2017 Embedded Markets Study

Integrating IoT and Advanced Technology Designs, Application Development & Processing Environments

April 2017

Presented By:  

© 2017 Eetimes/embedded.com  All Rights Reserved
AspenCore is the world’s largest media group and creative studio serving the global electronics industry with innovative marketing solutions. Over 200 employees of which include 100 engineers. 50 plus Brands-Over 50MM PV’s
We touch electronics professionals at every point in the design and manufacturing cycle.

- Industry news
- Design articles
- Tutorials
- Technical papers
- Data sheets
- Online tools
- Components database
The Key is the Journey

User sees your content on an Electronic Products Newsletter → Your message is then reinforced through the EETimes homepage → You touch your client again via an EEWeb article → Your influence increases through Electronics Tutorial → Trust is assured through an EDN Design Center

Multi-Channel Attribution

0% 1 CHANNEL 2 CHANNELS 3 CHANNELS 4 CHANNELS 5 CHANNELS

Customer Engagement

0% 50% 100%
Profile for Max The Magnificent

- Clive "Max" Maxfield is the Editor in Chief at Embedded.com. and EEWeb.com.

- Max received his BSc in Control Engineering in 1980 from Sheffield Hallam University, Sheffield, UK. He began his career as a designer of central processing units (CPUs) for mainframe computers. Over the years, Max has designed everything from silicon chips to circuit boards, and from brainwave amplifiers to steampunk "Display-O-Meters." He has also been at the forefront of Electronic Design Automation (EDA) for more than 30 years.

- Well-known throughout the embedded, electronics, semiconductor, and EDA industries, Max has presented papers at numerous technical conferences around the world, including North and South America, Europe, India, China, Korea, and Taiwan.

- Max has given keynote presentations at the PCB West conference in the USA, the FPGA Forum in Norway, and the Embedded Everywhere conference in Denmark. He's also been invited to give guest lectures at several universities in the USA, Oslo University in Norway, and Sheffield Hallam University in the UK.

- In 2001, Max "shared the stage" at a conference in Hawaii with former Speaker of the House, "Newt" Gingrich. Max is the author and/or co-author of a number of books, including Designus Maximus Unleashed (banned in Alabama), Bebop to the Boolean Boogie (An Unconventional Guide to Electronics), EDA: Where Electronics Begins, FPGAs: Instant Access, and How Computers Do Math.
The venerable EETimes/Embedded.com Embedded Markets Study has been conducted annually for over 20 years, with the sole exception of 2016, when organizational transitions and other events prevented the study from being fielded. Trending the data in this study bridges back to 2015 and the previous three to five years where relevant.

Remarkable consistency over the years has monitored both fast and slow moving market changes. A few surprises are shown this year as well, but overall trends are largely confirmed.

Emerging markets and technologies are also tracked in this study. New data regarding IoT and advanced technologies are included.

The data set this year is smaller than in previous years, but still exceeds a very high standard of confidence (see next slide). Data over 1100 respondents is considered the high end of market research projectability. Data as low as 200 respondents is still quite reliable and useful for marketing projections.
Purpose and Methodology

• **Purpose**: To profile the findings of the 2017 results of EETimes/Embedded.com comprehensive survey of the **embedded systems markets worldwide**. Findings include types of technology used, all aspects of the embedded development process, IoT and innovative technologies emergence, tools used, work environment, applications, methods/ processes, operating systems used, reasons for using chips and technology, and brands and chips being considered by embedded developers. Many questions in this survey are trended over three to five years, but in 2016 the survey was not conducted, so there is no data from that year.

• **Methodology**: A web-based online survey instrument based on the 2015 annual survey was developed and implemented by independent research company Wilson Research Group on February 20, 2017 through to April 15, 2017 by email invitation.

• **Sample**: E-mail invitations were sent to subscribers to EETimes and Embedded.com and related brands with reminder invitations sent later. Each invitation included a link to the survey and an incentive to participate.

• **Returns**: Data is based on **1,234** valid respondents for an overall confidence of 95% +/-2.8%. Confidence levels vary by question. As a guide, confidence for questions with:
  - **1,234 respondents for 2017** = 95% +/- 2.8%
  - **1,807 respondents for 2015** = 95% +/- 2.3%
  - **1050 respondents** = 95% +/- 3.0% (advanced research industry norm = very high confidence)
  - **600 respondents** = 95% +/- 4.0% (intermediate research industry norm = strong confidence)
  - **400 respondents** = 95% +/- 5.0% (basic research industry norm = good confidence)
In which region of the world do you reside?

- US & Canada: 56.3%
- Europe: 25.2%
- Asia: 10.6%
- South America: 4.3%
- Africa & Near East: 1.7%
- Australia: 1.9%
How many employees does your company have at all locations?

<table>
<thead>
<tr>
<th>Number of Employees</th>
<th>2017 (N = 616)</th>
<th>2015 (N = 809)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 100</td>
<td>47%</td>
<td>40%</td>
</tr>
<tr>
<td>100-499</td>
<td>14%</td>
<td>16%</td>
</tr>
<tr>
<td>500-999</td>
<td>7%</td>
<td>9%</td>
</tr>
<tr>
<td>1,000-4,999</td>
<td>10%</td>
<td>12%</td>
</tr>
<tr>
<td>5,000-9,999</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>10,000-19,999</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>20,000 or more</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Don't know</td>
<td>3%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Average Number of Employees:
- 2017 = 3,452
- 2015 = 3,644
- 2014 = 3,842
- 2013 = 3,965
Job Functions

- Debugging firmware/software: 62% (2017), 54% (2015)
- Writing firmware/software for embedded systems: 60% (2017), 55% (2015)
- Firmware/software design or analysis: 51% (2017), 44% (2015)
- Debugging hardware: 50% (2017), 42% (2015)
- Project management: 48% (2017), 43% (2015)
- Prototype testing: 44% (2017), 44% (2015)
- Device programming: 42% (2017), 36% (2015)
- Firmware/software testing: 41% (2017), 35% (2015)
- System design: 40% (2017), 30% (2015)
- Designing hardware for embedded systems: 38% (2017), 34% (2015)
- Hardware/software co-design: 30% (2017), 25% (2015)
- Board layout/design: 27% (2017), 21% (2015)
- Hardware/software co-verification: 18% (2017), 16% (2015)
- Connected device design: 16% (2017), 12% (2015)
- SoC (system-on-chip) design: 8% (2017), 8% (2015)
- Other (please specify): 3% (2017), N/A (2015)

Average number of years out of school:
- 2017 = 24.9 years
- 2015 = 20.0 Years
- 2014 = 21.8 years
- 2013 = 19.7 years
For what types of applications are your embedded projects developed?

<table>
<thead>
<tr>
<th>Application</th>
<th>2017 (N=853)</th>
<th>2015 (N=1152)</th>
<th>2014 (N=1529)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial control/automation</td>
<td>36%</td>
<td>34%</td>
<td>33%</td>
</tr>
<tr>
<td>Consumer electronics</td>
<td>21%</td>
<td>24%</td>
<td>20%</td>
</tr>
<tr>
<td>Internet of Things (IoT)</td>
<td>19%</td>
<td>24%</td>
<td>22%</td>
</tr>
<tr>
<td>Communications/netwrkg/wireless</td>
<td>12%</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Electronic instruments</td>
<td>16%</td>
<td>17%</td>
<td>16%</td>
</tr>
<tr>
<td>Automotive</td>
<td>16%</td>
<td>15%</td>
<td>17%</td>
</tr>
<tr>
<td>Medical</td>
<td>15%</td>
<td>17%</td>
<td>18%</td>
</tr>
<tr>
<td>Military/Aerospace</td>
<td>11%</td>
<td>10%</td>
<td>9%</td>
</tr>
<tr>
<td>Computers and peripherals</td>
<td>9%</td>
<td>6%</td>
<td>9%</td>
</tr>
<tr>
<td>Audio</td>
<td>6%</td>
<td>9%</td>
<td>11%</td>
</tr>
<tr>
<td>Video/ imaging</td>
<td>8%</td>
<td>8%</td>
<td>9%</td>
</tr>
<tr>
<td>Security</td>
<td>8%</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>Transportation</td>
<td>7%</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>Power generation and utilities</td>
<td>6%</td>
<td>9%</td>
<td>8%</td>
</tr>
<tr>
<td>Government /municipal</td>
<td>7%</td>
<td>6%</td>
<td>6%</td>
</tr>
</tbody>
</table>
How important will IoT development be to you and your organization in the next 12 months?

- Critically important, 7%
- Very important, 18%
- Important, 25%
- Not very important, 19%
- Not at all important, 20%
- Not sure/Don't know, 11%

“Critically important” to “Important” 50%

2017 (N=826)
If you are developing Internet of Things (IoT) applications, please indicate the type of application.

<table>
<thead>
<tr>
<th>Type</th>
<th>2017 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial</td>
<td>42%</td>
</tr>
<tr>
<td>Sensor-driven</td>
<td>39%</td>
</tr>
<tr>
<td>IP connected cloud/router</td>
<td>29%</td>
</tr>
<tr>
<td>Smartphone/mobile connected</td>
<td>26%</td>
</tr>
<tr>
<td>Smart buildings</td>
<td>19%</td>
</tr>
<tr>
<td>Medical</td>
<td>17%</td>
</tr>
<tr>
<td>Wearable</td>
<td>14%</td>
</tr>
<tr>
<td>Connected vehicles</td>
<td>13%</td>
</tr>
<tr>
<td>Non-IP connected hub/gateway</td>
<td>7%</td>
</tr>
<tr>
<td>Other</td>
<td>7%</td>
</tr>
</tbody>
</table>

2017 (N=484)
If you are creating Internet of Things (IoT) devices, please indicate the types of devices you are currently designing, and considering for your next design.

<table>
<thead>
<tr>
<th>Device Type</th>
<th>Currently Designing (N=342)</th>
<th>Planning to Design (N=337)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IoT edge device/system (on the edge of the Internet)</td>
<td>54%</td>
<td>44%</td>
</tr>
<tr>
<td>IoT infrastructure device/system</td>
<td>26%</td>
<td>29%</td>
</tr>
<tr>
<td>Wearable/mobile device/system</td>
<td>25%</td>
<td>31%</td>
</tr>
<tr>
<td>IoT bridge device/system</td>
<td>23%</td>
<td>25%</td>
</tr>
<tr>
<td>IoT cloud-based application/service</td>
<td>20%</td>
<td>29%</td>
</tr>
<tr>
<td>Full edge-to-cloud system</td>
<td>14%</td>
<td>23%</td>
</tr>
<tr>
<td>Other</td>
<td>7%</td>
<td>6%</td>
</tr>
</tbody>
</table>
Will have one or more projects devoted to IoT.

18% of all projects will be primarily devoted to IoT.

- Will have one or more projects devoted to IoT
- No projects devoted to IoT

2017 (N = 824)
Considering all applications of which you are aware, what do you regard as the most interesting use of the IoT? (Selected write-in responses).

- Automatic traffic control.
- Connected automated houses/buildings.
- Connected/autonomous vehicles.
- Detecting location: providing original content by screen, audio, phone.
- Distributed sensing for diagnostics and control. Think of sensors that detect bearing failures in rotating machinery, bridges, roadways, factory lines etc.
- Environment monitoring/ global electrical energy consumption reduction.
- Intelligent industrial machines, predictive maintenance of industrial components.
- Medical information/diagnostic integration, medical devices.
- Real-time sensing (road conditions, power grid data, total-plant monitoring).
- Earthquake/seismic monitoring signaling building evacuations in time to save lives.
- Drones; remote control and monitoring.
- Security within IOT - the technology is totally insecure.
- Smart cities, smart factories, precision agriculture, pest management in farming.
- Brain waves to control wheelchair movement. Opportunities endless and scary.
- Wireless monitor for underground water.
Gartner Hype Cycle for Emerging Technologies

2014: Machine Learning Not Even on the Radar
Gartner Hype Cycle for Emerging Technologies

2015: Machine Learning at Peak Hype!
Are you using any of these advanced technologies in your embedded systems?

- **Embedded vision**: Currently using 2017 (N = 202) - 50%, Considering using in next design 2017 (N = 298) - 43%
- **Cognitive (machine learning) capabilities**: Currently using 2017 (N = 202) - 25%, Considering using in next design 2017 (N = 298) - 47%
- **Embedded speech**: Currently using 2017 (N = 202) - 22%, Considering using in next design 2017 (N = 298) - 32%
- **Virtual Reality (VR) capabilities**: Currently using 2017 (N = 202) - 14%, Considering using in next design 2017 (N = 298) - 21%
- **Augmented Reality (AR) capabilities**: Currently using 2017 (N = 202) - 11%, Considering using in next design 2017 (N = 298) - 20%
- **Other (please specify)**: Currently using 2017 (N = 202) - 15%, Considering using in next design 2017 (N = 298) - 9%

Mentions of other technologies:
- Advanced sensors
- Android development for ARM Cortex-M4
- Early failure detection
- Home control
- Individual photon detection
- Model-based development
- Nanoscale sensing
- ULP
- Video recognition, voice recognition
What security measures are you taking with your current design?

- **Software security**: 45% in 2017, 40% in 2015
- **Encryption**: 39% in 2017, 32% in 2015
- **Hardware security (hard coding or FPGA)**: 26% in 2017, 21% in 2015
- **Considering options**: 21% in 2017, 20% in 2015
- **Other**: 14% in 2017, 14% in 2015
- **None**: 17% in 2017, 14% in 2015

Have taken one or more security measures: 66% in 2017, 61% in 2015
Overall Background

- **Focus** – IoT and Advanced Technologies were given some focus.

- **World Regions** – In this data, US/Canada (56%) are the predominantly represented region, Europe /ENEA (25%) is next, and Asia (11%) is less than in 2015.

- **Company Size** – Average of 3,452 employees is slightly down from 2015.

- **Job functions** – Debugging (62%), writing firmware/software (60%), hardware/software integration (62%), and architecture selection (59%) are the top four job functions.

- **Number of Years Out of School**: Average years out of school for the 2017 is 24.

- **Applications** – Industrial controls (36%) has led applications for many years. Consumer electronics (25%) is holding steady at second. Internet of Things (24%) upticks by leaps and bounds from fourth in 2015 to third place in 2017

- **IoT Usage/Advanced Technologies** – Sensor-driven (42%) and industrial (39%) applications led the IoT field. Half of all users felt IoT designs will be important in the next 12 months. Among advanced technologies used embedded vision technology was used most. **Machine learning** has greatest potential.
  - 54% are creating IoT edge of the internet devices.
  - 64% will have one or more projects devoted to IoT.

- **Security** – 45% of respondents are taking software security measures, 39% encryption, 26% hardware security measures. 66% are taking one or more of these.
Current Embedded Design Environment
My current embedded project is...

New to the world; a new project from scratch
- 2017: 44%
- 2015: 44%
- 2014: 44%
- 2013: 44%
- 2012: 44%

An upgrade or improvement to an earlier or existing project
- 2017: 57%
- 2015: 56%
- 2014: 57%
- 2013: 56%
- 2012: 56%
What does the upgrade or improvement include?

- New or different software features: 50% (2017), 51% (2015)
- New or different processor: 38% (2017), 39% (2015)
- New or different connectivity capabilities: 17% (2017)
- Mandatory changes/discontinued hardware/software: 17% (2017)
- New or different peripherals: 14% (2017), 16% (2015)
- New or different analog components: 11% (2017), 10% (2015)
- New or different system logic: 11% (2017), 15% (2015)
- New or different operating system: 10% (2017), 12% (2015)

Base: Those whose current project is an upgrade/improvement
Which of the following capabilities are included in your current embedded project?

- Digital signal processing: 56% (2017) vs 52% (2015)
- Networking capability: 54% (2017) vs 51% (2015)
- Analog signal processing: 43% (2017) vs 50% (2015)
- Wireless capability: 40% (2017) vs 38% (2015)
- GUI: 36% (2017) vs 37% (2015)
- Project rugged: 34% (2017) vs 30% (2015)
If wireless, what wireless interfaces does your current embedded project include?

- **Wi-Fi**: 65%
- **Bluetooth**: 49%
- **Cellular (LTE, 3G, 2G)**: 25%
- **IEEE802.15.4**: 14%
- **NFC**: 10%
- **LoRA**: 7%
- **IEEE802.15.4g**: 5%
- **Z-Wave**: 3%
- **SigFox**: 3%
- **RPMA**: 1%
- **Other**: 13%

*2017 (N = 379)*
If wireless, what wireless protocols/stacks does your current embedded project include?

- Zigbee: 35%
- 6LoWPAN: 15%
- Mbed: 12%
- Thread: 11%
- Wireless HART: 10%
- ISA 100: 2%
- Other: 45%

**Top mentions**

<table>
<thead>
<tr>
<th>Protocol</th>
<th>#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proprietary</td>
<td>17</td>
</tr>
<tr>
<td>Bluetooth / BLE</td>
<td>15</td>
</tr>
<tr>
<td>Custom</td>
<td>10</td>
</tr>
<tr>
<td>802.11</td>
<td>5</td>
</tr>
</tbody>
</table>
How many people are on your embedded project team?

14.8 engineers per team is slightly higher than 2015 and 2014.

Note: Outside vendors worked with is 2.7 on average.
What is your development team’s ratio of total resources (including time/dollars/manpower) spent on software vs. hardware for your embedded projects?

<table>
<thead>
<tr>
<th>Year</th>
<th>Average total resources devoted to software</th>
<th>Average total resources devoted to hardware</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>61%</td>
<td>39%</td>
</tr>
<tr>
<td>2015</td>
<td>61%</td>
<td>39%</td>
</tr>
<tr>
<td>2014</td>
<td>61%</td>
<td>39%</td>
</tr>
<tr>
<td>2013</td>
<td>61%</td>
<td>39%</td>
</tr>
<tr>
<td>2012</td>
<td>62%</td>
<td>38%</td>
</tr>
</tbody>
</table>

Note:
In 2017, respondents averaged working on 2.1 projects at the same time.
In 2015, respondents averaged working on 2.1 projects at the same time.
In 2014, respondents averaged working on 2.0 projects at the same time.
Do you primarily design or subcontract the design of custom circuit boards, or do you purchase off-the-shelf boards?

2017 (N=923)

- Primarily build/subcontract our own boards: 81%
- Primarily purchase off-the-shelf boards: 19%
Did you start your current embedded design with a development board?

<table>
<thead>
<tr>
<th>Development Board Started With (Write-in Answers Only)</th>
<th>N=356</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST Microelectronics</td>
<td>38</td>
<td>10.7%</td>
</tr>
<tr>
<td>TI (LaunchPad=5)</td>
<td>38</td>
<td>10.7%</td>
</tr>
<tr>
<td>Xilinx</td>
<td>29</td>
<td>8.1%</td>
</tr>
<tr>
<td>NXP</td>
<td>26</td>
<td>7.3%</td>
</tr>
<tr>
<td>Microchip</td>
<td>21</td>
<td>5.9%</td>
</tr>
<tr>
<td>Arduino</td>
<td>20</td>
<td>5.6%</td>
</tr>
<tr>
<td>Raspberry Pi</td>
<td>15</td>
<td>4.2%</td>
</tr>
<tr>
<td>BeagleBoard Bone Black</td>
<td>12</td>
<td>3.4%</td>
</tr>
<tr>
<td>Atmel</td>
<td>10</td>
<td>2.8%</td>
</tr>
<tr>
<td>Freescale (NXP)</td>
<td>10</td>
<td>2.8%</td>
</tr>
<tr>
<td>Cypress kits</td>
<td>6</td>
<td>1.7%</td>
</tr>
<tr>
<td>Renasas</td>
<td>6</td>
<td>1.7%</td>
</tr>
<tr>
<td>Altera Stratix V DSP Kit</td>
<td>5</td>
<td>1.4%</td>
</tr>
<tr>
<td>Avnet</td>
<td>5</td>
<td>1.4%</td>
</tr>
<tr>
<td>Intel Edison</td>
<td>5</td>
<td>1.4%</td>
</tr>
<tr>
<td>Silicon Labs</td>
<td>4</td>
<td>1.1%</td>
</tr>
<tr>
<td>Digi</td>
<td>3</td>
<td>0.8%</td>
</tr>
<tr>
<td>ESP32</td>
<td>3</td>
<td>0.8%</td>
</tr>
<tr>
<td>MSP430 - TI</td>
<td>3</td>
<td>0.8%</td>
</tr>
<tr>
<td>Nordic/nRF52-DK</td>
<td>3</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

2017 Embedded Markets Study

© 2017 Copyright by AspenCore. All rights reserved.
Which form factor boards are you currently using, and considering using?

- **Custom design**: 26% (27% considering)
- **Proprietary**: 23% (23% considering)
- **Arduino**: 17% (16% considering)
- **Raspberry Pi**: 16% (23% considering)
- **Beagle Board/Bone**: 10% (10% considering)
- **3.5”**: 8% (6% considering)
- **PCI Express**: 7% (6% considering)
- **5.25”**: 5% (3% considering)
- **PCI**: 5% (3% considering)
- **ATX**: 4% (3% considering)
- **Mbed *(new in 2017)**: 3% (6% considering)
- **PC/104**: 3% (2% considering)

Note: Answers under 3% are excluded.
Thinking now about the last embedded project you completed (no longer in development), how many months did that project take to finish?

- **6 months or less**: 37% (2017), 34% (2015), 35% (2014), 33% (2013), 35% (2012)
- **7 – 12 months**: 36% (2017), 34% (2015), 33% (2014), 35% (2013), 35% (2012)
- **19 – 24 months**: 9% (2017), 9% (2015), 10% (2014), 9% (2013), 9% (2012)
- **25 months or more**: 6% (2017), 8% (2015), 7% (2014), 6% (2013), 8% (2012)

- **2017 (N = 322)** Avg: 12.1 mos
- **2015 (N = 1,178)** Avg: 12.4 mos
- **2014 (N = 1,539)** Avg: 12.6 mos
- **2013 (N = 1,985)** Avg: 12.4 mos
- **2012 (N = 1,634)** Avg: 12.5 mos
In 2017, 41% of all projects finished “ahead of” or “on” schedule, and 59% finished “late or cancelled”.

In 2015, 38% of all projects finished “ahead of” or “on” schedule, and 62% finished “late or cancelled”.

2017 performance has returned to the performance levels of the 2012-2014 that averaged 41%-44% “on/ahead of” schedule.
My current embedded project is programmed mostly in:

- **C**: 56% (2017) vs. 66% (2015)
- **C++**: 22% vs. 19%
- Assembly language: 4% vs. 3%
- Python: 3% vs. 2%
- Java: 2% vs. 2%
- LabVIEW: 2% vs. 1%
- C#: 2% vs. 2%
- MATLAB: 2% vs. 1%
- JavaScript: 1% vs. 1%

2017 (N = 880) vs. 2015 (N = 1,217)
My next embedded project will likely be programmed mostly in:

- **C**: 52% (2017, N = 879) vs. 60% (2015, N = 1,220)
- **C++**: 24% vs. 23%
- **Python**: 5% vs. 2%
- **Java**: 2% vs. 3%
- **C#**: 3% vs. 2%
- **Assembly language**: 2% vs. 2%
- **LabVIEW**: 2% vs. 2%
- **MATLAB**: 2% vs. 2%
- **JavaScript**: 2% vs. 2%
Current languages used compared to next project’s likely language.

- **C**: 56% currently used, 52% likely to use in next project.
- **C++**: 22% currently used, 24% likely to use in next project.
- **Assembly language**: 4% currently used, 2% likely to use in next project.
- **Python**: 3% currently used, 5% likely to use in next project.
- **Java**: 2% currently used, 2% likely to use in next project.
- **LabVIEW**: 2% currently used, 2% likely to use in next project.
- **C#**: 2% currently used, 3% likely to use in next project.
- **MATLAB**: 2% currently used, 2% likely to use in next project.
- **JavaScript**: 1% currently used, 2% likely to use in next project.

**Notes:**
- 2017 Currently Use (N = 880)
- 2017 Likely to Use in Next Project (N = 879)
Does your current project reuse code from a previous embedded project?

In 2017, 87% reused code.
In 2015, 86% reused code.
In 2014, 86% reused code.
In 2013, 86% reused code.
In 2012, 85% reused code.

Note 1. Multiple choice for “Yes” answers (a respondents can select more than one type of reused code).
Note 2. 76% of respondents also reused hardware or hardware IP.
Embedded Design Environment

- **Upgrades vs. New** – 56% upgrades, 44% new projects – five years going.
  - Upgrades include new software features, processors, connectivity.
- **Capabilities** – Real time (59%), DSP (56%), networking capabilities (54%).
- **Team Size** – 14.8 is up from 14.0 three years ago.
- **Outside vendors** – Work with an average of 2.7 outside vendors.
- **Resources Used On** – Software (61%), hardware (39%).
- **Projects Worked On at Same Time** – Average of 2.1 projects.
- **Build or Purchase Boards** – 81% build their own boards, 19% purchase OTS.
- **Project Starts with Board** – 44% is down from 50% in 2015.
- **Form Factor Boards Used** – Custom design (26%), proprietary (23%) top two.
- **Months to Complete Project** – 12.1 months on average, down from 12.4.
- **On or ahead of schedule** – 41% in 2017 is two ticks better from 2015.
- **Languages** – C usage at 52%, down some but still dominant. No challengers.
- **Recode Use** – 87% was close to 2015 (86%), and is expected to continue
Embedded Design Process
Which of the following challenges are your own or your embedded design team's greatest concerns regarding your current embedded systems development?

1. The debugging process
2. Meeting schedules
3. Meeting application performance requirements
4. Increased lines of code & software complexity
5. Ensuring data security
6. Sticking to our cost budget
7. Maintaining legacy code
8. Testing/Systems Integration
11. Keeping pace with embedded systems technology
12. Meeting safety & development process standards
13. Providing network connectivity
14. Selecting the right processors for the job
15. Software compatibility when porting to new devices

* Added in 2015
What percentage of your design time is spent on each of the following stages?

- Developing system specs: 14% (2017), 14% (2015), 14% (2014)
- Conceptual design stage: 11% (2017), 11% (2015), 11% (2014)
- Detailed design stage: 32% (2017), 29% (2015), 29% (2014)
- Simulation stage: 8% (2017), 8% (2015), 8% (2014)
- Prototyping: 9% (2017), 10% (2015), 9% (2014)
- Sending to production: 7% (2017), 6% (2015), 6% (2014)
- Other (documentation, admin): 1% (2017), 1% (2015), 1% (2014)
How do you typically find and evaluate partners to work with?

- **Go to their websites & contact them**: 55% (2017), 55% (2015)
- **Referrals from colleagues**: 42% (2017), 44% (2015)
- **Recommended from other hw/sw vendors**: 26% (2017), 34% (2015)
- **Meet them at industry events**: 24% (2017), 27% (2015)
- **Read articles in industry pubs**: 23% (2017), 20% (2015)
- **Read white papers/industry communications**: 14% (2017), 8% (2015)
- **Read relevant blogs**: 8% (2017), 10% (2015)
- **See ads in industry magazines**: 5% (2017), 9% (2015)
- **Other sources**: 6% (2017), 5% (2015)

**Number of outside partners worked with on average:**
- 2.7 vendors in 2017
- 3.2 vendors in 2015
- 3.0 vendors in 2014
If you could improve one thing about your embedded design activities, what would it be?

- **Debugging tools**: 19% (2017) vs. 18% (2015)
- **Schedule**: 17% (2017) vs. 13% (2015)
- **Engineering team skill level**: 15% (2017) vs. 17% (2015)
- **Firmware itself**: 8% (2017) vs. 8% (2015)
- **Microprocessor**: 6% (2017) vs. 7% (2015)
- **Programming tools**: 7% (2017) vs. 8% (2015)
- **Interfaces**: 6% (2017) vs. 5% (2015)
- **Other hardware**: 6% (2017) vs. 5% (2015)
- **IDE**: 6% (2015)
- **Operating system**: 4% (2017) vs. 6% (2015)
- **The Compiler**: 2% (2017) vs. 2% (2015)
- **Other (Mgt, budget, legacy, etc)**: 5% (2017) vs. 5% (2015)
In general, what sources of information do you consult to research your embedded design decisions?

**Top 15 Sources**

- **Websites of vendors/mfrs**: 2017 (N = 870) 85%  2015 (N = 1,155) 78%
- **Search engine**: 2017 59%  2015 51%
- **Technical whitepapers**: 2017 50%  2015 43%
- **Colleagues**: 2017 46%  2015 42%
- **Technical standards**: 2017 42%  2015 40%
- **Technical communities (Sourceforge, ...)**: 2017 38%  2015 31%
- **Vendor tech support forums**: 2017 28%  2015 37%
- **Distributor websites**: 2017 21%  2015 37%
- **Print publications**: 2017 23%  2015 34%
- **Industry newsletters**: 2017 19%  2015 27%
- **Webinars/webcasts**: 2017 25%  2015 22%
- **Conferences/ trade shows**: 2017 23%  2015 20%
- **Blogs**: 2017 18%  2015 17%
- **Catalogs/ brochures**: 2017 18%  2015 14%
- **Video (YouTube, etc.)**: 2017 15%  2015 16%
What are your favorite websites related to your professional work? (Write-in responses only)

<table>
<thead>
<tr>
<th>Favorite Website (Write-in)</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE Times</td>
<td>102</td>
<td>13.7%</td>
</tr>
<tr>
<td>Embedded.com</td>
<td>65</td>
<td>8.8%</td>
</tr>
<tr>
<td>Google</td>
<td>61</td>
<td>8.2%</td>
</tr>
<tr>
<td>Stack Exchange/Stack Overflow</td>
<td>47</td>
<td>6.3%</td>
</tr>
<tr>
<td>EDN</td>
<td>35</td>
<td>4.7%</td>
</tr>
<tr>
<td>Digikey.com</td>
<td>30</td>
<td>4.0%</td>
</tr>
<tr>
<td>TI</td>
<td>28</td>
<td>3.8%</td>
</tr>
<tr>
<td>IEEE</td>
<td>26</td>
<td>3.5%</td>
</tr>
<tr>
<td>Linked In</td>
<td>22</td>
<td>3.0%</td>
</tr>
<tr>
<td>Wikipedia.com</td>
<td>16</td>
<td>2.2%</td>
</tr>
<tr>
<td>Microchip.com</td>
<td>15</td>
<td>2.0%</td>
</tr>
<tr>
<td>Altera/Intel/Intel.com</td>
<td>8</td>
<td>1.1%</td>
</tr>
<tr>
<td>Nxp.com</td>
<td>7</td>
<td>0.9%</td>
</tr>
<tr>
<td>Analog Design/Linear Tech</td>
<td>6</td>
<td>0.8%</td>
</tr>
<tr>
<td>Arduin.com</td>
<td>6</td>
<td>0.8%</td>
</tr>
<tr>
<td>Electronic Design</td>
<td>6</td>
<td>0.8%</td>
</tr>
<tr>
<td>Mouser.com</td>
<td>6</td>
<td>0.8%</td>
</tr>
<tr>
<td>Sourceforge</td>
<td>6</td>
<td>0.8%</td>
</tr>
<tr>
<td>xilinx.com</td>
<td>6</td>
<td>0.8%</td>
</tr>
<tr>
<td>Avrfreaks.com</td>
<td>5</td>
<td>0.7%</td>
</tr>
<tr>
<td>National Instruments</td>
<td>5</td>
<td>0.7%</td>
</tr>
<tr>
<td>Slashdot.org</td>
<td>5</td>
<td>0.7%</td>
</tr>
<tr>
<td>YouTube</td>
<td>5</td>
<td>0.7%</td>
</tr>
<tr>
<td>Atmel.com</td>
<td>4</td>
<td>0.5%</td>
</tr>
<tr>
<td>Embedded</td>
<td>4</td>
<td>0.5%</td>
</tr>
<tr>
<td>Farnell</td>
<td>4</td>
<td>0.5%</td>
</tr>
<tr>
<td>Hacker News</td>
<td>4</td>
<td>0.5%</td>
</tr>
<tr>
<td>Microsoft.com</td>
<td>4</td>
<td>0.5%</td>
</tr>
<tr>
<td>STMicro</td>
<td>4</td>
<td>0.5%</td>
</tr>
</tbody>
</table>
Thinking about the next year, what areas will be your greatest technology challenges?

- Managing increases in code size and complexity: 19%
- Integrating new technology or tools: 18%
- Security concerns: 17%
- Software tools: 15%
- Dealing with low power: 13%
- Dealing with wireless: 13%
- Processors: 11%
- Improving the debugging process: 10%
- OS/RTOS: 9%
- Programmable logic: 8%
- Functional safety: 7%
- Hardware tools: 6%
- SoCs/ASICs/ASSPs: 5%
- Integrating external IP into your designs: 4%
- IDE: 4%
Which of the following are your favorite/most important software/hardware tools?

(Top 21 shown)

- Oscilloscope: 50% (43% in 2015)
- Debugger: 49% (46% in 2015)
- Compiler/assembler: 49% (41% in 2015)
- IDE: 41% (31% in 2015)
- Logic analyzer: 31% (22% in 2015)
- JTAG/BDM: 23% (19% in 2015)
- Software libraries: 14% (14% in 2015)
- Linux tools: 14% (10% in 2015)
- ICE: 12% (11% in 2015)
- Configuration management tools: 9% (9% in 2015)
- Static analysis tools: 7% (7% in 2015)
- Software drivers: 7% (7% in 2015)
- Graphical Design tools: 8% (7% in 2015)
- Starter, evaluation kits/boards: 6% (6% in 2015)
- Software testing tools: 6% (6% in 2015)
- Simulation modeling tools: 6% (9% in 2015)
- FPGA-based prototypes: 6% (9% in 2015)
- Source code analysis/tools: 8% (5% in 2015)
- Trace: 4% (5% in 2015)
- Hardware emulators: 5% (5% in 2015)
- Automatic code generation: 8% (5% in 2015)
Which of the following conferences have you attended in the last two years, and which do you plan to attend in the next year?

<table>
<thead>
<tr>
<th>Conferences</th>
<th>Have Attended</th>
<th>Plan to Attend</th>
<th>Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training/seminars of distributors</td>
<td>38.0%</td>
<td>33.2%</td>
<td>-4.8</td>
</tr>
<tr>
<td>Embedded Systems Conference (USA)</td>
<td>21.8</td>
<td>31.4</td>
<td>9.6</td>
</tr>
<tr>
<td>Embedded World (Nuremberg)</td>
<td>15.1</td>
<td>19.1</td>
<td>4.0</td>
</tr>
<tr>
<td>Electronica</td>
<td>11.9</td>
<td>14.9</td>
<td>3.0</td>
</tr>
<tr>
<td>CES (Las Vegas)</td>
<td>10.4</td>
<td>12.5</td>
<td>2.1</td>
</tr>
<tr>
<td>DesignCon</td>
<td>9.7</td>
<td>8.8</td>
<td>-.9</td>
</tr>
<tr>
<td>Vendor technical forums/dev conf</td>
<td>9.2</td>
<td>8.8</td>
<td>-.4</td>
</tr>
<tr>
<td>Sensors Expo</td>
<td>8.2</td>
<td>13.6</td>
<td>5.4</td>
</tr>
<tr>
<td>CeBIT</td>
<td>6.2</td>
<td>6.9</td>
<td>.5</td>
</tr>
<tr>
<td>Embedded Linux Conference (ELC)</td>
<td>5.2</td>
<td>8.0</td>
<td>2.8</td>
</tr>
<tr>
<td>IEEE Intl Conf on ERTCSA</td>
<td>5.0</td>
<td>9.3</td>
<td>4.3</td>
</tr>
<tr>
<td>Embedded Systems Conference (India)</td>
<td>3.2</td>
<td>6.4</td>
<td>3.2</td>
</tr>
<tr>
<td>DAC</td>
<td>3.0</td>
<td>2.9</td>
<td>-.1</td>
</tr>
<tr>
<td>Mobile World Congress</td>
<td>3.0</td>
<td>5.1</td>
<td>2.1</td>
</tr>
<tr>
<td>Android Builders Summit</td>
<td>2.7</td>
<td>4.5</td>
<td>1.8</td>
</tr>
<tr>
<td>IIC (China)</td>
<td>1.7</td>
<td>2.4</td>
<td>.7</td>
</tr>
<tr>
<td>SAE Convergence</td>
<td>1.5</td>
<td>4.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Embedded Systems Expo (Japan)</td>
<td>1.0</td>
<td>3.7</td>
<td>2.7</td>
</tr>
<tr>
<td>Embedded Systems Conference (Brazil)</td>
<td>0.7</td>
<td>4.5</td>
<td>3.8</td>
</tr>
<tr>
<td>Other</td>
<td>9.4</td>
<td>8.8</td>
<td>-.6</td>
</tr>
</tbody>
</table>

2017 N=403  N=376
What are the most effective ways that you systematically or formally maintain, educate, and advance your professional skills?

- **Online training/webinars provided by vendors**: 43%
- **Technical white papers from vendors**: 38%
- **Professional/technical journals**: 37%
- **Online training/webinars by media orgs (EE Times)**: 31%
- **Professional devlpmnt courses by private cos**: 19%
- **Online training/webinars provided by distributors**: 18%
- **Conferences-seminars provided by vendors**: 17%
- **Books**: 17%
- **Online training/webinars by profnl assoc (like IEEE)**: 16%
- **Professional devlpmnt courses by university online**: 13%
- **On-site seminars given by vendors**: 13%
- **Conferences-seminars by media orgs (like ESC)**: 10%
- **Professional devlpmnt courses by univ ext progs**: 9%
- **Conf/seminars provided by professional assoecn**: 9%
- **Certification training**: 8%

### Other Related Demographics

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2015</th>
<th>2014</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average days per year spent on career training</strong></td>
<td>9.7</td>
<td>9.5</td>
<td>9.2</td>
<td>9.0</td>
</tr>
<tr>
<td><strong>Average number of years out of school</strong></td>
<td>24.9</td>
<td>20.0</td>
<td>21.6</td>
<td>19.7</td>
</tr>
<tr>
<td><strong>Hours per week spent reading technical publications</strong></td>
<td>4.8</td>
<td>4.6</td>
<td>5.2</td>
<td>4.8</td>
</tr>
<tr>
<td><strong>Technical books read in full or in substantial part per year</strong></td>
<td>3.2</td>
<td>3.7</td>
<td>3.9</td>
<td>3.9</td>
</tr>
</tbody>
</table>
Embedded Design Process Challenges

- **Challenges** – Debugging (23%) and meeting schedules (23%).

- **Stages** – Detailed design (32%) & testing/debugging (20%) take most time.

- **Vendors** – Work with 2.7 outside vendors on average in 2017 (down from 3.3).

- **Most Need to Improve** – Debugging tools (19%), schedule (17%), engineering team skills (15%).

- **Sources of Info** – Vendor websites (85%) leads all others by far.

- **Technical Challenges** – Dealing with code complexity (19%), integrating new technology (18%) and security (17%) are top priorities.

- **Favorite Tools** – Oscilloscope (50%), debugger (46%), compiler (42%) and IDE (31%).

- **Maintaining professional skills** – Online training courses (43%); technical white papers (38%), reading professional technical journals (37%); webinars by media orgs (31%) are at the top of the list.

- **Other Skill Enhancers:** 9.7 days/year career training; 24.9 years of career experience; 4.8 hours per week reading technical publications; read 3.2 books per year.
OPERATING SYSTEMS
Does your current embedded project use an operating system, RTOS, kernel, software executive, or scheduler of any kind?

Fairly consistent usage of RTOS, kernels, execs, schedulers over past 5 years

86% of those not using RTOSes, said the main reason RTOSes are NOT used is simply that they are not needed.
My current embedded project uses:

- **Open-source OS/RTOS, without commercial support**
  - 2017 (N = 539): 41%
  - 2015 (N = 804): 36%
  - 2014 (N = 1003): 31%
  - 2013 (N = 1402): 34%
  - 2012 (N = 1152): 39%

- **Commercial OS/RTOS**
  - 2017 (N = 539): 30%
  - 2015 (N = 804): 35%
  - 2014 (N = 1003): 33%
  - 2013 (N = 1402): 35%
  - 2012 (N = 1152): 35%

- **Internally developed or in-house OS/RTOS**
  - 2017 (N = 539): 17%
  - 2015 (N = 804): 15%
  - 2014 (N = 1003): 17%
  - 2013 (N = 1402): 19%
  - 2012 (N = 1152): 20%

- **Commercial distribution of an open-source OS/RTOS**
  - 2017 (N = 539): 12%
  - 2015 (N = 804): 11%
  - 2014 (N = 1003): 14%
  - 2013 (N = 1402): 13%
  - 2012 (N = 1152): 9%

My next embedded project will likely use:

- **Open-source OS/RTOS, without commercial support**
  - 2017 (N = 647): 43%
  - 2015 (N = 954): 37%
  - 2014 (N = 1394): 37%
  - 2013 (N = 1992): 39%
  - 2012 (N = 1620): 41%

- **Commercial OS/RTOS**
  - 2017 (N = 647): 28%
  - 2015 (N = 954): 32%
  - 2014 (N = 1394): 27%
  - 2013 (N = 1992): 29%
  - 2012 (N = 1620): 31%

- **Internally developed or in-house OS/RTOS**
  - 2017 (N = 647): 13%
  - 2015 (N = 954): 10%
  - 2014 (N = 1394): 19%
  - 2013 (N = 1992): 20%
  - 2012 (N = 1620): 19%

- **Commercial distribution of an open-source OS/RTOS**
  - 2017 (N = 647): 15%
  - 2015 (N = 954): 17%
  - 2014 (N = 1394): 17%
  - 2013 (N = 1992): 14%
  - 2012 (N = 1620): 13%
Which factors most influenced your decision to use a commercial operating system?

**Top 19 reasons**

- Real-time capability: 45%
- Processor or hardware compatibility: 36%
- Code size / memory usage: 36%
- Technical support: 35%
- Ease of future maintenance: 33%
- Good software tools: 33%
- Documentation: 29%
- Support for my processor & drivers (BSP): 29%
- Networking capability: 28%
- Overall cost: 24%
- Royalty-free: 23%
- Supplier's reputation: 21%
- Security: 20%
- Multicore support: 17%
- Scheduling efficiency: 16%
- Context switch time: 15%
- Safety Certification: 14%
- Customer's desire: 14%
- Modularity: 12%

*Base = Those who currently use a “Commercial” OS/RTOS*

© 2017 Copyright by AspenCore. All rights reserved.
What are your reasons for not using a commercial operating system?

- Current solution works fine: 68% (59% in 2015)
- Commercial alternatives too expensive: 35% (33% in 2015)
- Avoid reliance on commercial supplier: 23% (28% in 2015)
- No need for multithreading multitasking: 20% (20% in 2015)
- Incompatible with existing SW apps or drivers: 11% (11% in 2015)
- Commercial alternatives use too much memory: 11% (9% in 2015)
- Too much trouble to learn commercial alternative: 11% (9% in 2015)
- No need for real time: 9% (2015)
- Security concerns with commercial: 8% (7% in 2015)
- Safety concerns with commercial alternatives: 6% (5% in 2015)
- Commercial alternatives lack features I need: 6%
- Other: 8% (6% in 2015)

Base = Those who do not currently use a “Commercial” OS/RTOS
Did you use the same operating system, RTOS, or kernel as in your previous project?

![Bar chart showing the percentage of respondents who used the same OS, RTOS, or kernel as in their previous project, with data from 2012 to 2017.]

- Yes, used same OS, RTOS or kernel:
  - 2012 (N = 1,644): 60%
  - 2013 (N = 2,015): 61%
  - 2014 (N = 1,423): 61%
  - 2015 (N = 1,088): 62%
  - 2017 (N = 792): 57%

- No, didn't use same OS, RTOS or kernel:
  - 2012 (N = 1,644): 40%
  - 2013 (N = 2,015): 39%
  - 2014 (N = 1,423): 39%
  - 2015 (N = 1,088): 38%
  - 2017 (N = 792): 43%

Base: Those who use operating systems
Why did you use the same operating system?

- Happy with current one, no reason to switch (70% in 2017, 64% in 2015)
- Wanted to maintain software compatibility (39% in 2017, 39% in 2015)
- Wanted to make use of expertise/familiarity (38% in 2017, 35% in 2015)
- Wanted to maintain the same tools or software (35% in 2017, 31% in 2015)
- Wanted to keep same Operating System (28% in 2017, 27% in 2015)
- Switching OS too expensive/time-consuming (20% in 2017, 22% in 2015)
- Happy with supplier (12% in 2017, 10% in 2015)
- No other suitable alternatives available (7% in 2017, 5% in 2015)
- Not my choice/operating system chosen for me (5% in 2017, 7% in 2015)
- Other (4% in 2017, 4% in 2015)

Base = Those who are using the same operating system as in previous project

2017 (N = 462)
2015 (N = 641)
### Why did you switch operating systems?

<table>
<thead>
<tr>
<th>Reason</th>
<th>2017 (N = 269)</th>
<th>2015 (N = 406)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware or processor changed</td>
<td>36%</td>
<td>32%</td>
</tr>
<tr>
<td>Not my choice/OS chosen for me</td>
<td>23%</td>
<td>19%</td>
</tr>
<tr>
<td>New OS had better features</td>
<td>19%</td>
<td>19%</td>
</tr>
<tr>
<td>New OS had better SW/dev tools</td>
<td>15%</td>
<td>13%</td>
</tr>
<tr>
<td>New OS had better growth path</td>
<td>15%</td>
<td>12%</td>
</tr>
<tr>
<td>New OS is cheaper</td>
<td>10%</td>
<td>9%</td>
</tr>
<tr>
<td>New OS had OTS modules (apps, tools)</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>Previous OS no longer available</td>
<td>7%</td>
<td>4%</td>
</tr>
<tr>
<td>Previous OS too slow</td>
<td>6%</td>
<td>7%</td>
</tr>
<tr>
<td>Unhappy with previous OS supplier</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Other</td>
<td>15%</td>
<td>16%</td>
</tr>
</tbody>
</table>
What are the most important factors in choosing an operating system?

- **Availability of full source code**: 39% in 2017, 45% in 2015
- **No royalties**: 30% in 2017, 30% in 2015
- **Compatibility w/ other software, systems**: 27% in 2017, 24% in 2015
- **Availability of tech support**: 27% in 2017, 27% in 2015
- **Freedom to customize or modify**: 25% in 2017, 23% in 2015
- **Open-source availability**: 25% in 2017, 21% in 2015
- **My familiarity with the operating system**: 25% in 2017, 25% in 2015
- **Real-time performance**: 24% in 2017, 19% in 2015
- **Popularity**: 20% in 2017, 15% in 2015
- **Simplicity / ease of use**: 15% in 2017, 12% in 2015
- **Purchase price**: 15% in 2017, 14% in 2015
- **The processors it supports**: 15% in 2017, 13% in 2015
- **Small memory footprint**: 12% in 2017, 12% in 2015
- **Software development tools available**: 14% in 2017, 11% in 2015
- **Other software, middleware, drivers, code**: 10% in 2017, 9% in 2015
- **Successful prior use for similar apps**: 7% in 2017, 8% in 2015
- **Security functionality**: 7% in 2017, 6% in 2015

Base: Currently using an operating system
Please select ALL of the operating systems you are currently using.

<table>
<thead>
<tr>
<th>Operating System</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embedded Linux</td>
<td>22%</td>
</tr>
<tr>
<td>FreeRTOS</td>
<td>20%</td>
</tr>
<tr>
<td>In-house/custom</td>
<td>19%</td>
</tr>
<tr>
<td>Android</td>
<td>13%</td>
</tr>
<tr>
<td>Debian (Linux)</td>
<td>13%</td>
</tr>
<tr>
<td>Ubuntu</td>
<td>11%</td>
</tr>
<tr>
<td>Microsoft (Windows Embedded 7/Standard)</td>
<td>8%</td>
</tr>
<tr>
<td>Texas Instruments RTOS</td>
<td>5%</td>
</tr>
<tr>
<td>Texas Instruments (DSP/BIOS)</td>
<td>5%</td>
</tr>
<tr>
<td>Micrium (uC/OS-III)</td>
<td>5%</td>
</tr>
<tr>
<td>Microsoft (Windows 7 Compact or earlier)</td>
<td>5%</td>
</tr>
<tr>
<td>Keil (RTX)</td>
<td>4%</td>
</tr>
<tr>
<td>Micrium (uC/OS-II)</td>
<td>4%</td>
</tr>
<tr>
<td>Wind River (VxWorks)</td>
<td>4%</td>
</tr>
<tr>
<td>AnalogDevices (VDK)</td>
<td>3%</td>
</tr>
<tr>
<td>Express Logic (ThreadX)</td>
<td>3%</td>
</tr>
<tr>
<td>Freescale MQX</td>
<td>3%</td>
</tr>
<tr>
<td>Angstrom (Linux)</td>
<td>3%</td>
</tr>
<tr>
<td>Green Hills (INTEGRITY)</td>
<td>2%</td>
</tr>
</tbody>
</table>

2017 (N=619)

Only Operating Systems with 2% or more are shown.

Base: Currently using an operating system
Please select ALL of the operating systems you are considering using in the next 12 months.

FreeRTOS: 28%
Embedded Linux: 27%
In-house/custom: 19%
Android: 17%
Debian (Linux): 12%
Ubuntu: 11%
Micrium (uC/OS-III): 9%
Texas Instruments RTOS: 8%
Micrium (uC/OS-II): 6%
Microsoft Windows Embedded 7/Standard: 6%
Express Logic (ThreadX): 5%
Keil (RTX): 5%
Texas Instruments (DSP/BIOS): 5%
Freescale MQX: 5%
Wind River (Linux): 5%
Microsoft (Windows 7 Compact or earlier): 4%
Wind River (VxWorks): 4%
Red Hat (IX Lunix): 4%
AnalogDevices (VDK): 4%
Green Hills (INTEGRITY): 3%
QNX (QNX): 3%
Segger (embOS): 3%
Mentor Graphics Linux: 3%
Wittenstein HIS (OpenRTOS/SAFERTOS): 3%
Angstrom (Linux): 3%

2017 (N = 568)
Only Operating Systems with 3% more are shown

Base: Those who are considering an operating system in any project in the next 12 months
Are you currently using embedded virtualization/hypervisors or will you likely use this in the next 12 months?

Top reasons for using virtualization/hypervisors

- Separation of multiple applications: 49%
- Need to support hard real-time applications and guest OS: 37%
- Need to support multiple guest OSes (e.g., Android, VxWorks, Linux): 31%
Operating Systems

- **OS/RTOS usage** – 67% overall usage, down from 2015 (72%).
- **Open Source OS usage** – Now 41%, up from 31% in 2012 and continuing up.
- **Commercial OS usage** – Now 30%, down from 40% in 2012.
- **Used same OS** – 60% used the same OS, down one tick from 2015 of 61%. Happy with it, compatibility, familiarity, same tools are main reasons for using.
- **Reason for Switching** – Hardware/processor changed, chosen for me, new one had better features.
- **Reason for choosing OS** – Full source code (39%), no royalties (30%), compatibility (27%) and tech support (27%).
- **OS/RTOS used** – Embedded Linux (22%), FreeRTOS (20%), Inhouse (19%),
- **OS/RTOS considering** – FreeRTOS (28%), Embedded Linux (27%) and Inhouse (29%) were top three RTOSes being considered.
- **Embedded virtualization/hypervisor usage** – Down from 20% in 2015 to 15%.
MICROPROCESSORS
Who were the greatest influences on the choice of the processor for your current project?

- Hardware engineering staff: 28%
- Group decision in engineering: 26%
- Software engineering staff: 22%
- Hardware engineering mgr: 21%
- Software engineering mgr: 15%
- Same processor as in previous project: 11%
- Systems engineering staff: 11%
- Corporate mgmt.: 11%
- Systems engineering mgr: 7%
- Outside influence/customer/standards: 6%
- Purchasing mgr. or dept.: 4%
- Marketing mgr or dept.: 3%
- Other: 5%

2017 (N = 758)
My current embedded project contains:

- **A single microprocessor/microcontroller (can be multicore):**
  - 2017: 56% (N = 760)
  - 2015: 52% (N = 1,033)
  - 2014: 53% (N = 1,379)
  - 2013: 50% (N = 2,047)
  - 2012: 58% (N = 1,659)

- **2 processors/microcontrollers:**
  - 2017: 22% (N = 760)
  - 2015: 22% (N = 1,033)
  - 2014: 27% (N = 1,379)
  - 2013: 24% (N = 2,047)
  - 2012: 25% (N = 1,659)

- **3 – 5 processors/microcontrollers:**
  - 2017: 13% (N = 760)
  - 2015: 16% (N = 1,033)
  - 2014: 16% (N = 1,379)
  - 2013: 16% (N = 2,047)
  - 2012: 15% (N = 1,659)

- **6 – 10 processors/microcontrollers:**
  - 2017: 3% (N = 760)
  - 2015: 3% (N = 1,033)
  - 2014: 4% (N = 1,379)
  - 2013: 4% (N = 2,047)
  - 2012: 3% (N = 1,659)

- **>10 processors/microcontrollers:**
  - 2017: 3% (N = 760)
  - 2015: 3% (N = 1,033)
  - 2014: 4% (N = 1,379)
  - 2013: 4% (N = 2,047)
  - 2012: 3% (N = 1,659)

The average number of microprocessors/microcontrollers per project was:
- 2.3 in 2017
- 2.1 in 2015
- 2.4 in 2014
- 2.4 in 2013
- 2.3 in 2012
Does your embedded project contain...

<table>
<thead>
<tr>
<th>Description</th>
<th>2017 (N = 603)</th>
<th>2015 (N = 805)</th>
<th>2014 (N = 1051)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple different processor chips (diff. vendors)</td>
<td>27%</td>
<td>18%</td>
<td>19%</td>
</tr>
<tr>
<td>Single chip with multiple identical processor cores</td>
<td>18%</td>
<td>14%</td>
<td>16%</td>
</tr>
<tr>
<td>Multiple identical processor chips</td>
<td>16%</td>
<td>13%</td>
<td>15%</td>
</tr>
<tr>
<td>Multiple different processor chips (same vendor)</td>
<td>13%</td>
<td>15%</td>
<td>17%</td>
</tr>
<tr>
<td>Single chip with multiple different processor cores</td>
<td>9%</td>
<td>12%</td>
<td>10%</td>
</tr>
<tr>
<td>FPGA with a single hard/soft processor core</td>
<td>7%</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>FPGA with a multiple hard/soft processor cores</td>
<td>6%</td>
<td>4%</td>
<td>5%</td>
</tr>
</tbody>
</table>
My current embedded project's main processor is a:


Note. 52% of respondents said additional processors (if any) were 32-bit processors, 18% said they added 8-bit processors, 14% added 16-bit processors, and 11% added 64-bit processors to their current embedded project.
My current embedded project's main processor clock rate is:

- **Under 10 MHz**: 6% (2017), 7% (2015), 4% (2014)
- **10 – 99 MHz (Net)**: 34% (2017), 40% (2015), 37% (2014)
- **10 - 24 MHz**: 9% (2017), 11% (2015), 12% (2014)
- **25 - 49 MHz**: 10% (2017), 12% (2015), 10% (2014)
- **50 - 99 MHz**: 12% (2017), 18% (2015), 15% (2014)
- **100 – 249 MHz**: 23% (2017), 23% (2015), 18% (2014)
- **250 – 499 MHz**: 7% (2017), 7% (2015), 10% (2014)
- **500 – 749 MHz**: 7% (2017), 6% (2015), 8% (2014)
- **750 – 999 MHz**: 6% (2017), 7% (2015), 8% (2014)
- **1 GHz**: 13% (2017), 11% (2015), 12% (2014)
- **2GHz+**: 4% (2017), 3% (2015), 2% (2014)

The average processor clock rate was:
- 445 MHz in 2017
- 397 MHz in 2015
- 428 MHz in 2014
- 485 MHz in 2013
Did you use the same processor as in your previous embedded project?

- Yes, used the same processor as in previous embedded project:
  - 2017 (N = 759)
  - 2015 (N = 1,029)
  - 2014 (N = 1,380)
  - 2013 (N = 2,047)
  - 2012 (N = 1,654)

- No, did not use the same processor as in previous project:
  - 2017 (N = 759)
  - 2015 (N = 1,029)
  - 2014 (N = 1,380)
  - 2013 (N = 2,047)
  - 2012 (N = 1,654)
Why did you use the same processor?

- Happy with current processor/supplier: 66%
- To maintain software compatibility: 54%
- To maintain the same tools or software: 48%
- To make use of expertise/familiarity: 43%
- To use same operating system: 31%
- Switching too expensive/time consuming: 22%
- Not my choice/processor chosen for me: 7%
- No other suitable processors available: 3%
- Other: 2%

Base = Those who used the same processor as in previous project

2017 (N = 334)
What were your reasons for switching processors?

- New processor had better features: 2017: 40%, 2015: 39%
- New processor had better future growth path: 2017: 23%, 2015: 24%
- Too slow: needed increased performance/bit width: 2017: 19%, 2015: 23%
- Too slow: needed higher clock speed: 2017: 18%, 2015: 23%
- New processor had better SW/dev tools: 2017: 17%, 2015: 18%
- Previous processor no longer available: 2017: 14%, 2015: 13%
- Needed a lower power processor: 2017: 13%, 2015: 13%
- Not my choice/processor chosen for me: 2017: 14%, 2015: 12%
- Previous processor too expensive: 2017: 11%, 2015: 10%
- To change operating system: 2017: 11%, 2015: 6%
- Unhappy with previous processor's supplier: 2017: 4%, 2015: 4%
- Other: 2017: 9%, 2015: 10%

Base = Those who did not use the same processor as in previous project
Did you...

Choose a processor from a different family, architecture, or instruction set

- 2017 (N = 370) 55%
- 2015 (N = 473) 57%
- 2014 (N = 687) 56%
- 2013 (N = 1088) 56%
- 2012 (N = 862) 58%

Choose a different processor from the same family, architecture, or instruction set

- 2017 (N = 370) 45%
- 2015 (N = 473) 43%
- 2014 (N = 687) 44%
- 2013 (N = 1088) 44%
- 2012 (N = 862) 42%

Base = Those who did not use the same processor as in previous project

© 2017 Copyright by AspenCore. All rights reserved.
What’s most important when choosing a microprocessor?

- The chip itself: 25% (2017), 26% (2015), 27% (2014)
- The ecosystem surrounding the chip (software, tools, support, etc.): 68% (2017), 67% (2015), 65% (2014)
- The chip's supplier/vendor: 7% (2017), 8% (2015), 8% (2014)
Which vendor has the best ecosystem for your needs?

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microchip or Atmel (Microchip)</td>
<td>14%</td>
</tr>
<tr>
<td>Texas Instruments (TI)</td>
<td>14%</td>
</tr>
<tr>
<td>ST Microelectronics</td>
<td>11%</td>
</tr>
<tr>
<td>NXP/Freescale/Qualcomm</td>
<td>11%</td>
</tr>
<tr>
<td>Xilinx</td>
<td>5%</td>
</tr>
<tr>
<td>Intel, Intel Altera</td>
<td>5%</td>
</tr>
<tr>
<td>ARM</td>
<td>4%</td>
</tr>
<tr>
<td>Digi-Key</td>
<td>4%</td>
</tr>
<tr>
<td>Cypress Semiconductor</td>
<td>2%</td>
</tr>
<tr>
<td>Renesas</td>
<td>2%</td>
</tr>
<tr>
<td>Arrow</td>
<td>2%</td>
</tr>
<tr>
<td>Silicon Labs</td>
<td>2%</td>
</tr>
</tbody>
</table>

*2017 (N = 328) Unaided*
What are the most important factors in choosing a processor?

<table>
<thead>
<tr>
<th>Factor</th>
<th>2017 (N = 707)</th>
<th>2015 (N = 940)</th>
<th>2014 (N = 1,282)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software development tools available</td>
<td>70%</td>
<td>71%</td>
<td>72%</td>
</tr>
<tr>
<td>The chip's performance</td>
<td>38%</td>
<td>45%</td>
<td>46%</td>
</tr>
<tr>
<td>The chip's cost</td>
<td>34%</td>
<td>36%</td>
<td>35%</td>
</tr>
<tr>
<td>Available middleware, drivers, existing code</td>
<td>31%</td>
<td>34%</td>
<td>34%</td>
</tr>
<tr>
<td>HW development tools available</td>
<td>35%</td>
<td>31%</td>
<td>35%</td>
</tr>
<tr>
<td>The operating systems it supports</td>
<td>25%</td>
<td>29%</td>
<td>28%</td>
</tr>
<tr>
<td>The on-chip I/O or peripherals</td>
<td>24%</td>
<td>24%</td>
<td>26%</td>
</tr>
<tr>
<td>The chip's power consumption</td>
<td>18%</td>
<td>19%</td>
<td>19%</td>
</tr>
<tr>
<td>The supplier's reputation</td>
<td>12%</td>
<td>16%</td>
<td>16%</td>
</tr>
<tr>
<td>Familiarity w/ architecture/chip family</td>
<td>11%</td>
<td>13%</td>
<td>13%</td>
</tr>
<tr>
<td>Chip family's future growth path</td>
<td>10%</td>
<td>11%</td>
<td>12%</td>
</tr>
<tr>
<td>The processor’s debug support</td>
<td>7%</td>
<td>7%</td>
<td>6%</td>
</tr>
<tr>
<td>The chip's security features</td>
<td>6%</td>
<td>6%</td>
<td>5%</td>
</tr>
</tbody>
</table>

© 2017 Copyright by AspenCore. All rights reserved.
Please select the processor vendors you are familiar with.

- Texas Instruments: 53%
- Freescale (NXP / Qualcomm): 51%
- Microchip Technology: 49%
- Atmel (Microchip Technology): 47%
- STMicro: 43%
- Intel: 41%
- NXP (Qualcomm): 37%
- Altera (Intel FPGA): 36%
- Xilinx: 34%
- Cypress Semiconductor: 30%
- Analog Devices: 29%
- Renesas: 27%
- AMD: 25%
- Silicon Labs: 23%
- Broadcom: 22%
- Maxim: 20%
- Infineon: 20%
- Zilog: 20%
- Qualcomm: 19%
- NVIDIA: 17%
- Lattice Semiconductor: 17%
- Marvell: 15%
- Digi/Rabbit Semiconductor: 14%
- Microsemi: 14%
- Cirrus Logic: 13%
- Samsung: 13%
- IBM: 12%
- Energy Micro (Silicon Labs): 12%
- Toshiba: 12%
- Spansion (formerly Fujitsu): 8%
- Applied Micro: 8%
- VIA: 6%
- PMC-Sierra (Microsemi): 6%
- Cavium: 4%

2017 (N = 651)
Please select the processor vendors you are currently using.

- Texas Instruments: 31%
- Freescale (NXP / Qualcomm): 26%
- Atmel (Microchip Technology): 26%
- Microchip Technology: 25%
- STMicro: 23%
- NXP (Qualcomm): 17%
- Intel: 16%
- Xilinx: 15%
- Altera (Intel FPGA): 14%
- Analog Devices: 11%
- Renesas: 9%
- Broadcom: 8%
- Cypress Semiconductor: 7%
- Maxim: 5%
- Infineon: 5%
- Silicon Labs: 4%
- AMD: 4%
- Marvell: 4%
- Qualcomm: 3%
- NVIDIA: 3%
- Microsemi: 3%
- Digi/Rabbit Semiconductor: 3%
- Samsung: 2%
- Lattice Semiconductor: 2%
- Spansion (Fujitsu): 2%
- IBM: 2%
- Toshiba: 2%
- Zilog: 1%
- PMC-Sierra (Microsemi): 1%
- Energy Micro (Silicon Labs): 1%
- VIA: 1%
- Cirrus Logic: 1%
- Cavium: 1%
- Applied Micro: %
- Stretch: %

2017 (N = 609)
Please select the processor vendors you are considering using on your next project.

- Texas Instruments: 36%
- Freescale (NXP/Qualcomm): 32%
- STMicro: 30%
- Microchip Technology: 27%
- Atmel (Microchip Technology): 24%
- NXP (Qualcomm): 22%
- Xilinx: 21%
- Intel: 18%
- Altera (Intel FPGA): 17%
- Analog Devices: 13%
- Cypress Semiconductor: 11%
- Renesas: 10%
- Silicon Labs: 10%
- Broadcom: 7%
- Qualcomm: 7%
- Infineon: 6%
- Maxim: 6%
- Energy Micro (Silicon Labs): 6%
- Microsemi: 5%
- AMD: 5%
- Marvell: 5%
- NVIDIA: 5%
- Lattice Semiconductor: 4%
- Samsung: 4%
- Zilog: 3%
- Applied Micro: 2%
- Digi/Rabbit Semiconductor: 2%
- Toshiba: 2%
- Cirrus Logic: 2%
- Cavium: 1%
- IBM: 1%
- Spansion (Fujitsu): 1%
- PMC-Sierra (Microsemi): 1%
- VIA: 1%
- Stretch: 1%

2017 (N = 554)
Which of the following 32-bit chip families would you consider for your next embedded project?

- STMicro STM32 (ARM) 30%
- Microchip PIC 32-bit (MIPS) 20%
- Xilinx Zynq (with dual ARM Cortex-A9) 17%
- Freescale i.MX (ARM) 17%
- NXP LPC (ARM) 16%
- FreescaleKinetis (ARM/Cortex-M4/M0) 16%
- Atmel SAMxx (ARM) 14%
- TI Sitara (ARM) 14%
- Intel Atom, Pentium, Celeron, Core 2, Core iX 13%
- Altera (Intel FPGA) SoC-FPGA (with dual ARM Cortex-A9) 12%
- Arduino 12%
- Altera (Intel FPGA) Nios II (soft core) 11%
- TI SimpleLink (ARM)* 11%
- TI TM4Cx (ARM) 11%
- Atmel (AVR32) 11%
- Atmel AT91xx/ATSAMxx (ARM) 10%
- Cypress PSoC 4 ARM Cortex-M0/PSoc 5 ARM Cortex-M3 9%
- Renesas RX 8%
- Broadcom (any) 8%
- TI C2000 MCUs 7%
- Xilinx MicroBlaze (soft-core) 7%
- NVIDIA Tegra 6%
- TI Hercules (ARM) 6%

**2017 (N = 617)**

- SiLABS Precision32 (ARM) 5%
- Qualcomm (any) 5%
- Energy Micro EFM32 4%
- Microsemi SmartFusion2 SoC FPGA (Cortex-M3) 4%
- Infineon XMC4000 (ARM) 4%
- AMD Fusion, Athlon, Sempron, Turion, Opteron, Geode 4%
- Atmel AT91xx 4%
- FreescalePowerQUICC 4%
- Renesas RH850 4%
- Freescale PowerPC 55xx 4%
- Microsemi FPGA (Cortex-M1, softcore) 3%
- Freescale PowerPC 5xx, 6xx 3%
- Intel Itanium 3%
- Freescale Vybrid (ARM) 3%
- Freescale 68K, ColdFire 2%
- Microsemi SmartFusion SoC FPGA (Cortex-M3) 2%
- IBM PowerPC 4xx, 7xx 2%
- Infineon XMC1000 (ARM Cortex-M0) 2%
- Marvell 2%
- Infineon Tricore 2%
- Xilinx Virtex-5 (with PowerPC 405) 2%
- Infineon AURIX (TriCore-based) 1%
- Cirrus Logic EP73xx, EP93xx (ARM) 1%
- AMD Alchemy (MIPS) 1%
- SPARC (any) 1%
- Xilinx Virtex-4 (with PowerPC 405) 1%
- SPansion (formerly Fujitsu) FM3 (ARM) 1%
- Infineon TriCore 1%
- Infineon TriCore-based 32-bit families AUDO MAX 1%
- AMCC PowerPC 4xx 1%
- Other (please specify) 4%
Which of the following 16-bit chip families would you consider for your next embedded project?

<table>
<thead>
<tr>
<th>Chip Family</th>
<th>2017 (N = 412)</th>
<th>2015 (N = 621)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microchip PIC24 / dsPIC</td>
<td>38%</td>
<td>43%</td>
</tr>
<tr>
<td>TI MSP430</td>
<td>42%</td>
<td>43%</td>
</tr>
<tr>
<td>STMicroelectronics ST9, ST10</td>
<td>22%</td>
<td>21%</td>
</tr>
<tr>
<td>Freescale HC16</td>
<td>15%</td>
<td>19%</td>
</tr>
<tr>
<td>Intel 8086, '186, '286</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Renesas RL78</td>
<td>12%</td>
<td>12%</td>
</tr>
<tr>
<td>Freescale HC12</td>
<td>10%</td>
<td>12%</td>
</tr>
<tr>
<td>Renesas R8C</td>
<td>9%</td>
<td>7%</td>
</tr>
<tr>
<td>AMD 186, '188</td>
<td>6%</td>
<td>5%</td>
</tr>
<tr>
<td>Zilog Z180, Z380</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>Maxim</td>
<td>4%</td>
<td>5%</td>
</tr>
<tr>
<td>Infineon XE166, XC2000, XC166</td>
<td>4%</td>
<td>6%</td>
</tr>
<tr>
<td>Other</td>
<td>3%</td>
<td>5%</td>
</tr>
</tbody>
</table>
Which of the following 8-bit chip families would you consider for your next embedded project?

<table>
<thead>
<tr>
<th>Chip Family</th>
<th>2017 (N = 462)</th>
<th>2015 (N = 695)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microchip PIC</td>
<td>39%</td>
<td>46%</td>
</tr>
<tr>
<td>Atmel AVR</td>
<td>34%</td>
<td>43%</td>
</tr>
<tr>
<td>STMicroelectronics ST6, ST7, ST8</td>
<td>18%</td>
<td>19%</td>
</tr>
<tr>
<td>Freescale HC</td>
<td>13%</td>
<td>17%</td>
</tr>
<tr>
<td>TI TMS370, 7000</td>
<td>13%</td>
<td>17%</td>
</tr>
<tr>
<td>Intel 80xx, '251</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>NXP/Philips P80x, P87x, P89x</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Atmel 80xx</td>
<td>8%</td>
<td>9%</td>
</tr>
<tr>
<td>Renesas H8</td>
<td>9%</td>
<td>12%</td>
</tr>
<tr>
<td>Cypress PSoC 1 (M8C) / PSoC 3 (8051)</td>
<td>9%</td>
<td>11%</td>
</tr>
<tr>
<td>Xilinx PicoBlaze (soft core)</td>
<td>9%</td>
<td>10%</td>
</tr>
<tr>
<td>SiLabs 80xx</td>
<td>8%</td>
<td>9%</td>
</tr>
<tr>
<td>Zilog Z8, Z80, Z180, eZ80</td>
<td>4%</td>
<td>7%</td>
</tr>
<tr>
<td>Digi / Rabbit 2000, 3000</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Parallax</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Toshiba</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>Infineon XC800, C500</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>Maxim 80xx</td>
<td>2%</td>
<td>2%</td>
</tr>
</tbody>
</table>
Have you upgraded from an 8-bit or 16-bit chip to a 32-bit design in the last 12 months?

- Yes, upgraded from 8-bit chip: 12% (2017), 16% (2015), 14% (2014)
- Yes, upgraded from 16-bit chip: 12% (2017), 17% (2015), 15% (2014)
- No: 76% (2017), 67% (2015), 71% (2014)
Which of the following DSP chip families would you consider for your next embedded project?
Microprocessors

- **Deciders for chips** – Hardware engineers (28%) and engineering group (26%)
- **Single chip usage** – 56% down a little from 2015. 2.3 chips per design on average.
- **Chip Type** – In 2017: 32-bit (63%), 64-bit (13%) 16-bit (9%), 8-bit (12%).
- **Clock speeds** – Now 445 MHz, up from 397 MHz in 2015, more in line with 2014, 2013.
- **Same processor used** – Now 47%, down from 50% in 2015. Happy with it, compatibility, same tools.
- **Family** – 55% chose main chip from different family, 46% different processor from the same family.
- **Ecosystem** – 68% say “ecosystem” outweighs “the chip” (25%). Best ecosystem is Microchip and TI.
- **Important in chip decision** – Software development tools (70%), chip performance (38%)
- **Top 5 Vendors Familiar With** – TI, Freescale, Microchip, Atmel, STMicro
- **Top 5 Vendors Currently Using** – TI, Freescale, Atmel, Microchip, STMicro (same as 2015)
- **Top 5 Vendors Considering Using** – TI, Freescale, STMicro, Microchip, Atmel (same as 2015)
- **Top two 32-bit chips considering** – STMicro STM32 (ARM), Microchip PIC 32-bit (same as 2015)
- **Top two 16-bit chips considering** – Microchip PIC 24 (dsPIC) and TI MSP430 (reversed from 2015)
- **Top two 8-bit chips considering** – Microchip PIC and Atmel AVR same as 2015 and 2014
- **Upgraded from 8 or 16-bit to 32-bit** – 12% from 8-bit, 12% from 32-bit. No = 76%.
- **Top two DSP chips considering** – Microchip dsPIC and TI ‘C6000 (replaced TI DaVinci).
FPGA CHIPS
Does your current embedded project incorporate an FPGA chip?

Note 1: Among those not using FPGAs, only 12% said the trend towards FPGAs with built-in multicore processors would change their mind, and 51% said “maybe” it would. And 37% said it would not change their mind.

Note 2: Only 25% of all respondents said they would use an FPGA in their next project further supporting the downward trend in using FPGAs. Those not using FPGAs in the future say they don’t need the functionality, the cost of FPGAs is too high, or they consume too much power.
Which of the following vendors does your current embedded projects use for FPGAs?

- **Xilinx**: 2017: 63%, 2015: 64%, 2014: 64%, 2013: 70%, 2012: 55%
- **Lattice**: 2017: 5%, 2015: 7%, 2014: 10%, 2013: 12%, 2012: 13%
- **Mentor Graphics**: 2017: 5%, 2015: 6%, 2014: 6%, 2013: 5%, 2012: 5%
- **Atmel (Microchip Technology)**: 2017: 7%, 2015: 7%, 2014: 7%, 2013: 7%, 2012: 7%
- **Cypress Semiconductor**: 2017: 4%, 2015: 3%, 2014: 3%, 2013: 3%, 2012: 3%
- **Synopsys**: 2017: 3%, 2015: 3%, 2014: 3%, 2013: 3%, 2012: 3%
- **Cadence**: 2017: 4%, 2015: 3%, 2014: 3%, 2013: 3%, 2012: 2%
Which of the following FPGA vendors will you consider in your next embedded project?
• **Current FPGA usage** – 30% used in current project, continuing a downward trending.

• **Next Project FPGA usage** – 25% will likely use an FPGA in their next project.

• **Why FPGAs NOT used** – Don’t need this functionality, too expensive, use too much power, and too difficult to program.

• **Built-in Multicore Trend** – 12% say it encourages use of FPGAs

• **Vendors currently used** – Xilinx (55%) and Altera (42%) dominate and Lattice is 13%.

• **Vendors will consider** – Xilinx (70%) and Altera (58%). Altera/Intel and Atmel/Microchip mergers portend a possible challenge to Xilinx.
Hardware IPs, System Level Design & GUIs
Does your current embedded project reuse hardware or hardware IP from a previous project?

Over three quarters of embedded developers reuse hardware or hardware IP and 7 in 10 have been doing so for the last five years. Six in ten reuse hardware or hardware IP that was developed in house.
Which of the following design techniques will become more important to your designs in the future?

- **Simulation**
  - 2012 (N = 1401): 63%
  - 2013 (N = 1743): 63%
  - 2014 (N = 1007): 63%
  - 2015 (N = 719): 63%
  - 2017 (N = 548): 63%

- **Emulation (added 2017)**
  - 2017 (N = 548): 33%

- **Modeling in a high level language**
  - 2012 (N = 1401): 29%
  - 2013 (N = 1743): 30%
  - 2014 (N = 1007): 32%
  - 2015 (N = 719): 32%
  - 2017 (N = 548): 37%

- **Virtual prototyping**
  - 2012 (N = 1401): 25%
  - 2013 (N = 1743): 31%
  - 2014 (N = 1007): 32%
  - 2015 (N = 719): 33%
  - 2017 (N = 548): 32%

- **Graphical system design**
  - 2012 (N = 1401): 27%
  - 2013 (N = 1743): 30%
  - 2014 (N = 1007): 31%
  - 2015 (N = 719): 32%
  - 2017 (N = 548): 40%
What system level design tools do you or your organization currently use?

- MATLAB: 48% (2017), 56% (2015), 54% (2013)
- LabVIEW: 35% (2017), 34% (2015), 36% (2013)
- System C or other "hardware C" language: 28% (2017), 28% (2015), 20% (2013)
- Simulink: 22% (2017), 26% (2015), 24% (2013)
- UML: 17% (2017), 23% (2015), 23% (2013)
- QEMU: 10% (2017), 19% (2015), 22% (2013)
- Cadence Virtual System Platform: 5% (2017), 4% (2015), 4% (2013)
- Synopsys Virtualizer: 5% (2017), 4% (2015), 4% (2013)
- Other: 6% (2017), 9% (2015), 11% (2013)
Who were the three greatest influencers on the choice of the system-level tools for your current project?

- Software engineering staff: 36%
- Hardware engineering staff: 28%
- Software engineering manager: 21%
- Hardware engineering manager: 18%
- Hardware architects: 17%
- Systems engineering manager: 15%
- Systems engineering staff: 15%
- Corporate management: 14%
- Outside influence, customer, standards: 8%
- Purchasing manager: 2%
- Marketing manager: 2%
- Other: 4%

2017 (N = 536)
Which of the following project management software packages do you currently use?

- Microsoft Excel: 44% (2017) vs. 47% (2015)
- Microsoft Project: 38% (2017) vs. 45% (2015)
- Open Source tools: 23% (2017) vs. 24% (2015)
- Visio: 22% (2017) vs. 27% (2015)
- Simulink: 7% (2017) vs. 10% (2015)
- IBM Telelogic DOORS: 6% (2017) vs. 7% (2015)
- TeamCenter: 3% (2017) vs. 2% (2015)
- Other software package: 7% (2017) vs. 11% (2015)
Which of the following Version Control software systems do you currently use?

- Git: 38% (2017) vs 31% (2015)
- Subversion: 33% (2017) vs 41% (2015)
- Clearcase: 6% (2017) vs 10% (2015)
- Perforce: 5% (2017) vs 7% (2015)
- Other: 14% (2017) vs 17% (2015)
Does your current design use a graphical user interface?

![Bar chart showing the percentage of respondents who use a graphical user interface over the years 2013 to 2017. The chart indicates that the percentage of respondents using a graphical user interface has remained relatively stable, with slight variations each year.](chart.png)
Hardware IPs, System Level Design, GUIs

- **Reuse of Hardware/Hardware IPs** – 76% up from 71% reuse in 2015.

- **Design Techniques Becoming More Important** – Simulation (63%), emulation (new om 2015) (33%) and modeling high level language (27%).

- **System Level Design Tools Used** – MATLAB (48%) is the big leader followed by LabVIEW (35%), System C (28%) and FPGA based prototypes (24%).

- **Deciders of Systems Level Tools** – Software engineers (36%) and hardware staff (28%) are the top influencers

- **Project Management** – Excel (44%) & Microsoft Project (38%) are tops.

- **Version Control Software** – Git (38%) switched places with Subversion (33%), and CVS (14%) is a distant third.

- **GUI usage** – Stayed even at 49% in 2017.
THANK YOU!