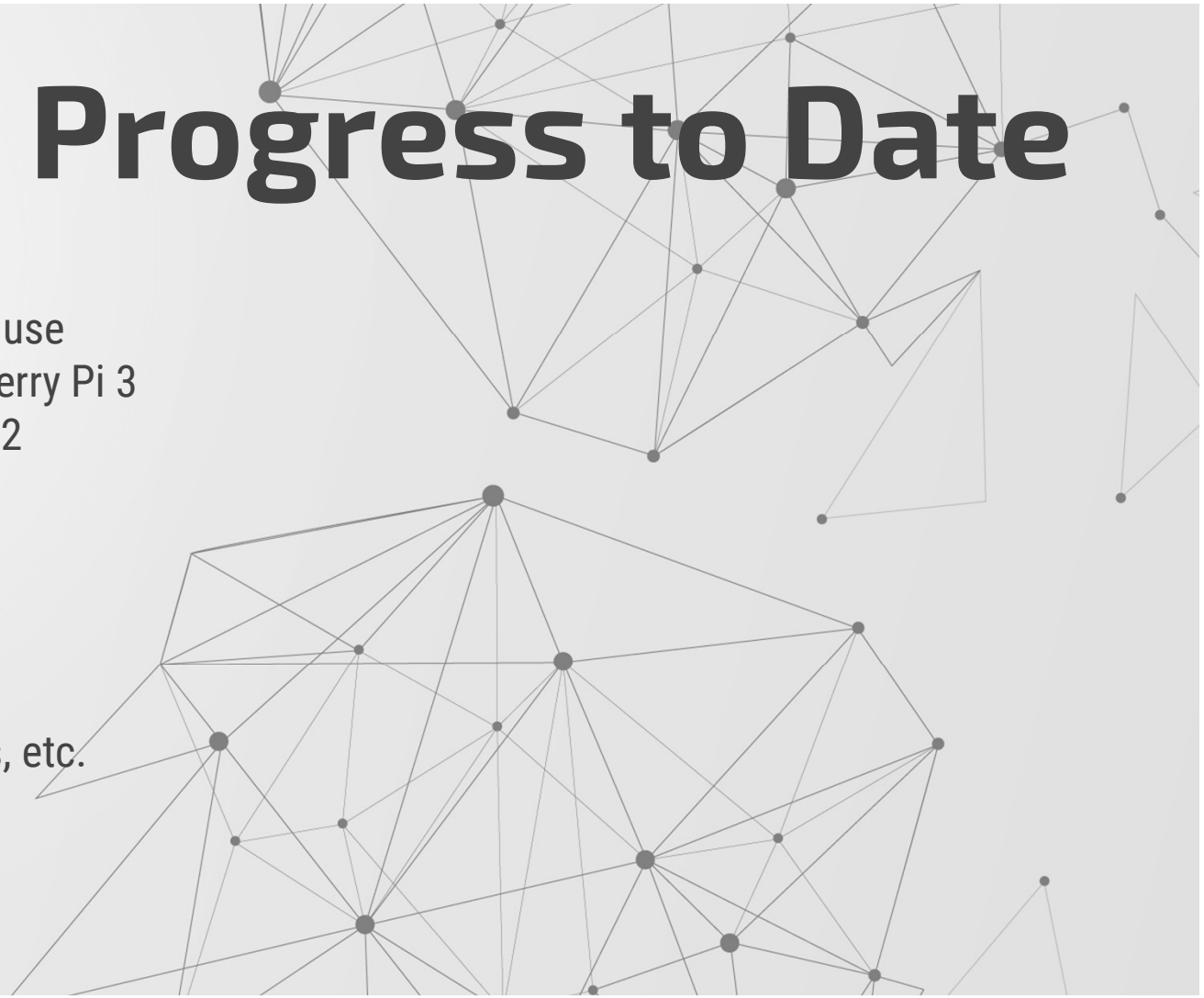
Insert more lines as needed...

Total BOM Cost	$106.53

Project Progress to Date

Decided on hardware to use
- Hub Device: Raspberry Pi 3
- Leaf devices: ESP32

Ordered Parts/Devices
- ESP32
- Raspberry Pi
- Sensors/switches
- Breadboards, wires, etc.
- Battery Packs



Remaining Project Schedule

After Spring Break: FreeRTOS modified sufficiently to utilize sensors on ESP32

End of March: Full working sensor relaying data in proper format to cloud, able to display on computer

Early April: Print Poster for project

End of April: Demo setup with 2X ESP32 door/light sensors, Pi hub, computer, etc. Finished & ready for expo

Project Progress

- ESP32: flashed with Amazon FreeRTOS, running Greengrass Connectivity Demo
  - Discovers local hub device
  - Authenticates on AWS
  - Sends MQTT message to AWS cloud via hub device
- Raspberry Pi
  - Running Greengrass Core software
  - Deployed as hub device with potential for C/Python lambda functions
  - Communicates directly with AWS cloud

Potential Decisions

- Possibility that learning/modifying FreeRTOS is too complicated/time consuming for scope of this project
  - Could modify demo project for sake of proof-of-concept
- Decision may have to be made between power consumption and reliability of sensors
  - Sensor reliability more important
  - If interrupts cannot be used, can implement polling and wall power instead
- May run into issues formating sensor data into TRDF format

THANK YOU

Does anyone have any questions?


Thank You