TURNING A CLASSROOM INTO A CYBER LABORATORY

How SUNY Delhi transformed cyber learning from lecture to hands-on.

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INTRODUCTION

- Associate Professor – SUNY Delhi
  - PhD Information Technology
  - Teaching since Fall 2017
- 23 Years military experience in Cyber
  - Teaching 18-22 year-olds the norm
  - Designed initial USAF cyber training
- 4 Years Business owner
  - Leveraged Cyber knowledge to grow $430 business into $1M annual sales

DAY 1

Typical Classroom

DEATH BY POWERPOINT

FIRST SEMESTER RESULTS

Measures	Fall 17
Hands-On Labs	0
Number of Slides	4,800+
Student Feedback	2.1
Pass Rate	63%

NOTE: Factors consolidated to simplify presentation

I. Student Feedback: A 5-point scale: 1- Poor, 5 - Excellent
II. Pass Rate: All students with minimum course average of 65%
III. Pass Rate: Withdrawals are counted as not passing

OBSTACLES TO CHANGE

- No time – Teaching Load
- No money – New Idea, not budgeted
- No precedence – Classes not considered hands-on material
- No feedback – Student comments did not address lack of equipment or hands-on
- Bureaucracy – No government organization changes quickly

NEW PLAN

~ 5 Years of Work

1. • Prototype
2. • Expand
3. • Full Scale
4. • Sustainment
5. • Dedicate

PHASE 1

PROTOTYPE:

Demonstrate the effectiveness of hands-on learning

1. Prototype
2. Expand
3. Full Scale
4. Sustainment
5. Dedicate

PHASE 1 STRUGGLES

Today

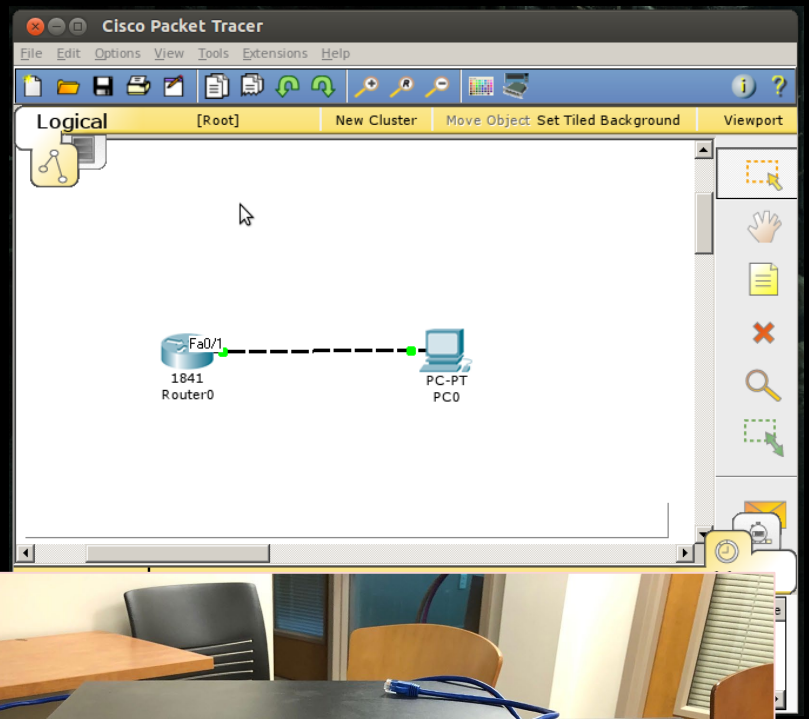
Short-term

Long-term

PHASE 1 PROGRESS

- Used simulators in place of equipment
- Wrote 4 labs
- Leveraged broken equipment for student learning

Managed to divert $350 from pens/pencil purchases for 1 learning kit.



SECOND SEMESTER RESULTS

	Fall 17	Spring 18
Hands-On Labs	0	4
Number of Slides	4,800+	3,600
Student Feedback	2.1	2.8
Pass Rate	63%	71%

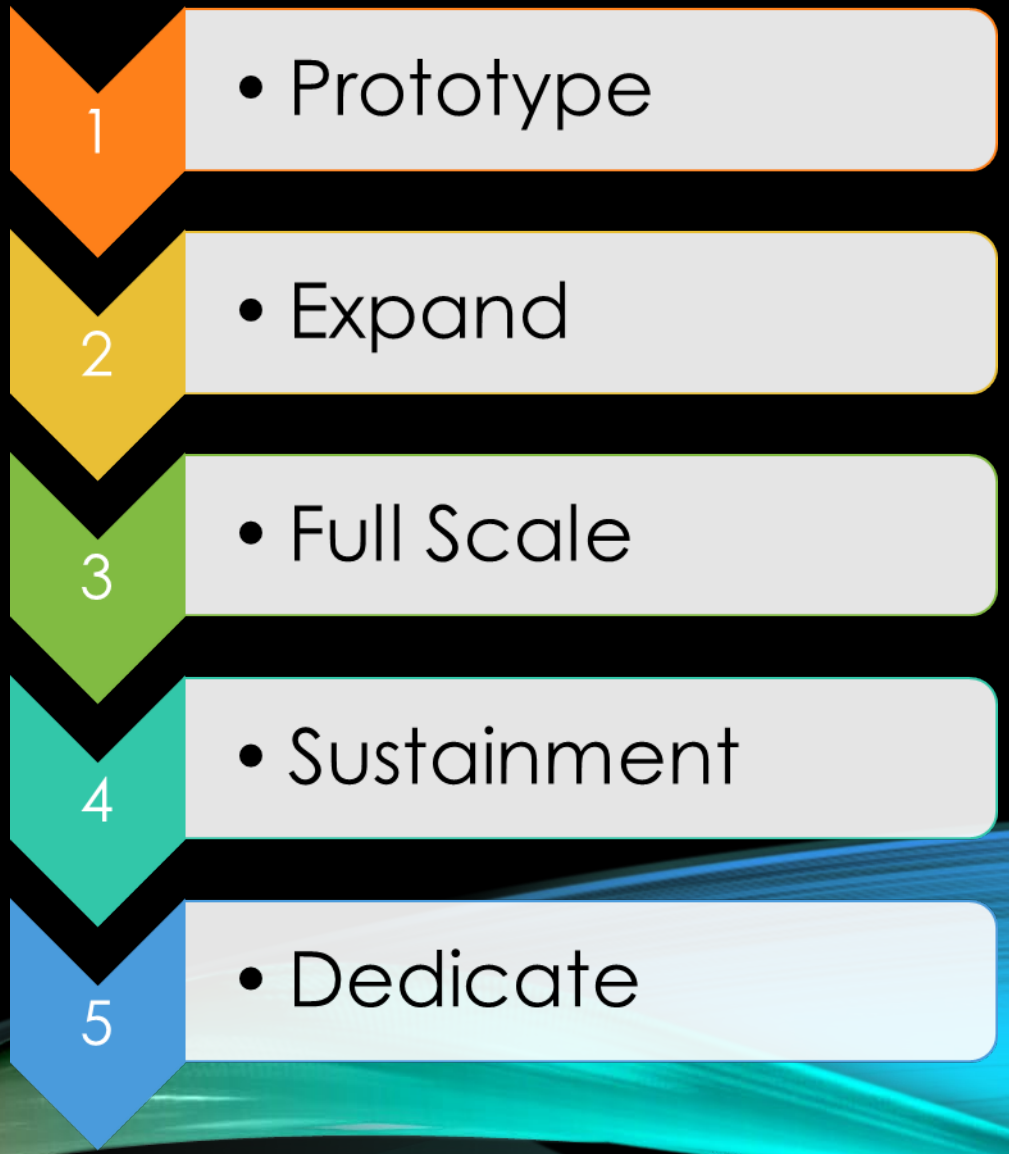
NOTE: Factors consolidated to simplify presentation

I. Student feedback on a 5-point scale: 1- poor, 5 - Excellent
II. Pass Rate is a student average of 65% or better
III. Pass Rate: Withdrawals are counted as not passing

PHASE 2

Expand program:

Adjust the prototype to include more student learning



STRUGGLE

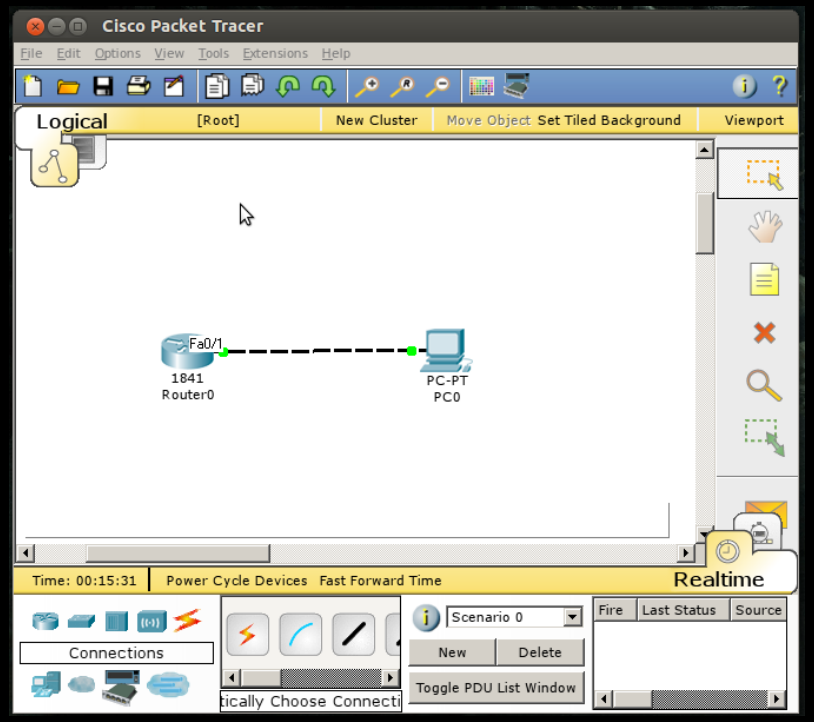
Today

Short-term

Long-term

SHORT-TERM SOLUTIONS

- Used simulators in conjunction with equipment
- Purchased 9 learning kits
- Wrote 18 labs
- 4-port NICs and used VMs



SHORT-TERM PROBLEMS

- CLUTTER!
  - Desks were not designed for this much equipment
  - Classroom used by non-lab courses
- Not enough learning stations for a full class
- Broken PCs are dying
- No dedicated classroom
  - Shared HVAC
  - Typical Power

LONG-TERM PLANNING

- Need money to build "proof of concept"
  - Started grant paperwork to transform classroom
- Need to get equipment off of desks
- Need to reduce lecture and focus on hands-on learning
- Related issues
  - Get students excited about IT
  - Get parents excited
  - Need some "wow" - Wargames

THIRD SEMESTER RESULTS

	Fall 17	Spring 18	Fall 18
Hands-On Labs	0	4	22
Number of Slides	4,800+	3,600	1,200
Student Feedback	2.1	2.8	3.9
Pass Rate	63%	71%	73%

NOTE: Factors consolidated to simplify presentation

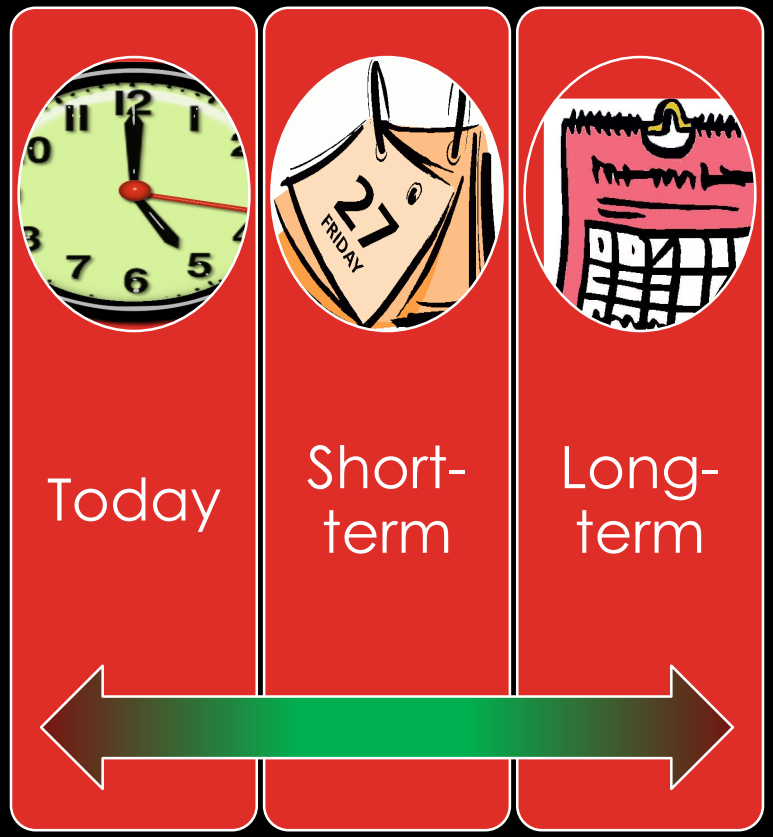
I. Student feedback on a 5-point scale: 1- poor, 5 - Excellent
II. Pass Rate is a student average of 65% or better
III. Pass Rate: Withdrawals are counted as not passing

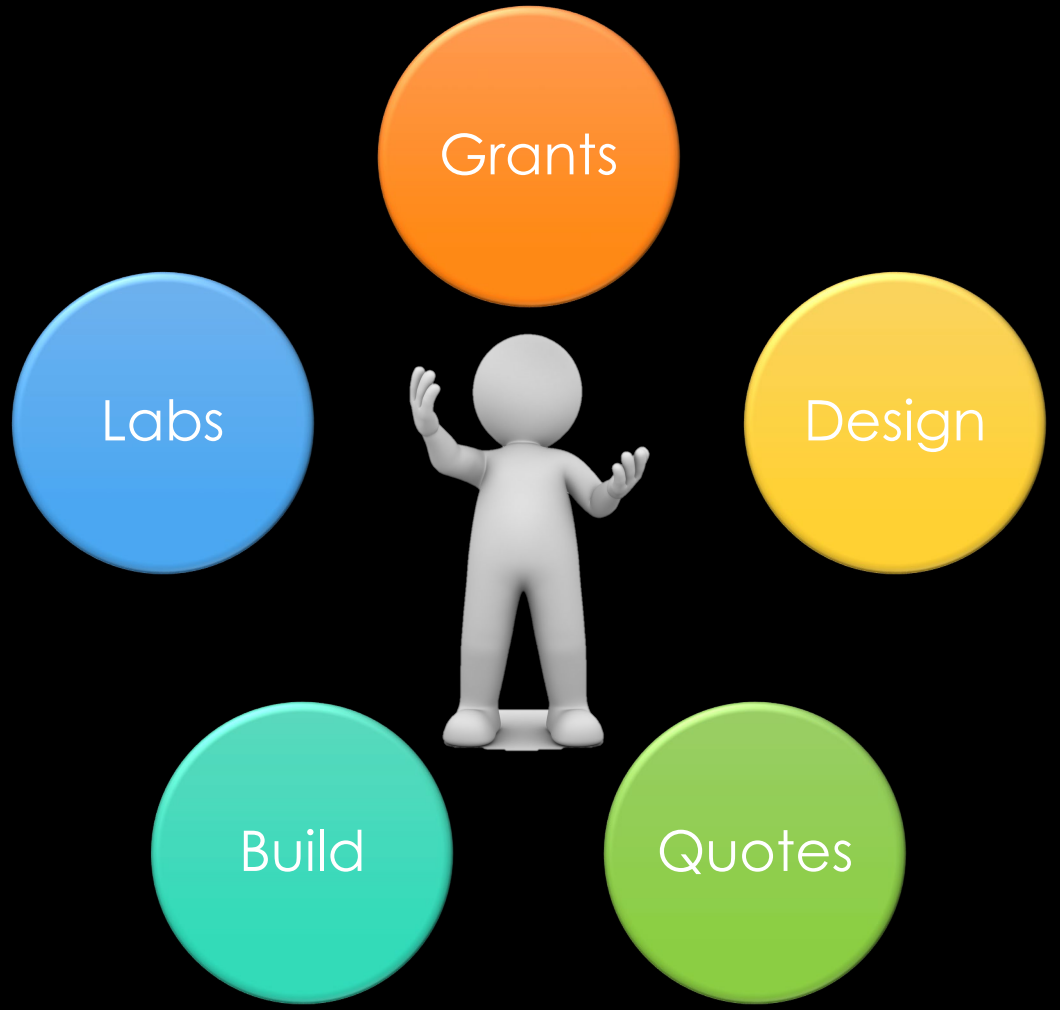
PHASE 3

Go Full Scale

1. Prototype
2. Expand
3. Full Scale
4. Sustainment
5. Dedicate

STRUGGLE TO JUGGLE



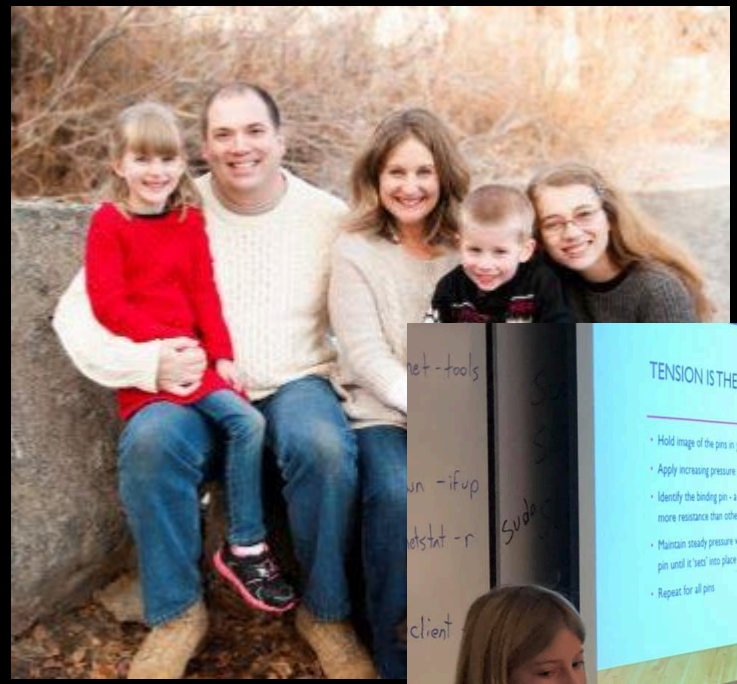


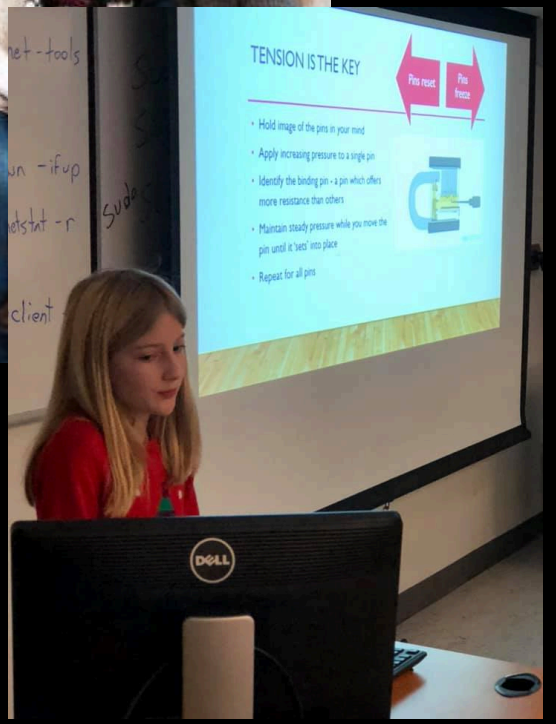
EQUIPMENT

- 10 Equipment Racks, 19” wide
- 30 PC’s
  - Rack mounted
  - Cheap - $700/ea
  - Host 5 VMs at same time
- Power Strips
- 14 Additional Networking Kits

ACTIONS

- Two Saturdays – My Family
  - Assembled Equipment Racks
  - Installed learning kits
- Introduction to Computer Hardware/Software
  - Students built the PC's
  - Installed the OS and software
- Introduction to Cyber Security
  - Installed the Virtual Machines
  - Tested the first labs
- Networking Class started 100% hands-on





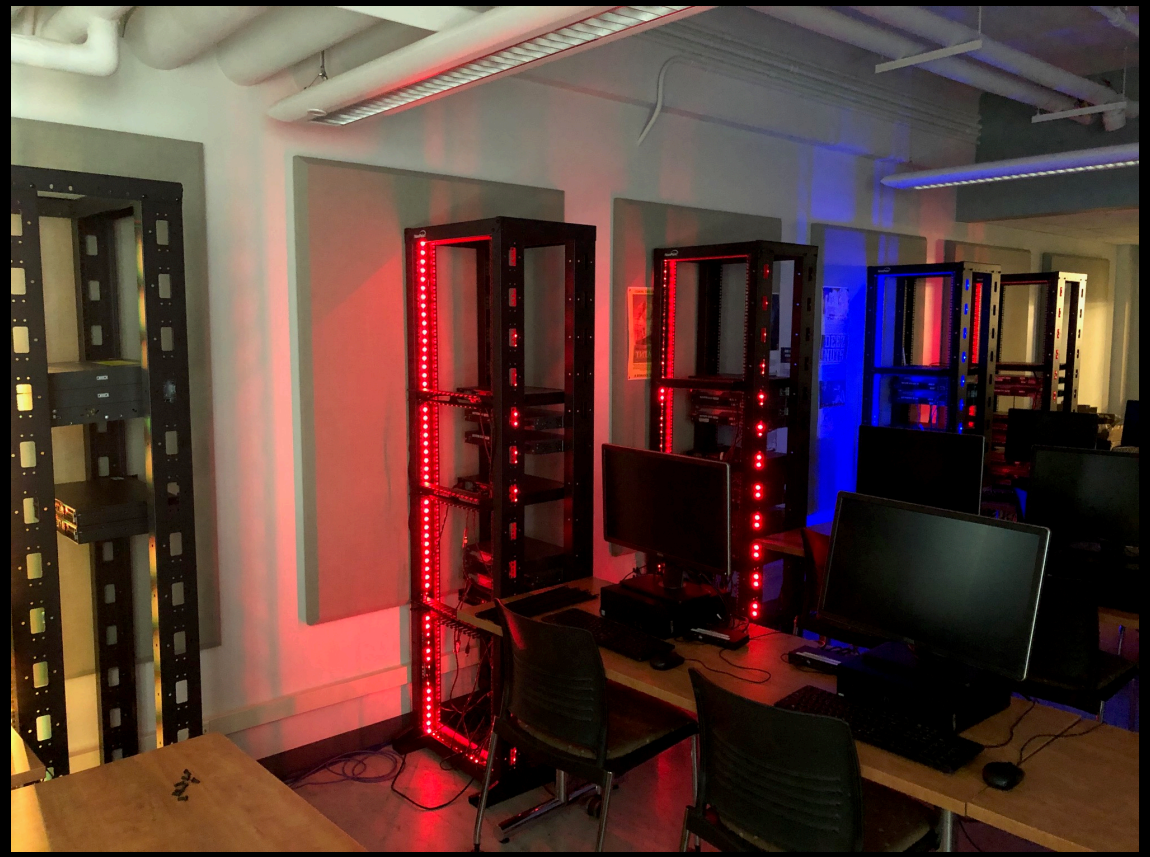
EVERYTHING ELSE

- Flipped three of the courses
  - Increased reading on own
  - Class time: Answer questions, quiz, hands-on labs
  - First time through, largely self-paced
- Offer Stellar Students Independent Study
  - Create Instructional Videos
  - Write Labs
  - Test labs I wrote
  - Provide feedback on their class
- Wrote labs in step-by-step format

END PRODUCT

$32,817.70

ITS ALWAYS ABOUT MARKETING
THE "WARGAMES" EFFECT



TRICKLE DOWN EFFECTS

Freshmen learn PC hardware, operating systems and virtualization

Cyber students can hack and defend their networks

Networking students can build small business networks that support 50 users

Able to transform the room to satisfy course needs

FOURTH SEMESTER RESULTS

	Fall 17	Spring 18	Fall 18	Spring 19
Hands-On Labs	0	4	22	54
Number of Slides	4,800+	3,600	1,200	426
Student Feedback	2.1	2.8	3.9	4.1
Pass Rate	63%	71%	73%	75%

NOTE: Factors consolidated to simplify presentation

I. Student feedback on a 5-point scale: 1- poor, 5 - Excellent
II. Pass Rate is a student achieving 65% or better

PHASE 4

Sustainment

1. Prototype
2. Expand
3. Full Scale
4. Sustainment
5. Dedicate

PHASE 4 ACTIVITIES

- SUNY Center for Professional Development – Grant writing

- Grant#1
  - Need a sustainment budget of $30k/year
    - $20k in equipment
    - $10k in support
  - Opportunity to learn grant-writing process

PHASE 4 ACTIVITIES CONT.

- Grant#2
  - PC's are end of life at 4 years
  - Effects of students building PC's that they will use for their degree program?
    - Increase Learning?
    - Increase Dedication?
    - Reduce Help Desk support?

PHASE 4 ACTIVITIES CONT.

- Grant#3
  - Build a lab designed to support a robust IT infrastructure
    - Equipment
    - Support
    - Dedicated HVAC
    - Dedicated Power
    - Collaborative learning

PHASE 4 ACTIVITIES CONT.

- Proof of Concept
  - Can Raspberry Pi's be used instead of PC's?
  - Rack mounted solution
  - Reduce lab station costs from $2,000 to $200 per seat
- Amazon Web Services
  - Can our students conceptualize?
  - Can they translate skills to real network environments?

1. • Prototype $350
2. • Expand $3,500
3. • Full Scale $30,000
4. • Sustainment $30,000/yr
5. • Dedicate $1M + $30k/yr

Complete by 2020

QUESTIONS

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