



ARM Developer Day: Engaging Engineering Students through Targeted Hands-On Workshops

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The ARM Developer Day: Engaging Engineering Students through Industry-relevant Hands-On Workshops

Abstract

The annual ARM Developer Day at the Rochester Institute of Technology (RIT) is a unique event offered to engineering students and faculty on campus centered on ARM-based processor development and technology. The ARM University Program is a key driver of the event which aims to unite a large number of ARM partner companies to offer a series of hands-on, academic workshops for students ranging from freshmen to graduate students. This paper presents the process of creating the ARM Developer Day with the objective of sparking engineering creativity in students and faculty by offering a combination of academic and industry training on the most relevant technologies used in the microprocessor industry today. The hope is that this event inspires other universities to offer similar industry-supported opportunities to their students and faculty.

Introduction

Engineering students are becoming scarce. Instructors need to better engage them as well as expose them to state of the art technologies used in industry. Through careful study and consideration of industry trends, an industrial convergence to ARM processors as the preferred microprocessor architecture of current and future consumer and industrial electronic products has been identified.

While industry reports show there is still heavy use of 8-bit and 16-bit microcontrollers in these products, there is an industry trend towards 32-bit processing. 32-bit processors can allow more performance and functionality while maintaining good code efficiency, low cost, and low power consumption, and this is evident in the ARM architecture-based processors implemented by a vast number of semiconductor companies. Students familiar with ARM processors and architectures have a competitive advantage after graduation due to ARM's large share in the microprocessor industry. A new hire trained on ARM requires less training and is better prepared to start developing real-world applications.

These days, microcontroller programming is typically done through a high-level language such as embedded C, C++, or Java. While programming in a high-level language hides the inner-operations of the processor architecture, the role of both engineering and engineering technology programs is to educate embedded engineers on hardware design as well as the high-level and low-level software skills to be able to, for example, code a device driver in either C or an assembly language. This also allows students to implement embedded applications as either "bare metal" without an operating system (OS) or under the control of an OS such as Linux.

Based on these needs, the annual "ARM Developer Day @ RIT" has been organized for the last three years to bring a significant number of ARM partners together in the areas of integrated circuits, software, operating systems, and end-product manufacturing to offer a full day of free, hands-on workshops and presentations for engineering and engineering technology students and faculty. Some local entrepreneurs, hobbyists, and multidisciplinary teams of innovators also attend the workshops.

Most of the platforms used in the workshops are economically viable for both students and university faculty for their own teaching and labs. Several of the workshops are based on open source platforms encouraging students and faculty to collaborate and enhance software code repositories and knowledge bases. It also promotes the creation of open hardware prototypes for building projects. The event has also included hardware and software platform donations which students and faculty use to develop innovative products and create classes and teaching labs around relevant technology. A good example of this is the mbed prototyping platform.

Last year an ARM Student Design Contest was announced at the event where students would later have the opportunity to competitively demonstrate their projects at the annual on-campus innovation festival “Imagine RIT”, which brings together 30-40 thousand people including many from the general area public. The projects ranged in areas in robotics, music, biomedical, sustainability, and consumer electronics.

Background

Never has there been such a plethora of options and accessibility to such a large number of embedded design companies as there is today. Intel has dominated the personal computer (PC) space for more than three decades with their x86 processor architecture, while the ARM processor architecture has been the industry leader for mobile devices.

However, there is a big difference between these two companies, as ARM does not actually produce silicon. ARM licenses processor architecture Intellectual Property (IP) and technology to almost every semiconductor company in the world, who in turn design their own ARM-based processors and System-on-Chips (SoCs). The semiconductor partners then sell those components to equipment manufacturers to create a variety of embedded systems, including most of the world’s mobile phones and tablets. ARM receives IP licensing fees from its semiconductor partners and royalties off the shipments of ARM-based processors. The ARM brand is relatively unknown to the every-day user since there are no “ARM inside” logos on the outside of devices such as smartphones, tablets, and a variety of other electronic devices, but with over 30 billion ARM processors in the world today, it is by far the most prevalent 32-bit processor architecture and should continue to be for the foreseeable future.

Current embedded system designs require efficient code, low-power capabilities, competitive cost, innovation, high levels of integration, high performance, expandability for future growth, connectivity to the internet, and the ability to measure different variables in its surroundings, e.g. temperature, acceleration, position, location and ambient conditions.

Engineering students at a given university range in experience from freshmen to PhDs, and also range in study focuses from Electrical and Computer Engineering to Chemical Engineering. One issue to sort out was how to offer an industry-driven educational event that met the needs of such a wide variety of students?

Some semiconductor and electronic design automation (EDA) companies have university programs designed to expose students to their technologies before joining the workforce so that when those students find themselves in key decision making roles, they have an instinctive preference to the technology they have learned in school.

Choosing a single vendor constrains students to that particular technology, platform, design language, EDA tools, etc., but at some point, this must be done. At the same time, it is of extreme importance to make students aware of the myriad options which should be evaluated before making an embedded systems design decision. The amount of choices is so large that there is not always a best approach to a problem, and students must be given the information in order to make the correct decisions. What is common among all these factors is that the ARM processor architecture has emerged as the common denominator in a vast variety of ultra-low power, digital signal processing (DSP), control, server, and network sensor applications

A connection was established with the ARM University Program and ARM's response was prompt and fruitful. The original engagement was based on a need to update basic microcontroller and embedded system design courses in the Electrical, Computer and Telecommunications Engineering Technology (ECTET) department at RIT. Since then, the collaboration has grown to include a number of ARM partner companies where students and faculty greatly benefit by being able to learn, evaluate and get support for a number of modern embedded systems development platforms.

The 1st ARM Developer Day (<http://afmiee.wordpress.com/>)

The Event

The initial step in enabling ARM technology into the department's microcontroller and embedded systems design courses was to arrange an industry guest workshop for the students and faculty of those courses. As the ECTET department already had strong connections with several ARM semiconductor partners with university programs, it made sense to have a common event centered on ARM.

Some of these companies already had their own developer events on campus or nearby locations, so concern was expressed about duplicating efforts. However, the key difference was that their current events catered more to their commercial customers rather than students and academic faculty, some even focusing on technology road maps and marketing pitches. Students and faculty are encouraged to participate in these events, but many times the academic takeaway is not valuable.

Interestingly, most ARM partners are in competition with each other, and this caused concern as well. Forcing the ARM Developer Day to be completely academic- and student-focused rather than customer-focused alleviated some of this concern from the participating companies, but in the end, this kind of competition benefits students and the university.

Another concern was the large gaps in student experience, and this was addressed by the selection of more simplistic development platforms and environments for the workshops. Many of these included open-source environments.

It was also agreed that the format was to have a series of hands-on workshops where the students could evaluate and work on basic applications with selected platforms. Prerequisites were kept to a minimum and the intention was to show students the right tools for the right tasks.

Dates were another important factor; a date had to be selected in which the laboratories used for the workshops had minimal impact on running courses. A solution was to have the event on a Saturday, but most company employees do not work on weekends, and students and faculty are also busy on weekends. The solution was to schedule the event on the first week of the winter quarter when all students are back from holiday, most of laboratories are not heavily used, and there was a good opportunity to promote the event during the previous quarter.

The first ARM Developer Day was very modest in terms of content and saw support from companies with the platforms and workshops shown in Table 1 and Figure 1.

Table 1. Sponsor companies, platforms and workshops offered.

Company	Platform	Workshop
Texas Instruments	BeagleBoard	BeagleBoard + Linux Workshop
ARM	mbed	mbed - hands-on workshop
Cypress	PSoC	PSoC 5 Workshop

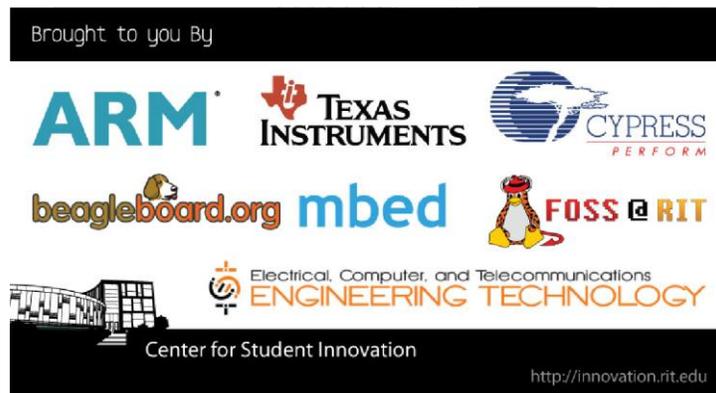


Figure 1. First ARM Developer Day sponsor logos

In order to promote the event and provide information, a blog site was created with links to registration and in-depth descriptions of the workshops. It also created a place to post photos and videos from the event, conduct feedback polls for students, and publish workshop materials for future reference. The blog site is shown in Figure 2 and a photograph of one of the workshops is shown in Figure 3.

Workshop Format

All workshops had similar formats and goals, were hands-on, and interactive given the limited time slots. Students and faculty were presented with the information required to be able to create a basic application on the designated platform. In some cases they may have just blinked an LED, and in other cases displayed a message in a terminal which measured, e.g., room temperature. Other cases involved interaction with operating systems allowing demonstration applications using graphics and networking capabilities. This format has been maintained through all event offerings and has been well received.

During the event opening, the companies presented student expectations from the workshop and gave an idea of the level at which it would be presented. Sometimes students attend a more

complex workshop to find out what level of expertise is needed in the future to be able to understand and apply the concepts.

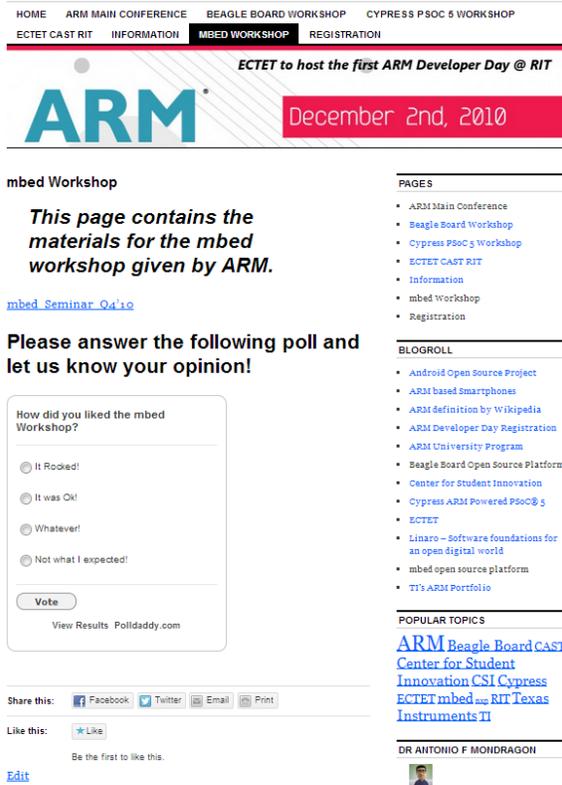


Figure 2. First ARM Developer Day blog site



Figure 3. mbed workshop (top). Texas Instruments showcasing ARM development platforms (bottom).

The Day of the Event

The workshops were catered to a variety of levels of expertise, covering the introductory (mbed), the intermediate (PSoC), and the advanced (Beagleboard + Linux) platforms. The event was well received; students and faculty enjoyed it, as did the company representatives. In addition, there was an opening “Keynote” by ARM to introduce ARM processors and architectures, as well as a networking lunch for students to interact with the company representatives and see live demonstrations of their platforms. There was also time for one-on-one meetings between capstone senior design students with industry engineers who offered their advice and consultation on their ideas. It was a win-win for the university and industry.

All of the participating companies agreed to participate in a similar future event. There were other partner companies participating in the organization of the event, but due to resources and logistics were not able to offer workshops. This first pass of the event was not given the proper anticipation and resource, as university budgets were already tied to other commitments. But departmental staff agreed to allocate more resource to a similar future event based on the positive feedback from the students.

Interestingly, even though the event was organized primarily by the Engineering Technology department, students from Engineering, Computer Science, the Center for Student Innovation, and other disciplines participated in the event as well. Many students were drawn to the event in hopes of winning industry-sponsored prizes from the frequent and advertised raffles. Additionally, after most of the workshops, students walked away with the development platforms used. After the workshops, all around campus several students started using their development hardware for their own personal projects. Some faculty updated their course content with donated teaching platforms as well.

In order to have an estimate of the number of students that participated, all registration was done using an online event manager called Eventbrite. Figure 4 shows the number of tickets “sold” per event (tickets were free, but students had to request a ticket for each workshop). There were 67 individual orders (not shown), and 46 were for lunch. There were some no-shows, so lunch was a good indicator of the actual number of students that attended. There was some difficulty in keeping track attendees as the event is run by volunteers also attending workshops, but the exact amount of attendees was not hugely important, especially for a first-pass of the event. All laboratories were however at capacity, and there were more than 20 students attending every workshop. As the labs only had 20 workstations each, many students worked in pairs. Figure 5 shows the ticket sales by date. Spikes can be seen at initial offering before thanksgiving and right before the event. 190 individual workshop tickets were sold. Taking the average of each student participating in at least two events plus lunch, the result is about 63 students (which seemed fairly accurate).

Summary of the “First ARM Developer Day”

In the end, student feedback indicated that they enjoyed the event, and several independent student projects began using the platforms presented at the workshops. Since then, mbed in particular has become a choice platform on campus for fast prototyping of a wide range of projects, largely due to the ARM Developer Day, but also because of its simplicity and abstracted programming model simple enough for non-Electrical and Computer Science students to develop applications with. Senior design projects also started migrating from a single design platform to a search to find the most suitable platform for a wider range of applications.

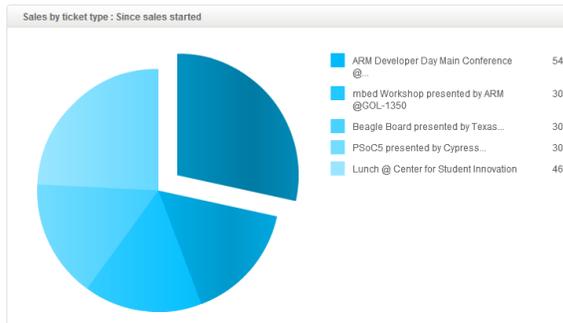


Figure 4. Ticket sales by ticket type.

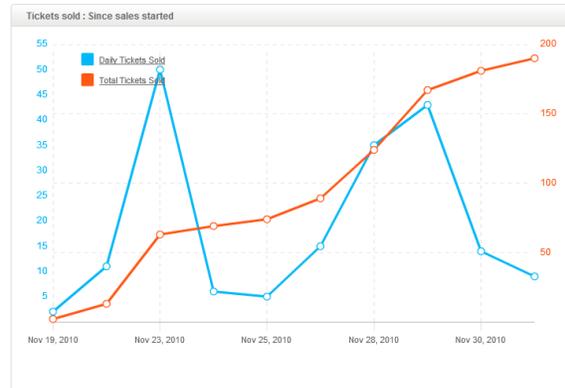


Figure 5. Tickets sold.

The 2nd ARM Developer Day (<http://armdeveloperday2nd.wordpress.com/>)

The Event

Despite its small size, the first year's event was a success to build off of. The second year's event was better timed, and the total number of workshops increased from 4 to 16. Additionally, many students had time conflicts with other scheduled events during the first ARM Developer Day. The format was changed for year two such that some workshops were replicated during different time slots. One "Gaming App developing" workshop was even scheduled as an all-day event. This allowed students more flexibility in their scheduling. Figure 6 show the eight companies participating in the 2nd ARM Developer Day and Table 2 shows the platforms and name of the workshops.



Figure 6. Second ARM Developer Day sponsor logos

As can be observed in Table 2, the range of unique workshops went from 3 to 11, but the total number of concurrent workshops between four different lab venues was 16. This was a major upgrade from the first year's event. The workshops covered basic (mbed), intermediate (LPCXpresso, Evalbot, SAM3/9, Kinetis, Xilinx), and advanced (QNX, Tablet OS) platforms.

The spectrum of applications and workshop themes for year two included:

- Rapid prototyping
- Robotics
- Sensors
- USB development
- Smartphone and tablet development
- RTOS development
- System on a Chip (SoC)

The breadth of the workshops was consistent with the goals of the event, and all workshops were based on ARM technology. For example, consider a Blackberry Tablet OS or the BeagleBoard development platform running Android or QNX and developing on these platforms at a high-level. It is important to remember that the underlying hardware consists of a Texas Instruments

OMAP platform based on an ARM Cortex-A processor core. Almost all current Android devices use ARM processors.

All workshops were at full capacity with at least 60 students at each of the four available venues. Most of the company representatives again raffled off a large numbers of platforms and door prizes helping to create another great event with nothing but positive feedback from students.

Table 2. Sponsor companies, platforms and workshops offered.

Company	Platform	Workshop
Texas Instruments	Stellaris	Stellaris M3/Evalbot
ARM	mbed	mbed - hands-on workshop
Freescale	Kinetis K60	C development for Kinetis K60, coding, running and debugging
NXP	LPCXpresso	NXP MCU LPCXpresso Tools Workshop – USB Development made Easy!
Atmel	SAM3/9	SAM3 Hands-on Training
		SAM9 and Android Hands-on Training
QNX	Neutrino	QNX RTOS Development on Beagleboard
RIM	BlackBerry Playbook	Introduction to the Native SDK for BlackBerry Tablet OS
		Game Makers Dream: Native SDK and BlackBerry Tablet OS
		BlackBerry NDK Samples walkthrough lab
Xilinx/Avnet	Zynq-7000	Embedded 28nm ARM processors within Xilinx FPGA's

Event Statistics

For the second year's event, better statistic collection systems were used, and a total of 615 tickets "sold" (there is actually no cost for a ticket it is to be able to keep track of the event). This was key information for the industry representations in order for them to evaluate the impact of the event. Figure 9 and Figure 10 show ticket sales by ticket type and the total number of tickets sold. In this case we had 80 students register for lunch, again a good estimate of the number of students who actively participated in the workshops.

The full-day workshop on tablet applications had very few participants, likely due to timing conflicts with such a long workshop and a desire for a variety of shorter workshops.

Year two saw collection of more useful information about the students that gave insight on student's department, program level, year level, as well as the number of times the event page itself was visited. This is helpful in gaining insight into which department's students preferred which type of workshops. As can be observed in Figure 11, the majority of the students were from Engineering followed by Engineering Technology, which makes sense based on the difference in the colleges' sizes (3,015 and 1,796 respectively). Figure 12 shows that about twice as many undergraduates participated compared to graduate students, which again made sense. Figure 13 proves that the majority of the students were in their 4th and 5th year of studies, but it is

not clear if the count in the first two years accounts for freshmen and sophomores being mixed with graduate students. Figure 14 shows how many visits vs. actual tickets were sold.

The ARM Student Design Contest

The 2nd ARM Developer Day introduced the first ARM Student Design Contest that ended at Imagine RIT. It was decided to launch a student design contest to build on the momentum generated from the large amount of platforms students received during the workshops. The idea was to create a theme and students would then register their intent to participate. The theme was “Creating a Better Quality of Life”, and there were nine projects registered with teams varying in size from 1 to 9 students.

In the months before the end of the contest, all participants and faculty advisors met every Friday afternoon to comment on the progress of each project. The meetings were informal, but there was a lot of cooperation among teams in terms of personal recommendations and experience on, e.g., how to connect to the university’s Wi-Fi, or how to program a microcontroller to perform a particular task.

The teams competitively showcased their projects during the Imagine RIT university innovation festival, as was shown previously in Figure 7 and Figure 8 show the ARM Developer Day website as well as some photos of both the ARM Developer Day and the ARM Student Design Competition. In the figures are shown the three first places on the competition. It was estimated that there were around 30,000 visitors.

The winners of the competition were selected by the general public. People of all ages visiting the ARM Student Design Contest exhibit were given imaginary investment money, and in order to win the contest, the student teams had to convince participants to invest the most amount of the money in their imaginary “company” via a pitch on why their “product” is a wise investment. This was in effect emulation of how start-up companies are formed. A group of second year students won the competition by a large margin with a muscle movement controlled car. The second place team showed a wandering ambassador robot, while the third place project was a smart refrigerator.

Many companies gave gifts in-kind and cash to be used as prizes. Several companies sponsored the exhibit through donations to the college. In addition to the student design contest prizes, the innovation festival provides a ribbon to all sponsoring companies at the higher levels of support. Two of the limited number of ribbons were given out to the student projects in the ARM Student Design Contest exhibit to recognize their efforts from the perspective of a sponsoring company; they found the exhibit to be the best of all exhibits in the innovation festival!

2nd ARM Developer Day @ RIT

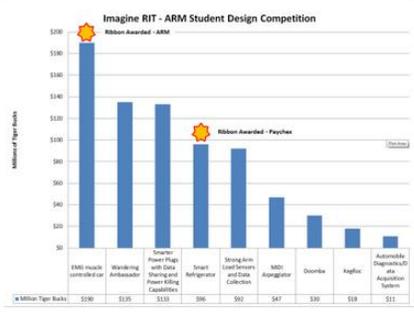
First Place – EMG Bio-Drive
 Posted on May 8, 2012 | [Leave a comment](#)



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Imagine RIT – ARM Student Design Competition
 Posted on May 7, 2012 | [Leave a comment](#)

Creating a Better Quality of Life!



[Event Photos!](#)

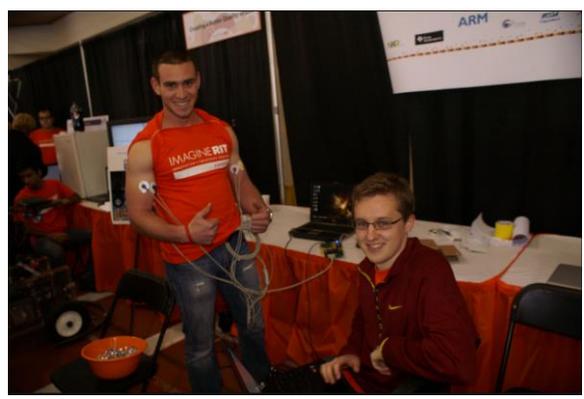


Figure 7. Second ARM Developer Day Blog Site. Arm and Freescale representatives delivering first prize to EMG Bio Drive team (top). EMG Bio Drive team (bottom)

REGISTRATION
[CLICK AND REGISTER](#)

TOP POSTS & PAGES
 There are no posts to display. [Want more traffic?](#)

- RECENT POSTS
- First Place – EMG Bio-Drive
 - Imagine RIT – ARM Student Design Competition
 - Lucky Winner of a screaming SB Touch!
 - Multi-disciplinary Robotics Club gets mbeds
 - Photos and Videos

ARMDAYTITTERER
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2ND ARM DEVELOPER DAY

A social media widget showing a grid of photos and text: "ARM Developer Day at RIT", "61 people like ARM Developer Day at RIT.", and "Tech Me!"

CLOUD
[Apps ARM Blackberry](#)



Figure 8. NXP workshop (top). President Destler talking with wandering ambassador team (middle top) and students promoting their projects (middle bottom). Students performing demonstrations (bottom)

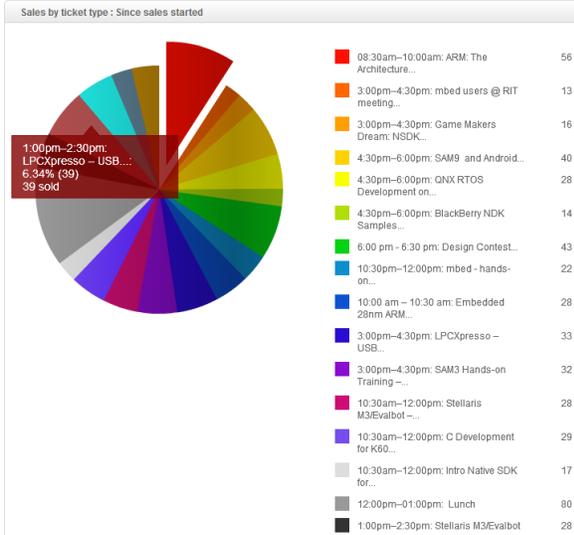


Figure 9. Ticket Sales by Ticket Type.
Note: Not all events are shown.

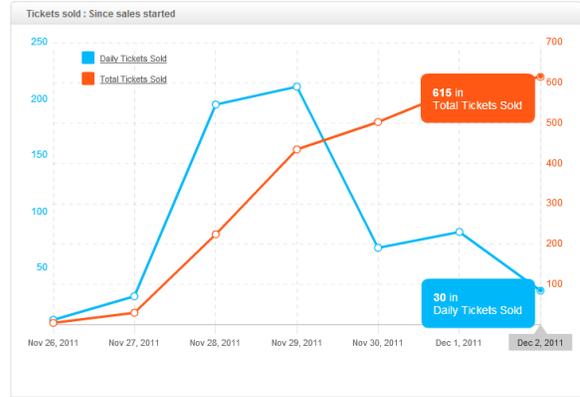


Figure 10. Tickets sold since sales started.

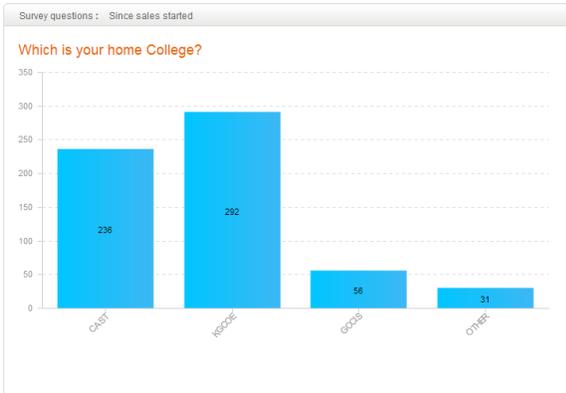


Figure 11. Home College: Engineering Technology, Engineering, Computer Science and Other.

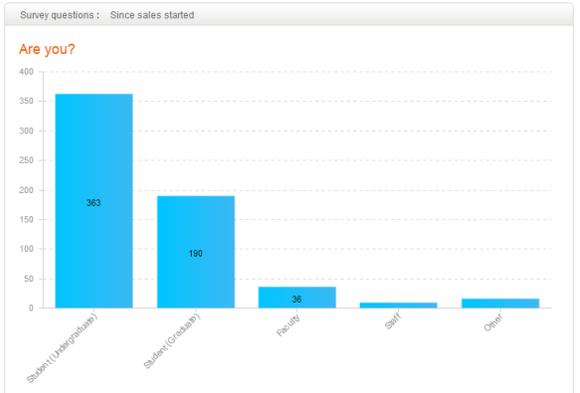


Figure 12. Program level: Undergraduate, Graduate, Faculty, Staff and Other

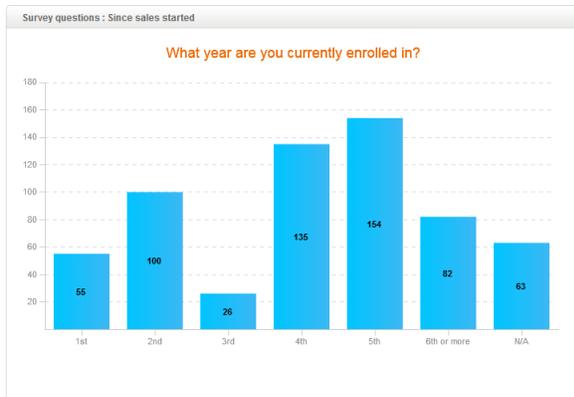


Figure 13. Year enrolled



Figure 14. Page views

Summary of the 2nd ARM Developer Day

The 2nd ARM Developer Day was again a success and beneficial to both industry and academia. All involved companies participating focused on the students, some offering internships and full-time positions to those most qualified and interested, and networked with faculty about migrating their technology to classes and teaching labs.

From the university standpoint, there is little associated cost other than the use of on campus resources. The ARM University Program sponsored the catering during the ARM Developer Day, while some partner companies sponsored the innovation festival at differing levels (i.e., Freescale was a silver sponsor).

Since the 1st ARM Developer Day, it has been evident that student interest in embedded systems and microprocessors from all disciplines has significantly grown. For example, the student design competition saw students across a wide range of engineering disciplines as well as non-engineering disciplines. There were also student entrepreneurs that integrated technology into their products.

Senior design projects from both Engineering and Engineering Technology are also trending towards ARM. Additionally, further courses and labs adopted ARM platforms as a result of the 2nd ARM Developer Day. Soon after, students were eager for information on the next ARM Developer Day.

The 3rd ARM Developer Day (<http://armdeveloperday3rd.wordpress.com/>)

The Event

The latest event saw further growth from the previous year, and the overall format was kept similar. However, the third edition had the opportunity to bring in Rob Bishop, a technology evangelist from the Raspberry Pi foundation based the United Kingdom (UK), as a keynote speaker and to deliver workshops. The surrounding hype around the Raspberry Pi platform generated an incredible excitement not just from students in a wide range of majors, but also from local industry professionals! One of the main goals of Raspberry Pi foundation is to engage future generation in STEM areas.

Raspberry Pi is a platform designed in the UK in response to the needs of a generation of computer savvy young adults enrolling in computer engineering and computer science in university studies. Faculty at the University of Cambridge in the UK identified that the computer knowledge and hands-on skills of students enrolling in the computer programs was declining in terms of engagement and abilities.

The Raspberry Pi movement has been a worldwide phenomenon, and this year it is expected that one million boards will be sold just by word of mouth and press releases, without the need for any incurred advertising expenses. Several months after its release, there was such a huge demand that many electronic distributors had backlogs for months. The 3rd ARM Developer Day was able to secure 20 boards for workshops and 100 boards were made available exclusively for student participants to purchase online. Raspberry Pi has been embraced by a large group of people interested in technology, e.g., open source hobbyists, hackers, and maker communities, as

well as professionals around the globe creating both hardware and software applications. The main group benefiting from this movement will be the K-12 generation that could grow up using and programming bare metal, low-cost computers before going on to university studies. The Raspberry Pi platform is based on ARM, so fit very well with our event, and the response to the keynote speaker was very well received.

In the days leading to the 3rd ARM Developer Day, Raspberry Pi workshops were given at local venues open to a variety of organizations (e.g. the IEEE local chapter, maker communities, and surrounding high schools). Individual meetings with freshmen, a graduate seminar, and a robotics club were arranged. The demand was so large that the ARM Developer Day Raspberry Pi workshop had to be extended an additional day with another keynote speaker talk, and two further workshops open to the public. A challenge for the 4th ARM Developer Day will be to hold a similar total number of workshops and bring in as many attendees with the possibility of not having Raspberry Pi's participation.

Another difference with previous years is that several students and faculty from regional universities were able to attend the workshops. This was the first time attendees from other universities in the area were officially identified. This accomplishment fulfilled one of the initial goals for the event: to congregate a diverse group of students and faculty under the same roof to take advantage of the event's workshops and networking. Table 3 shows the different workshops and presentations offered, and Figure 15 shows the logos of participating companies.



Figure 15. Third ARM Developer Day sponsor logos

A very interesting workshop was taught by two mechanical Engineering Technology students focused on teaching mechanical engineers how to use mbed. The objective was to show “mechies” how to integrate microcontrollers into their mechanical applications. Both students had taken the Microcomputers course as an elective and have been working actively on embedded and mechanical systems at their own initiative as a direct result of the 1st ARM Developer Day where they attended the mbed workshop. M^2 is a fictitious company name created just to be able to associate a company with the workshop (as seen at the end of Table 3). This is a clear example on how students from all disciplines can benefit from these types of events.

Table 3. Sponsor companies, platforms and workshops offered.

Company	Platform	Workshop
Texas Instruments	Stellaris	Stellaris Launchpad
ARM	mbed	mbed - hands-on workshop
Freescale	Kinetis L	Freedom Board
Cypress	PSoC	PSoC5
MicroSemi	SmartFusion	Build Your Own Custom ARM-based System
Keil	NXP	CAN Primer: Creating Your Own Network
QNX/Freescale	iMX53	QNX Neutrino RTOS and Graphics for the iMX53
Raspberry Pi	Raspberry Pi	A Taste of Pi - A hands on workshop with the Raspberry Pi
Mathworks	BeagleBoard	Connecting Simulink to Hardware
Xilinx/Avnet	Zedboard	Getting your hands dirty with the Xilinx Zynq-7000 SoC
M ²	mbed	Introduction to Embedded Systems and Applications for Mechies!

Overview of ARM Cores and Platforms

One thing learned over three years of the event is that there is an ARM core and a respective educational platform for a wide variety of student projects, as well as some specific opportunities for them to be integrated at different levels in engineering programs. Table 4 shows the most relevant ARM cores to academia, some of the more popular vendor platforms implementing those cores, as well as the types of applications and features that can be leveraged from those platforms. It is important for students to learn that there is a particular ARM architecture targeted for particular applications, and the level of the workshops for the 4th ARM Developer Day could be categorized by ARM core.

Table 4. ARM Core architectures, companies and characteristic features.

ARM Core	Company/Platform	Features
Cortex M0	NXP/mbed	Low power 8 bit microcontroller replacement, USB, rapid prototyping, web based compiler.
Cortex M0+	Freescale/Freedom Board/mbed	Low power 8 bit microcontroller replacement, capacitive touch, accelerometer, OpenSDA and USB. Arduino compatible shields.
Cortex M3	Cypress/PSoC 5	Programmable SoC with programmable analog and programmable logic device (PLD).
	MicroSemi/SmartFusion	Programmable SoC with programmable analog and field programmable gate array (FPGA).
Cortex M4	Texas Instruments/Stellaris LM4F120	Floating point and USB. Expandable through booster packs.
ARM 11	Raspberry Pi Foundation/ Broadcom BCM2835	Floating point, GPU
Cortex A8	Texas Instruments/DM3730/ BeagleBoard/BeagleBone	Superscalar, DSP, Graphics accelerator
Cortex A9	Avnet/Xilinx Zynq-7000	Dual core, SoC, FPGA

Event Statistics

Again, the number of workshops grew compared to the previous year. The third year again filled all the venues to capacity, despite additional labs being allocated. It is not expected that future iterations of the event will grow past more than having four parallel workshops with an average of 25 seats per venue. This has been found to be the limit where students and faculty get the most out of the workshops, and where students select a “track” (basic, intermediate and advanced) to utilize the workshops. Figure 16 shows how individual workshops were promoted, including information such as the title, an abstract, a short bio of the presenter, and what students should expect. In Figure 17, several photographs from the day of the event show some of the networking activities, the setup of the workshops, as well the extended Raspberry Pi workshop that overflowed into Saturday due to high demand.

A total of 19 workshops and presentations were available, as shown in Figure 18. In Figure 19, the total number of tickets sold is shown. Both of these numbers can be misleading, since students can feasibly register for all possible events but not show up to any of them. Once again, the most useful indicator of total students participating in the event was the number of lunch tickets requested. As can be observed, there were 131 students and faculty registered for lunch in comparison to 80 from the previous year (an approximate 50% increase). The total number of tickets went up to 930, which also represents also an approximate 50% increase. Figure 19 shows that the tickets were requested in “waves”. The first wave indicates word-of-mouth publicity, and a second wave began when online publicity and targeted emails to student and faculty began. Another wave began around the period of Thanksgiving. There is a then large peak the day before the event when mass emails were sent by all departments.

As observed in the previous event data collection, Figure 20 shows that traditional engineering had a bigger participation than engineering technology, and it makes sense because the department is larger. In Figure 21, it can be observed again that undergraduate students had a bigger participation. This year the data included a distinction between first and second year undergraduates and graduates, and the total number of freshmen and sophomores. As can be seen in Figure 22, freshmen and seniors accounted for a large number of participants. The maximum growth was in terms of page views (people that visited the site) which were almost trifold, as can be observed in Figure 23.

The ARM Student Design Contest

During the catered lunch, the ARM Student Design Contest was announced for 2013. The theme for this year is “Energy Efficiency” and students had to make an initial proposal with an idea and the resources needed. A considerably higher amount of participants is expected compared to last year. The contest will again finish during the innovation festival and will also be judged by the public in the same format used in 2012.

Summary of the 3rd ARM Developer Day

The event was again a success by any measure, with a good amount of additional momentum generated by Raspberry Pi. Additionally, the workshops created a lot of excitement, so much that students and faculty from neighboring universities were in attendance. The event was flooded

with activity before and after the 3rd ARM Developer Day, and it was fortunate to establish links with maker/hacker communities, high schools, and community colleges. The ARM Student Design Contest is a currently ongoing activity, and by the time this paper is presented, there will be examples of student projects and the level of engagement that the ARM Developer Day has brought to RIT. The exhibit will have a 45'x10' space at the main Imagine RIT location; this is a 50% increase from last year's. The number of registered participating teams for 2013 doubled from 9 to 18. More information can be obtained at: <http://armdeveloperday3rd.wordpress.com/>

3rd ARM Developer Day @ RIT

ARM @ RIT

Electrical, Computer, and Telecommunications
ENGINEERING TECHNOLOGY

ARM The Architecture for the Digital World[™]

ARM element14 THE KATE GLEASON COLLEGE OF ENGINEERING

CYPRESS PERFORM Raspberry Pi MathWorks[®] NXP M² KEIL Tools by ARM XILINX[®] TEXAS INSTRUMENTS QNX QNX SOFTWARE SYSTEM Microsemi freescale[™] semiconductor

Student Innovation Hall

Home 2013 ARM Student Design Contest About Agendas and Maps ARM - The Architecture For the Future Digital World

CSI Cypress - PSoc ECETET Element14/Cadsoft - Raspberry Pi/Accessories & Eagle PCB Freescale - Freedom Board KeilARM - CAN KGCCE Mathworks - Matlab/Simulink Beagleboard Meda MicroSem - SmartFusion

NXP - mbed Cortex M0 QNX - QNX Neutrino RTOS and Graphics for the MMS3 Raspberry Pi Saleae - Logic16 SC0B

Texas Instruments - Shikari Launchpad Xilinx/Avnet - Zedboard

Xilinx/Avnet - Zedboard

XILINX AVNET

ZedBoard

Time and Location

- 2:30-3:00 Presentation "Getting your hands dirty with the Xilinx Zynq-7000 AP SoC" - Innovation Hall
- 3:00-4:30 Hands on Workshop - Innovation Hall
- 4:30-6:00 Hands on Workshop - Innovation Hall

Name

Timothy Duffy

Timothy.Duffy@Avnet.com

Workshop Name

Getting your hands dirty with the Xilinx Zynq-7000 AP SoC

Presenter's name and small bio

Name: Tim Duffy
Bio: Tim attended RIT for Computer Engineering Technology out of the ECETET department. Tim currently works for Avnet locally at the Henrietta, NY branch. Avnet is the world's largest distributor of electronic components. Tim is a Field Applications Engineer (FAE) covering Xilinx for western New York. Tim is passionate about open source software as well as open knowledge. Tim also has worked with the FOSS box within the RIT Innovation center.

Figure 16. Blog page with workshop information. <http://armdeveloperday3rd.wordpress.com/xilinxavnet-zedboard/>



Figure 17. Students and faculty visiting company booths during lunch break (top). Alumnus who works as FAE for Avnet/Xilinx conducted the workshop on Zedboard (middle). Saturday Raspberry Pi Workshop (bottom). More photos available at: <http://www.flickr.com/photos/antoniofmondragon/sets/72157632128988010/>

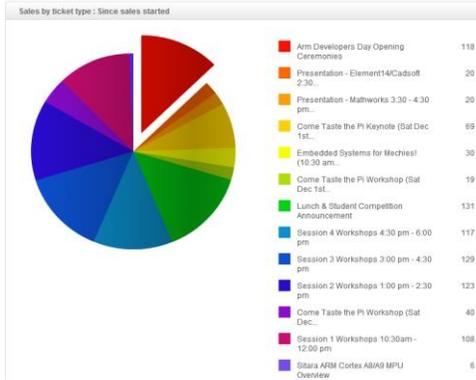


Figure 18. Ticket sales by ticket type.
Note: not all events are shown.

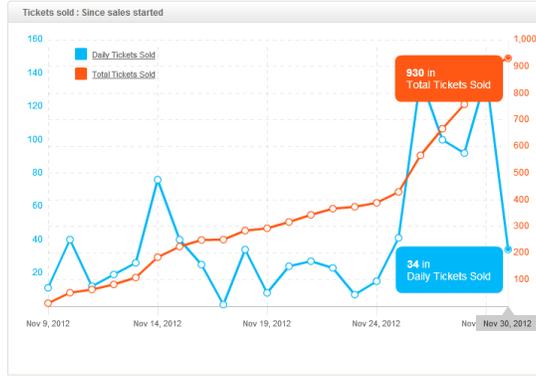


Figure 19. Tickets sold since sales started

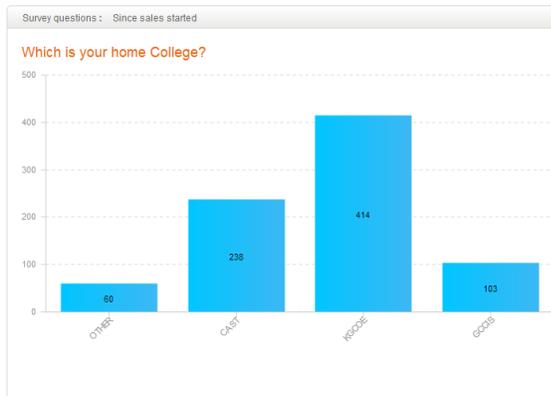


Figure 20. Home College: Other, Engineering Technology, Engineering, and Computer Science.

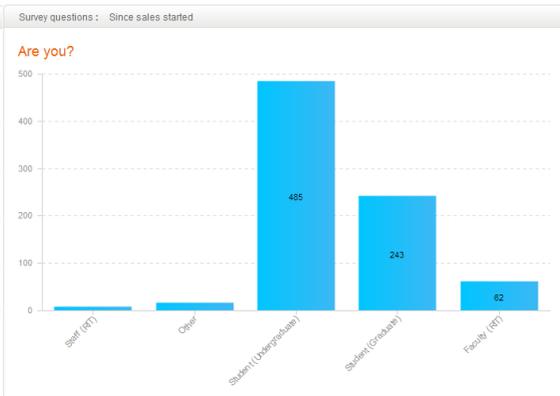


Figure 21. Program level: Undergraduate, Graduate, Faculty, Staff and Other

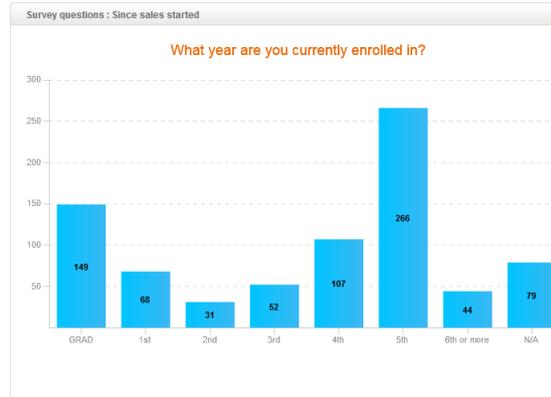


Figure 22. Year enrolled.

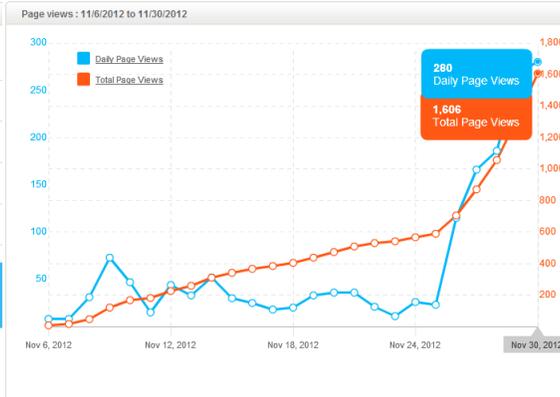


Figure 23. Page Views.

Conclusions

We can conclude that the ARM Developer Day and the ARM Student Design Contest have been a great experience for students and faculty, and a great way for companies to promote their university programs to a considerable number of attendees. This is proven by the level of student engagement, the number of projects developed by students using ARM technology and how different departments at RIT have been embracing this technology in its courses. ARM and partner companies have been increasing their participation in these events as they have seen the level of interest to grow in an environment targeted exclusively to academia.

The university's goal is for students to create a wave of innovation to begin creating the next generation of embedded devices while obtaining the required set of skills to become industry ready upon graduation.

The event has grown about 50% in terms of attendees at every offering, but further significant growth is not expected since the number of concurrent, controllable venues of the university is a limiting factor, offering 16 to 20 total workshops provides a valuable tradeoff between instructor/student ratios and the number of workshops offered for flexibility in student scheduling. Another factor is the possible cost to the university, as growing the event to multiple days could require significant budget.

Figure 24 shows observable parameters over the last three years of the event including the number of students and faculty that participating, the total number of workshops offered, and the number of participating companies. Using a percentage difference formula (1), a simple analysis of event growth over three years can be calculated.

$$\Delta\% = \frac{(x_{year} - x_{year-1})}{x_{year-1}} \quad (1)$$

Figure 25 shows that the growth from 2010 to 2011 is high, while a smaller growth percentage is observed from 2011 to 2012. However, this data can be misleading based on the educational tradeoffs discussed when growing the event too much year to year.

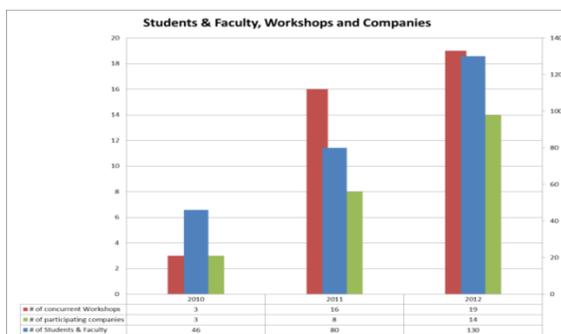


Figure 24. Yearly number of Students & Faculty, workshops and participating companies.

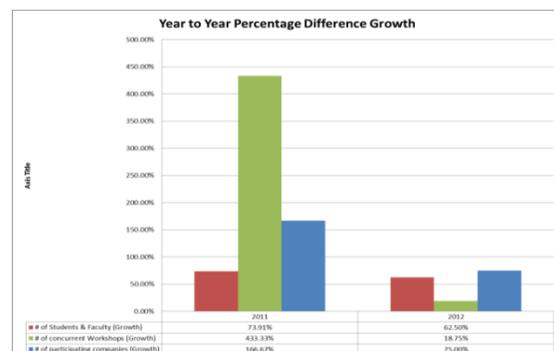


Figure 25. Year to year percentage difference growth.

Behind the scenes, the event has been largely organized from the university side by just two faculty members one in Engineering and one in Engineering Technology with support from student volunteers and staff in the areas of logistics and information technology. Other faculty members have had a hand in helping by encouraging their own students to attend, which makes the event a further success. Additionally, department heads from both departments have strongly supported the event and participated in furthering the relations with the participating companies.

The event has been a success by any measure in terms of student engagement. The effect is similar to what is expected from the startup company model; for every ten that start, just one or two will have products that are going to be visible in the short run. This is what has been observed from student participants; not all students will create projects that could be evaluated within the next year, and some students may be very successful entrepreneurs or leverage on the experiences acquired during the event for future decision taking. It may never be possible to directly measure tangible outcomes of student success until a cycle is completed. The same is true of the participating companies and their university programs in general; they promote where they cannot measure a direct, tangible benefit, and it is difficult to realize these results even when students join industry and later find themselves in leadership and decision taking positions.

Based on feedback from all sides and the perceived long-term effectiveness of this experience, it is highly recommended to give students at other universities similar opportunities to have a day of high quality workshops to spark their engineering creativity innovation, entrepreneurship, and networking skills. These events also give students the opportunity to connect with industry and make partnerships for future co-op and job opportunities. Having several companies at the same time under one roof all working together focused on students and academia makes such an event more collaborative and effective for students.

The students and faculty at RIT have applied the knowledge acquired, and the platforms donated have been applied in multiple senior projects and a variety of updated classes and labs for sustainable, more industry-relevant teaching going forward. The event has also engaged students in pursuing ideas and innovation on their own.

The ARM University Program has been a strategic piece of this endeavor by uniting a variety of companies and their university programs under similar goals to expose students and faculty to the most widely used computer architectures and technologies for embedded systems. In the end, all parties benefit.

Acknowledgments

We would like to thank the following companies who have participated in and sponsored all or some of the events.

- ARM
- Atmel
- Avnet
- Cypress
- Element 14
- Freescale
- Keil
- Mathworks
- MicroSemi
- NXP
- QNX
- Raspberry Pi Found
- RIM
- ST Microelectronics
- Texas Instruments
- Xilinx