Building an Isolated Wireless Lab Space on a College Campus

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Advisors/Clients:
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Problem Statement

- Create isolated wireless and cellular networks inside a Faraday cage
- Provide curriculum that showcases the educational value of the isolated networks
- Ensure the security of student data

What Makes Our Project Unique

- Only have wired environments
- Opportunity to do wireless labs
  - Real world application
  - Different protocols
- Completely new material

Technical Challenges

- Route GSM signals to simulate cellular traffic
- Cage Design
  - Durability
  - Wiring
  - Blocking Signals

Non-Functional Requirements

- Deliverables: Lab curriculum with network environment
- Curriculum Design ⟷ Network Arch.
- User Authorization
- Users can access network off-campus

- Cages will fit next to existing Linux server on campus
- Regulate airflow to prevent overheating

Functional Requirements

- One cage
  - 802.11 WiFi network
  - GSM cellular network
- Signal isolation
- Software Defined Radio (SDR) to act as cell tower
- Intended Android phones connect to SDR
- Network environment accessible via ISU VPN
- Network access point: VM

- Automated clients
  - Send and receive text messages and make phone calls
  - Scripts to automate network traffic (emails, website logins, etc.)

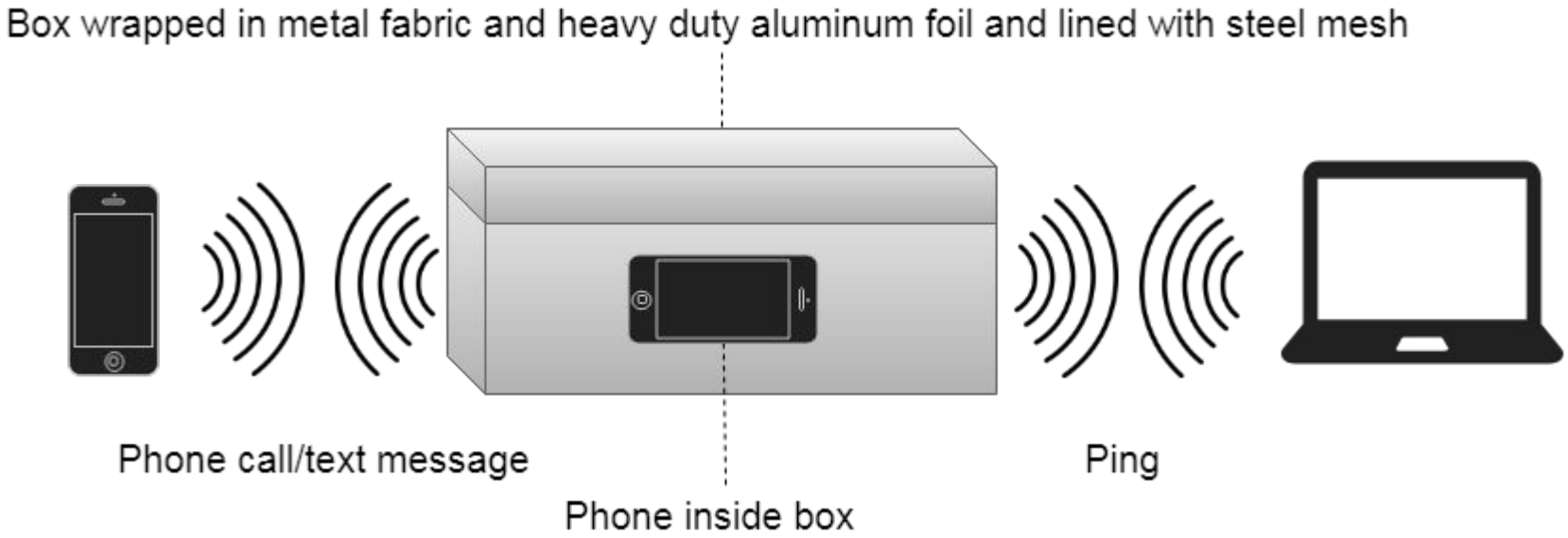
SW/Technology Platforms

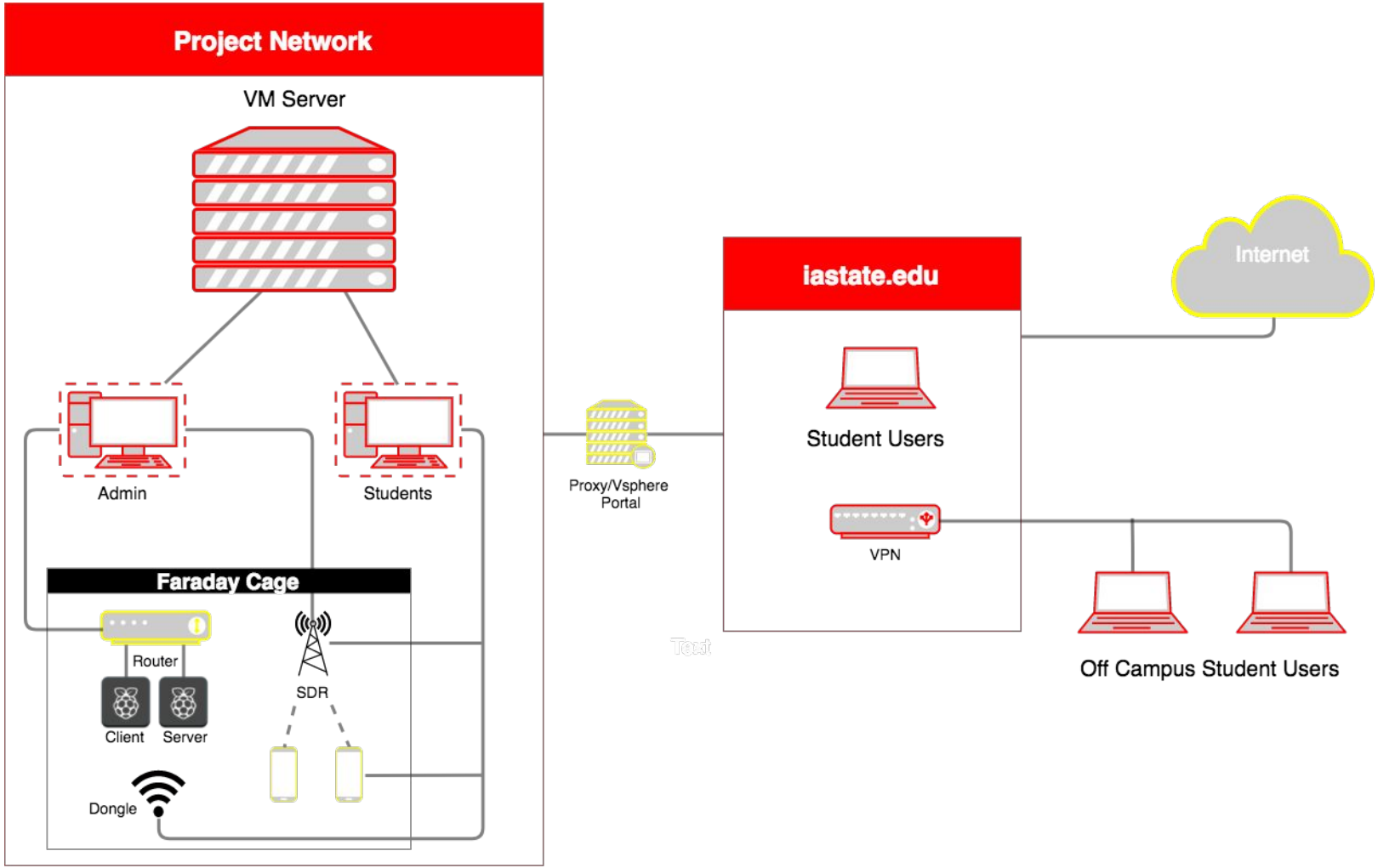
- GSM Traffic
  - Android application
    - Send SMS
    - Outgoing phone calls
- 802.11 Traffic
  - Python scripts on Raspberry Pi
    - Send emails
    - Log in to websites
    - HTTP Server
- Remotely access
  - Proxy
  - VPN

HW/Technology Platforms

- Faraday Cage
- Linux Server
  - Support ~50 users
- Raspberry Pi 3’s
- Android Phones
- National Instruments USRP-2920 SDR
  - Equipped with OpenBTS software
  - Admin Linux VM - Ubuntu Server 16.04 LTS

Prototype Faraday Cage




Project Network
VM Server
Admin
Students
Faraday Cage
Router
Client
Server
SDR
Dongle
Proxy/Vsphere
Portal
iastate.edu
Student Users
VPN
Internet
Off Campus Student Users

Potential Risks and Mitigation

- Students would unintentionally sniff public wireless and cellular traffic.
- If we were working with malware or viruses they could escape to the wild.
- Personal Cell Phones could connect to our SDR
- As mitigation, extensive testing will be done to ensure no signals cross the cage walls.
- Restricted access to the environment.

Test Plan

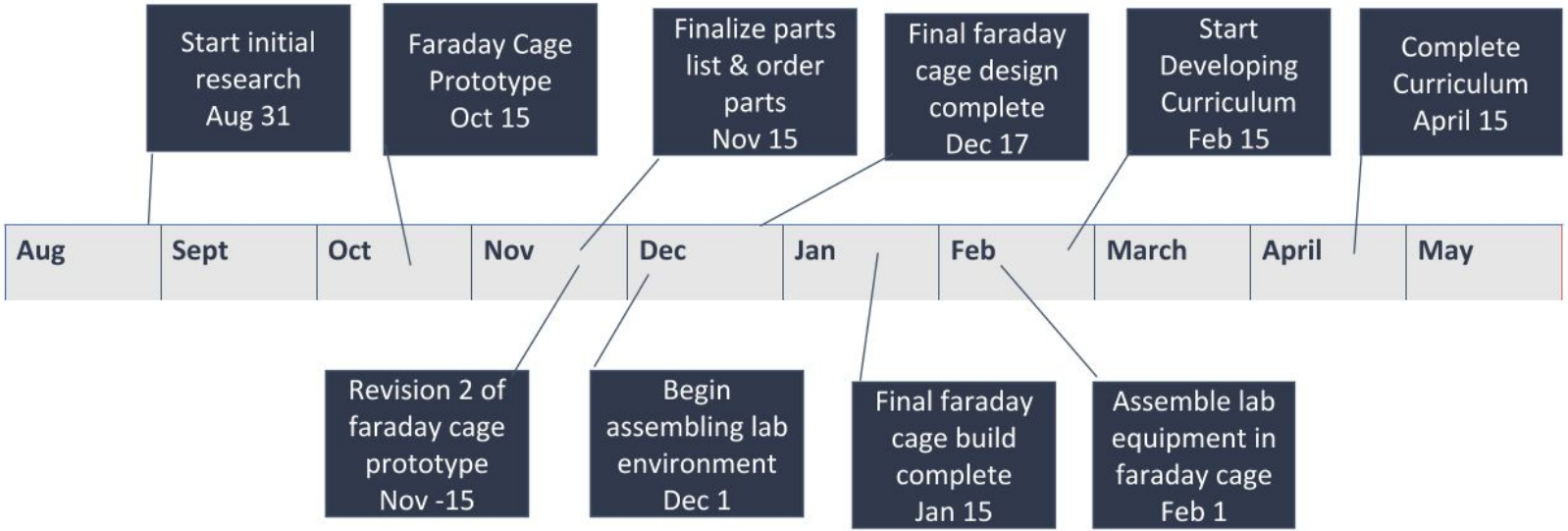
- Signal Isolation
- Connecting devices and networking
- Script tests

Resource/Cost Estimate

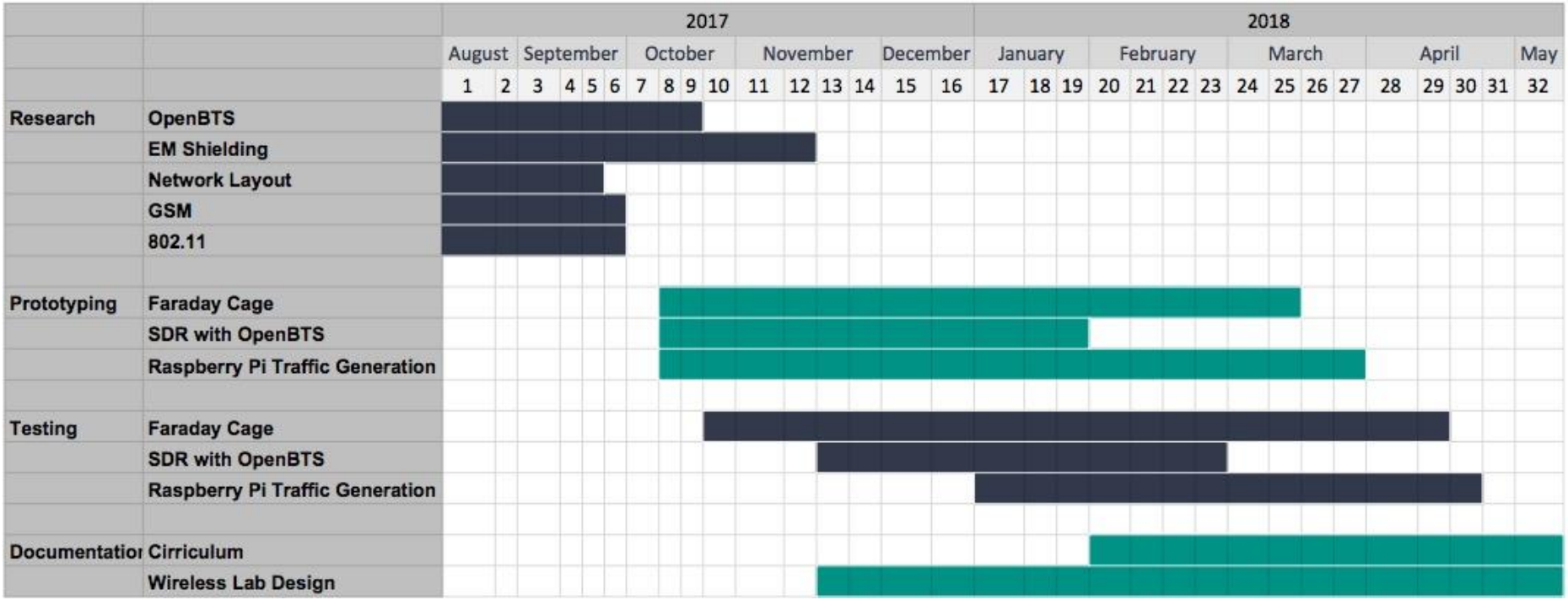
Name	Quantity	Price
Raspberry Pi 3	2	$35
USB to Wireless Dongle	1	$34.99
Wireless Router	1	$142.63
Android Phone	2	$164.58(each)
Metal Fabric	12ft^2	~$60
Linux Server (~100GB RAM)	1	(Supplied by ISU)
Base	2ft^2	$0.99 a square foot.
Plastic Tub	1	$19.99

~$625
total cost

Project Milestones and Schedule



Project Milestones and Schedule



Conclusion

Current Project Status

- Current prototype successfully blocks signals
- Technical parts confirmed for purchase
- SDR is capable of utilizing OpenBTS

Tasks & Responsibilities

- Dalton & Omar
  - SDR & connection to phones
- Hope & Alec
  - Cellular traffic simulation
  - Curriculum
- Colin
  - Raspberry Pi 3 integration
  - Web traffic simulation scripts
- Tyler
  - System/network Design
  - Prototyping

Team Plans

- Construct final design
- Test final prototype in Faraday room in Coover
- Test developed curriculum

Questions

Appendix

Presentation Order

- Introduction
- Project Plan
  - Problem Statement
  - Diagram
  - What makes it unique
  - Requirements
  - Constraints
  - Risks and Mitigation
  - Cost Estimate
  - Milestones & Schedule
- System Design
  - Detailed Design
  - Technology Platforms
  - SW/Technology Platforms
  - Test Plan
  - Prototype
- Conclusion
  - Current status, tasks and plans

Color Code:

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