eSyst Implementation Webinar Series Part Five: Data Acquisition

Maricopa Advanced Technology Education Center

NSF ATE Grant #0702753

A presentation of eSyst.org

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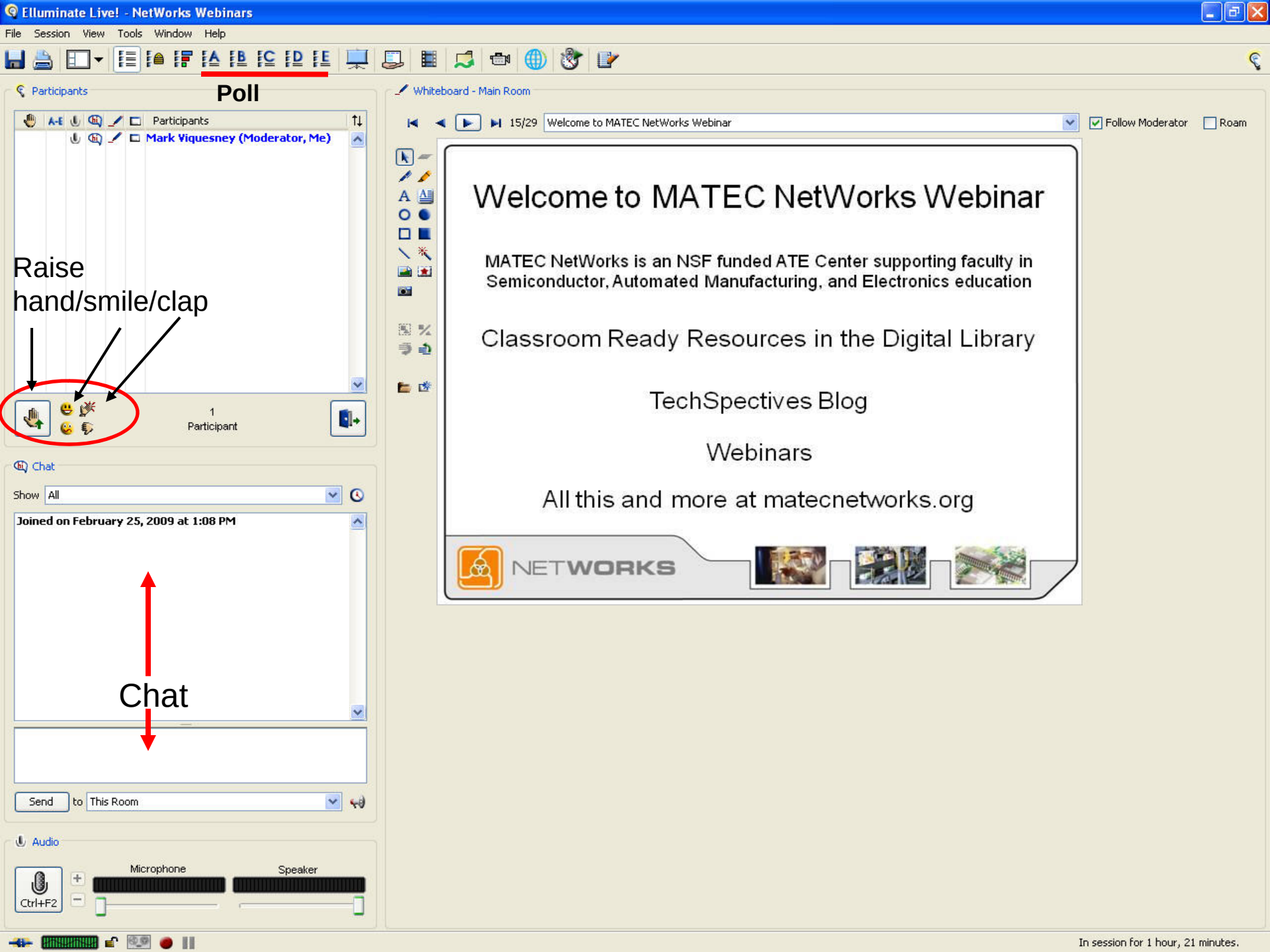
Funded, in part, by a grant from the
National Science Foundation.
DUE- 0702753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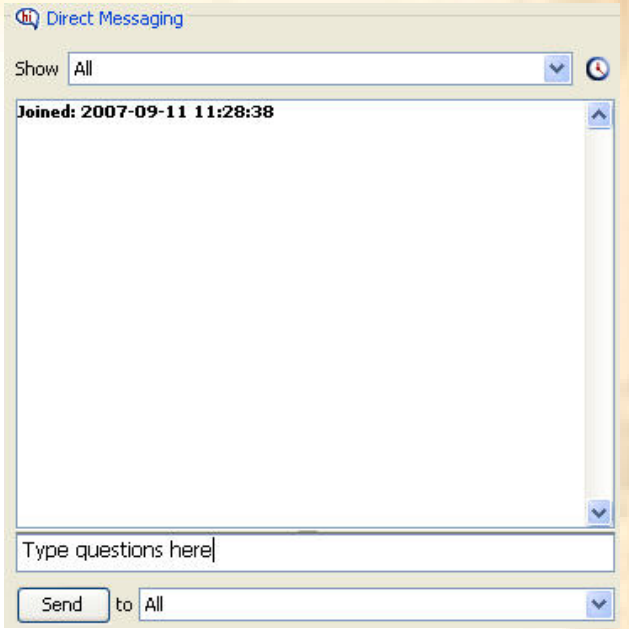
In session for 1 hour, 21 minutes.

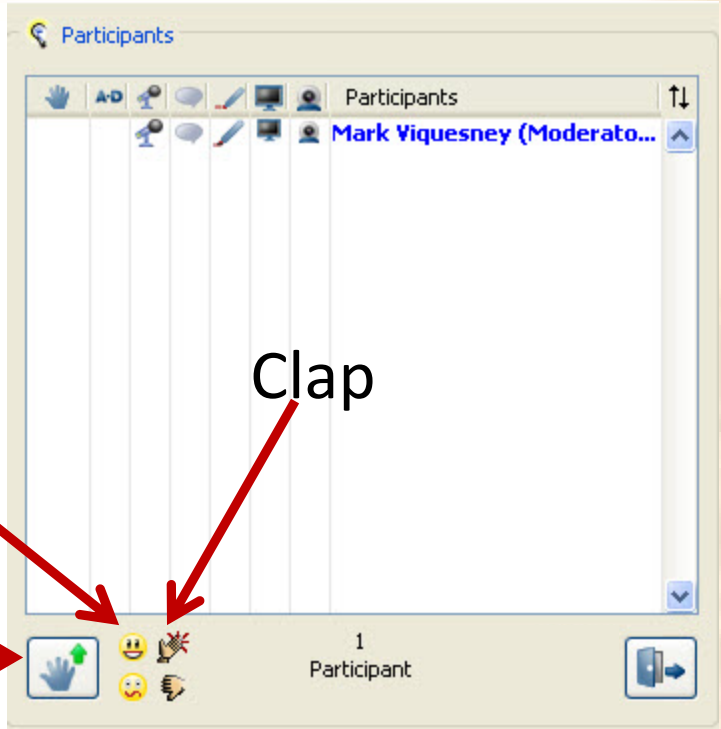
Chat Box

- If you have questions during the presentation, please submit them in the Chat Window and Send to "All" so that others can follow along.
- Throughout the presentation and at the end of the session we will answer as many questions as we can.



Participants Box

Allows you to respond to the presenter's comments.



eSyst Webinar Presenter

Tom McGlew:
eSyst Project Manager

eSyst Webinar Agenda

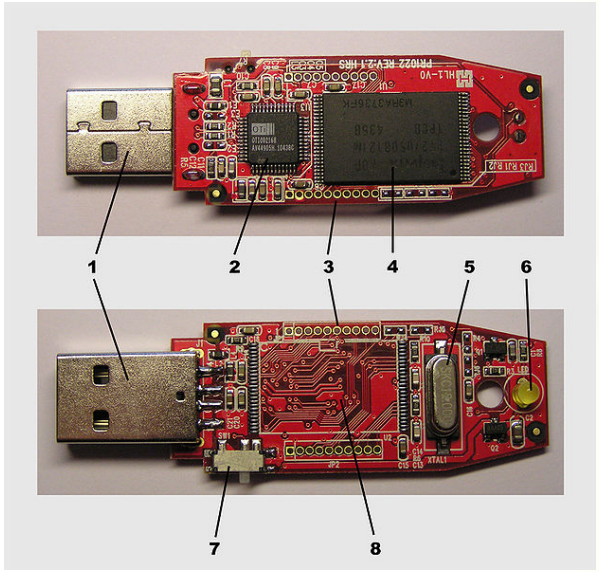
- Overview of the eSyst Project
- Review of the eSyst Implementation Guide
- Demonstration of an Electro Cardiograph System Lab
- Web site tour
- Review of Tektronix Oscilloscope resources
- Survey and Final Questions from Participants

eSyst Project Overview

A presentation of eSyst.org

So what has changed and what is a System?

Then to Now

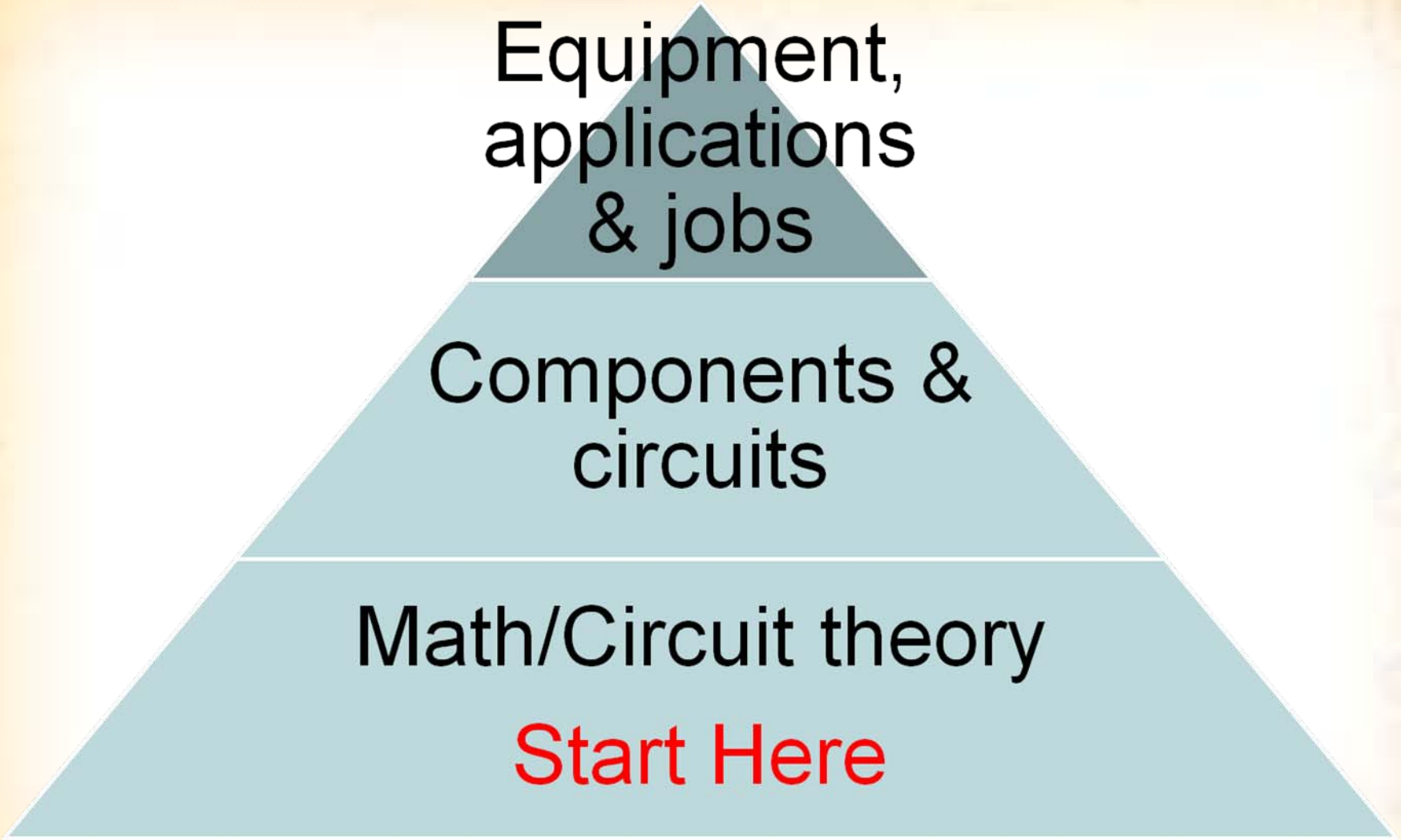


Now to the Future

eSyst Home Media Animation

http://www.esyst.org/Courses/Entertainment_System/animation900.html

The Legacy Bottom Up Approach



Impact to Graduating Technicians

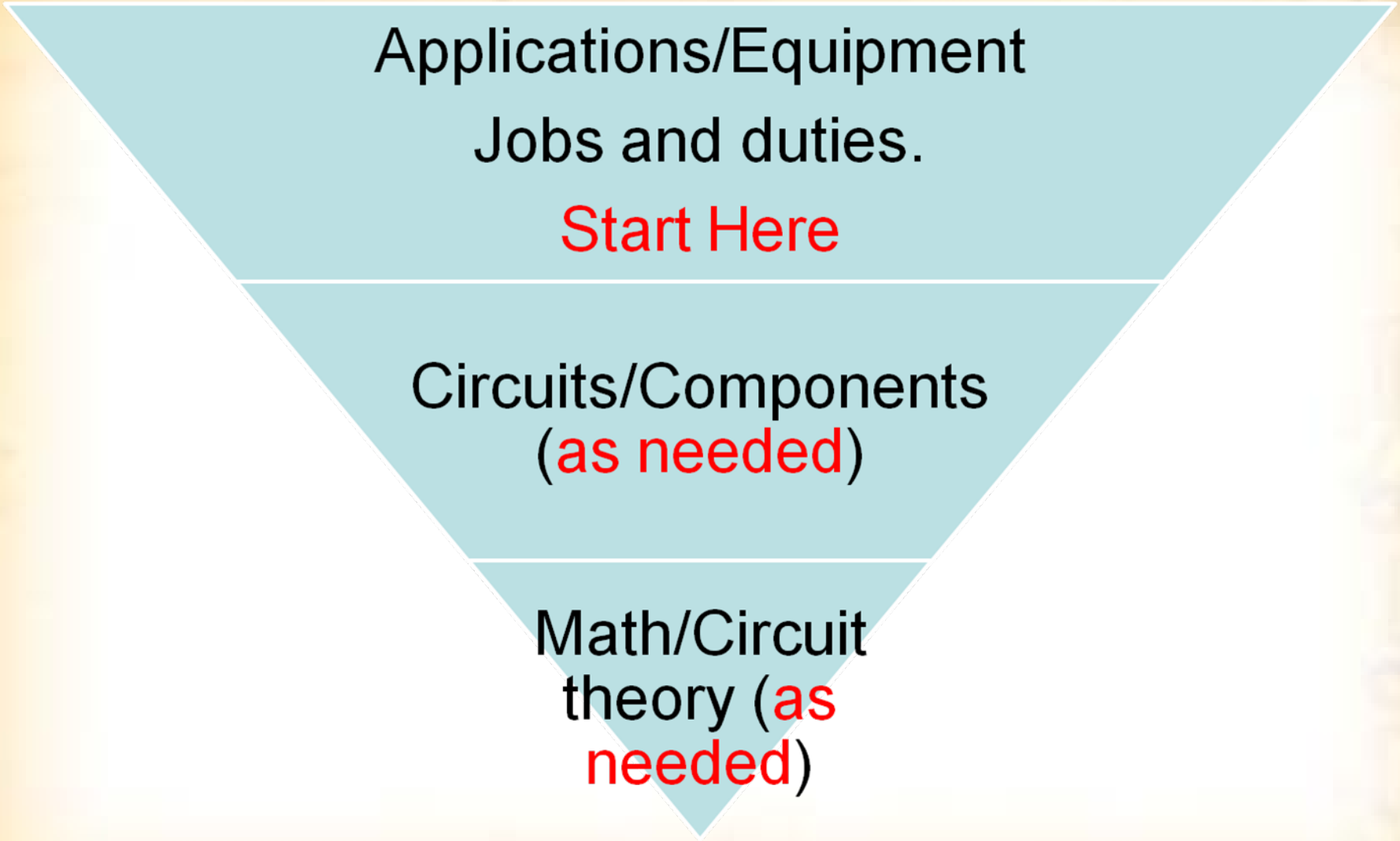
- Major implications for graduating technicians
  - Less troubleshooting to the component level
  - More system troubleshooting, measurement, and test
  - More equipment interaction via software operating systems
  - Few, if any engineering technician jobs

Results in:

- Legacy programs being out of touch with reality

So what's a Faculty going to do?

The Top-Down Approach



One Solution: eSyst Resources

- An NSF project conceived to address the systems view of electronics to meet industry's current needs by:
  - Developing new systems resources
  - Creating a guide to help facilitate the changes
  - Encouraging colleges to update programs

Electronics Courses Identified by eSyst Project Team

- DC and AC Circuits Analysis
- Solid State Devices
- Digital Fundamentals
- Microprocessors including microcontrollers
- Data Acquisition and Measurement
- Electronics Communications

Project Status

- Project has resources for the following on eSyst.org:
  - Implementation Guide
  - DC/AC Circuits
  - Solid State Devices
  - Digital Fundamentals
  - iLabs Remote Phase Two is now available on the Student Resources webpage
  - Microprocessors
  - Data Acquisition
  - eCommunications – new resources being posting

Questions?

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Implementation Guide: Project Information

- eSyst Drive for Revision and Project Goals
- eSyst Approach to Electronics Systems
- Definition of an Electronics System
- Technicians and Systems Applications
- eSyst Program recommendations
- eSyst Course recommendations
- M.I.T. iLabs eSyst Project description

The ***Implementation Guide*** can be found on the **Faculty** tab menu on the eSyst web site.

Implementation Guide: Course Information

- Traditional View versus Systems View
- General Course Recommendation
  - De-emphasized Topics
  - New Systems Topics
  - General Lab Recommendations
  - Textbook Recommendations
- Student Learning Outcomes
- Systems Course Outlines
- Systems Instructional materials

Traditional View versus Systems View

Traditional View

- Most AAS electronic technology degree programs do not have an instrumentation or data acquisition course. The traditional view is that test equipment operation and use is taught in the regular courses as needed. For example, digital multimeters are taught in DC, scopes in AC and solid state, scopes and logic analyzers are used in the digital course and a spectrum analyzer and other RF test gear is taught in a communications course if one is available.
- Furthermore, most AAS curricula also do not include a data acquisition course. The traditional view is that this is not a mainstream subject so most colleges ignore it. There are exceptions, of course.

Traditional View versus Systems View

New Systems View

- In analyzing what modern technicians do on the job today, it is clear that their function is still largely testing and measuring in manufacturing, troubleshooting and maintenance. A large portion of the work involves using test equipment and other instruments to make measurements.
- Other work includes the collection of data by setting up data acquisition systems. Most of this work involves sophisticated test and measurement instruments and systems.
- Most schools do not do an adequate job of teaching such instruments and how they are used. It has also been found that when use of test instruments is taught in the regular courses, the outcome is typically that students know only the barest minimum of how these instruments work or are applied. A case can be made for creating a separate course covering the operation, specifications, and use of advanced test equipment.

Traditional View versus Systems View

New Systems View Continued:

- In addition, studies show that data acquisition is a very widespread operation used in a wide range of companies, industries and facilities around the world. Large systems and equipment are commonly instrumented with huge data acquisition systems. Technicians are the ones who set up and test these systems then capture the data that is later usually analyzed by engineers and others. Virtual instrumentation is widely used in such systems, and the LabVIEW software is more often than not the central capture and processing effort.
- A general view is that technicians need to know more about test instruments and how to use them, and data acquisition systems are common and should be taught in all AAS degree programs.

General Course Recommendation

The following recommendations are congruent with graduates' needs and industry's requirements:

- Student must have good general knowledge of the electronic test instruments available and how to use them.
- Student must understand the principles and purposes of data acquisition (DAQ) systems, be familiar with the components of a DAQ system, and how the data is collected, stored and processed.

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De-emphasized Topics

The following traditional topics should be de-emphasized for a Data Acquisition and Measurement course:

1. Reduce detailed coverage of analog oscilloscopes and other primarily analog instruments.

Rationale: Most oscilloscopes in use today are digital as well as many other measurement instruments. Students should understand their operation, specifications, and the data they generate.

De-emphasized Topics continued

2. Detailed circuit analysis of analog-to-digital converters ADC) and digital-to-analog converters (DAC) such as R-2R, etc.

Rationale: Most ADC and DAC are fully integrated and individual circuits cannot be accessed so there is no need to do detailed analysis. Instead, focus on ADC types, specifications and how to select a type for a given application.

3. Minimize detailed circuit analysis and design of sensor signal conditioning. (e.g., bridge design, op amp circuits and filters, etc.)

Rationale: Technicians rarely design signal condition circuits as they are mostly already present in most commercial DAQ systems.

New Systems Topics continued

The following new systems topics should be integrated into a Data Acquisition and Measurement course:

1. Emphasize the importance of the digital oscilloscope and other digital instruments focusing on specifications and measurement capabilities.

Rationale: Most test equipment is digital in nature. Its capabilities are generally greater than older analog instruments.

New Systems Topics continued

2. Include a discussion of the various types of ADC and DAC. Also discuss the details of their specifications, errors, types, and compare/contrast the different types as they relate to different applications.

Rationale: ADC and DAC are an essential part of every test instrument and data acquisition system. It is essential to know the capabilities and limitations of each type and where each time they should be deployed.

New Systems Topics continued

3. Include coverage of how data is processed after it is acquired. Teach the most commonly used software such as National Instrument's LabVIEW.

Rationale: The most difficult part of implementing a DAQ task is programming the processing. Standard software, like LabVIEW and others, makes implementing DAQs faster and easier. Include coverage of basic processing and display of data.

New Systems Topics continued

4. Include coverage of virtual instrumentation.

Rationale: Many test instruments and most DAQs are virtual instrumentation. Students should understand the concepts, capabilities and limitations of this form of instrumentation.

5. Emphasize the analysis and application of commercial instruments and DAQ equipment. Technicians select and use commercial products rather than analyze and design them. Provide practice in analyzing specifications and matching them to the application.

General Lab Recommendations

1. The key to a good instrumentation and DAQ course is the lab. Modern state of the art test instruments are a must, as this is what the student will encounter on the job. However, such instruments are expensive. This prevents an electronic department from buying multiple units. However, it is generally possible to purchase at least one good multifunction advanced digital oscilloscope for the lab that the instructor can use in demos and the students can take turns using.
2. The recommended scope should be a digital model with a bandwidth of at least 200 MHz, have multiple channels (4), a logic analysis option and software modules for analysis of serial data from RS-232, CAN, I2C and SPI interfaces.
3. Similarly, at least one digital signal generator with AWG capability and a spectrum analyzer should be purchased for demos and shared usage.

General Lab Recommendations continued

4. The DAQ lab can be implemented with widely available DAQ low cost modules and software. The modules contain a basic multiplexer and ADC with an interface to a PC for data storage, display and analysis.
5. At least one DAQ module from National Instruments should be used along with at least one PC with LabVIEW software from NI installed. LabVIEW is expensive but most schools can afford at least one system that can at least provide an introduction to this widely used software and equipment. The sensor and signal conditioning circuitry is an issue to be addressed by the faculty.

Questions?

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Electro Cardiograph Data Acquisition Lab

Jesus Casas
Austin Community College

eSyst Project Developer

Questions?

Type them in your Chat Window

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Web Site Tour

Demonstrate eSyst web site:

- Implementation Guide for Data Acquisition
- Data Acquisition Systems Lab Activities
- Tektronix Oscilloscope resources

eSyst Web Site

Project Development Team Members

Mike Lesiecki – Principal Investigator

Lou Frenzel - Project Lead Subject Matter Expert

Roy Brixen – Project Developer

Wayne Phillips – Project Developer

Jesus Casas – Project Developer

Ui Luu – Project Developer

Bassam Matar – Project Developer

James Hardison – M.I.T. Project Developer

Tom McGlew – Project Development Manager

Questions?

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Webinar Recordings

To access this recording, visit **www.matecnetworks.org**,
Keyword Search:
"**Data Acquisition webinar**"

Password: "networks"

eSyst Upcoming Webinars

April 2: Electronics Communications

Visit ***www.esyst.org*** for more details about upcoming webinars

NetWorks Upcoming Webinars

March 12: **Industry Expectations of Graduates**

April 9: **Converging Technologies Career Exploration**

Visit **www.matecnetworks.org** for more details about these and other upcoming webinars

Join Us in Orlando, FL
July 26-29, 2010

Visit ***www.highimpact-tec.org*** as more details develop

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Thank You to everyone for participating in today's Electronics Systems Technology Project Implementation Webinar Series
Part 5: Data Acquisition Implementation

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