

### 2019 Embedded Markets Study

Integrating IoT and Advanced Technology Designs, Application Development & Processing Environments March 2019





### **Preliminary Comments**

- **Results:** Data from this study is highly projectable at 95% confidence with +/-3.15% confidence interval. Other consistencies with data from previous versions of this study also support a high level of confidence that the data reflects accurately the EETimes and Embedded.com audience's usage of advance technologies, software and hardware development tools, chips, operating systems, FPGA vendors, and the entire ecosystem of their embedded development work environment and projects with which they are engaged.
- **Historical:** The EETimes/Embedded.com Embedded Markets Study was last conducted in 2017. This report often compares results for 2019 to 2017 and in some cases to 2015 and earlier. This study was first fielded over 20 years ago and has seen vast changes in technology evolution over that period of time.
- **Consistently High Confidence:** 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.
- **New Technologies and IoT:** Emerging markets and technologies are also tracked in this study. New data regarding IoT and advanced technologies (IIoT, embedded vision, embedded speech, VR, AR, machine learning, AI and other cognitive capabilities) are all included.

### **Purpose and Methodology**

- **Purpose:** To profile the findings of the 2019 Embedded Markets Study comprehensive survey of the embedded systems markets worldwide. Findings include *technology* used, all aspects of the *embedded development process*, *IoT, emerging technologies, tools* used, *work environment, applications developed for, methods/ processes, operating systems used, reasons for using chips and technology*, and *brands* and *specific chips* being considered by embedded developers.
- **Methodology**: A web-based online survey instrument based on the 2017 survey was developed and implemented by independent research company Wilson Research Group. It was fielded on January 29, 2019, and closed March 7, 2019.
- **Sample:** E-mail invitations were sent to subscribers to EETimes and Embedded.com and AspenCore related brands with reminder invitations sent at 5-7 day intervals. Each invitation included a link to the survey and incentives to participate.
- **Returns:** This data is based on 958 valid respondents for an <u>overall</u> confidence of 95% +/-3.15%. Confidence levels vary by question. Confidences for questions with:
  - 958 respondents for 2019 = 95% +/- 3.15%
  - 1,234 respondents for 2017 = 95% +/- 2.8%

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- 600 respondents = 95% +/- 4.0% = high confidence, fairly tight margin of error
- 400 respondents = 95% +/- 5.0% = high confidence, standard margin of error
- 300 respondents = 95% +/- 5.5% = high confidence, with slightly wider margin of error
- 200 respondents = 95% +/- 6.7% = high confidence, with still wider margin of error



### In which region of the world do you reside?





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### How many employees does your company have at all locations?





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#### **Job Functions**

Hardware/software integration Debugging firmware/software Architecture selection/specification Writing firmware/software for embedded systems Debugging hardware Firmware/software design or analysis Project management Prototype testing Firmware/software testing Device programming Designing hardware for embedded systems System design Hardware/software co-design Board layout/design Hardware/software co-verification Connected device design SoC (system-on-chip) design Other (please specify)

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# For what types of applications are your embedded projects developed?



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### How important will IoT development be to you and your organization in the next 12 months?



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# If you are developing Internet of Things (IoT) applications, please indicate the type of application.



\* Added in 2019.

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### If you are creating Internet of Things (IoT) <u>devices</u>, please indicate the types of devices you are *currently* designing and *considering* for your next design.

Devices currently designing for (N=296)

Devices considering for next design (N=265)



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### Will have one or more projects devoted to IoT.



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# Considering all applications of which you are aware, what do you regard as the <u>most interesting</u> use of the IoT? (Selected write-in responses from 2019 & 2017).

- Automatic traffic control.
- **AR/VR** -- Augmented Reality/Virtual Reality.
- 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.
- **Remote 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.

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### **Gartner Hype Cycle for Emerging Technologies 2015**



2015: Machine Learning and IoT at peak of hype! AR is in disillusionment, VR moving towards productive implementations!

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### **Gartner Hype Cycle for Emerging Technologies 2018**



### 2018: Machine Learning (Deep Neural Nets) and IoT still at Peak Hype! AR has moved along only slightly, and VR is out of hype stage and into productivity.

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### Are you using any of these <u>advanced technologies</u> in your embedded systems?

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# What security measures are you incorporating into your current design?



EMEA uses **Encryption** significantly more than other regions (49%).



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#### **NEW IN 2019**

# What hardware support measures are you implementing into your current design?





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#### **Overall Background**

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- Focus IoT, AI, AV, AR and other advanced technologies focus.
- World Regions The Americas (58%), EMEA at (21%), and APAC at (21%).
- **Company Size** Avg of 3,467 employees. Americas (4,091), EMEA (1,858), APAC (3,034).
- Number of Years Out of School: Average years out of school for the 2019 is 26.3.
- Job functions Hardware/software integration (59%), debugging (52%), architecture design (52%), writing firmware/software (51%) were top four job functions.
- Applications Developed Top three apps were *Industrial controls (32%), consumer electronics (29%)* and *Internet of Things (25%)* remained even with 2017.
- **IoT Usage/Advanced Technologies** Half (50%) of users feel IoT will be *important to critically important* in 2019 (same as 2017), but among APAC users it is **64%**. **IoT apps** include *sensor driven (40%), industrial (35%), IP connected cloud (28%), smart phone/mobile (20%)* and *smart buildings (19%)*.
- Advanced technology used most was *embedded vision (43%)*. Machine learning (55%) has greatest potential. 55% are creating IoT <u>edge of the internet</u> devices. 66% will have one or more projects devoted to IoT.
- Security 70% of respondents are taking software security measures: 45% encryption, 41% authentication. 71% used hardware support measures, which included MCU security at 31%.

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Current Embedded Design Environment



### My current embedded project is...



New to the world; a new project from scratch

An upgrade or improvement to an earlier or existing project

In 2019, APAC ratio of "New to the World" vs "Upgrade" was 40%/60%.





### What does the upgrade or improvement include?

New or different software features

New or different processor

New or different connectivity capabilities

Mandatory changes/discontinued hdwr/sftwr

New or different analog components

New or different system logic

New or different peripherals

New or different operating system



Base = Those whose current project is an upgrade/improvement



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# Which of the following capabilities are included in your current embedded project?

54% 59% **Real-time capability** 51% 56% Digital signal processing 49% 54% Networking capability 46% 50% Analog signal processing 42% 40% Wireless capability 34% 34% Battery-powered 31% 34% **Rugged design** 26% GUI ■ 2019 (N = 943) 36% ■ 2017 (N = 1,107) 15% AI (machine learning)\* 9% GPU\* \*AI and GPU were added in 2019.

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### If wireless, what wireless interfaces does your current embedded project include?



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### If wireless, what wireless protocols/stacks does your current embedded project include?



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### How many people are on your embedded project team?



Team size for Americas is **15.1** engineers/ team. Team size for EMEA is **14.1** engineers/ team.

Team size for APAC is **19.6** engineers/ team.

Teams also work with an average of 2.7 outside vendors on a typical project.

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What is your development team's ratio of total resources (including time/dollars/manpower) spent on software vs. hardware for your embedded projects?



In 2019, respondents averaged working on 2.1 projects at the same time. 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.

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Do you primarily design or subcontract the design of custom circuit boards, or do you purchase off-the shelf boards?





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# Did you start your current embedded design with a development board?



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Development Board Started With (Write-in recall answers only)	N=281	%
STMicroelectronics	43	15.3%
ті	30	10.7%
NXP	20	7.1%
Raspberry Pi	19	6.8%
Microchip	14	5.0%
Arduino	13	4.6%
Xilinx	13	4.6%
Atmel	11	3.9%
Espressif ESP-32	7	2.5%
Renesas	7	2.5%
Silicon Labs	6	2.1%
Nordic	5	1.8%
Digilent	4	1.4%
Nucleo Board	4	1.4%
ZedBoard	4	1.4%
Analog Devices	3	1.1%
Beaglebone Black	3	1.1%
Cypress	3	1.1%
AdaFruit 'Feather' Cortex-M4	2	0.7%
ARM	2	0.7%
Atmega	2	0.7%
Avnet Picozed	2	0.7%

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# Which form factor boards are you currently using, and which are you considering using?

2019 Currently Using (N = 697)
2019 Considering Using (N = 553)



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Thinking now about the last embedded project you completed (no longer in development), how many months did that project take to finish?



**EMEA** averaged 12.6 months **APAC** averaged 10.1 months



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### Was that project completed ...

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In **2019**, 39% of all projects finished "<u>ahead of</u>" or "<u>on</u>" schedule, and 61% finished "<u>late or cancelled</u>".

In **2017**, 41% of all projects finished "<u>ahead of</u>" or "<u>on</u>" schedule, and 59% finished "<u>late or cancelled</u>".

In **2015**, 38% of all projects finished "<u>ahead of</u>" or "<u>on</u>" schedule, and 62% finished "<u>late or cancelled".</u>



# My *current* embedded project is programmed mostly in:



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# My *next* embedded project will likely be programmed mostly in:

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# Does your current project reuse code from a previous embedded project?



Note 1. Multiple choice for "Yes" answers (a respondents can select more than one type of reused code), therefore will not add to 88%. Note 2. In 2019, 77% of respondents also reused <u>hardware</u> or <u>hardware IP</u>, up 1% from 2017

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### **Embedded Design Environment**

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• New/Upgrade Ratio – 44% new/56% upgrades. APAC ratio is 40%/60%.

Upgrades include new software features (46%), processors (37%), connectivity (22%).

- Design Capabilities Real time (54%), DSP (51%), Networking (49%).
- Team Size 16.1 engineers is up from 14.8. APAC has 19.6 engineers per team.
- Outside vendors Work with an average of 2.7 outside vendors.
- Resources Used On Software (60%), hardware (40%). No change in 5 years.
- Number of Projects Worked On at the Same Time Average of 2.1 projects.
- Build or Purchase Boards 77% build their own boards, 23% purchase OTS.
- Project Starts with Board 46% is up 2% from 2017. STMico, TI, NXP mostly.
- Form Factor Boards Used Custom design (26%), proprietary (18%) top two.
- Months to Complete Project 12.2 mos. on average. APAC was 10.1 mos.
- On or ahead of schedule 39% in 2019 is two ticks down from 2017.
- Languages C usage at 56%, C++ 23%. Python is starting to grow.
- Code/HW IP Reuse 88% code reuse; 77% hardware or hardware IP reuse.

# **Embedded Design Process**




Meeting schedules The debugging process Meeting application performance requirements Ensuring data security Testing/systems integration Maintaining legacy code Increased lines of code & software complexity Ensuring code/IP security Power management/energy efficiency Keeping pace with embedded systems technology Software compatibility when porting to new devices Sticking to our cost budget Meeting safety & development process standards Providing network connectivity Managing remote design team/multiple locations

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## What percentage of your design time is spent on each of the following stages?



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## How do you typically find and evaluate partners to work with?

Go to their websites & contact them **Referrals from colleagues** Recommended from other hw/sw vendors Meet them at industry events Read articles in industry pubs 18% Read white papers/industry communications 14% 8% Read relevant blogs 8% 7% See ads in industry magazines 5% 5% Other sources 6%



### Number of outside partners worked with on average:

- 2.7 vendors in 2019
- 2.7 vendors in 2017
- 3.2 vendors in 2015

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## If you could improve one thing about your embedded design activities, what would it be?



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### In general, what sources of information do you consult to research your embedded design decisions?



#### **Top 15 Sources**

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## What are your favorite websites related to your professional work? (Write-in responses only)

Favorite Website (Write-in)	N = 350	%
EE Times	53	10.9%
Google	41	8.4%
Embedded.com	37	7.6%
Stack Overflow	26	5.3%
Digikey	23	4.7%
EDN	20	4.1%
IEEE	19	3.9%
TI	19	3.9%
Analog Devices	11	2.3%
Github.com	11	2.3%
LinkedIn	11	2.3%
Stack Exchange	11	2.3%
Microchip	9	1.8%
Wikipedia	9	1.8%
Electronicdesign.com	8	1.6%
Hackaday	6	1.2%
Microsoft	6	1.2%
Mouser	5	1.0%
Xilinx	5	1.0%
Youtube.com	5	1.0%
Texas Instruments	4	0.8%
Embedded Systems Design	3	0.6%
NXP	3	0.6%
Sourceforge	3	0.6%
ST.com	3	0.6%
ADI/LTCC	2	0.4%
Arduino	2	0.4%
Avrfreaks.net	2	0.4%

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## Thinking about the next year, what areas will be your greatest technology challenges?



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## Which of the following are your favorite/most important software/hardware tools?

(Top 21 shown) Oscilloscope Debugger Compiler/assembler IDE 21% 22% Logic analyzer JTAG/BDM 17% 19% 16% 14% Software libraries 12% 12% ICE 10% Linux tools 9% 7% Static analysis tools 8% 6% Starter, evaluation kits/boards 8% Hardware emulators 5% 6% 6% Software testing tools 7% 7% Software drivers 7% 5% Automatic code generation 6% 9% Configuration management tools **Graphical Design tools** 6% 7% 4% 3% Network debuggers 4% 6% Simulation modeling tools 4% 6% **FPGA-based prototypes** 4% 5% Trace



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Which of the following conferences have you attended in the last two years, and which do you plan to attend in the next year?

Conferences	Have Attended	Plan to Attend	Diff
Training/seminars of distributors	40.2	33.2	-7.0
Embedded Systems Conference (USA)	17.5	26.4	+8.9
Vendor technical forums/developer conferences	16.8	12.5	-4.3
Embedded World (Nuremberg)	15.7	19.3	+3.6
CES (Las Vegas)	12.6	16.8	+4.2
Electronica	11.9	13.6	+1.7
DesignCon	11.2	15.4	+4.2
Sensors Expo	9.8	14.6	+4.9
DAC	7.3	7.1	-0.2
IEEE International Conference on Embedded and Real-Time Computing Systems and Applications	7.0	10.4	+3.4
Embedded Linux Conference (ELC)	6.3	7.1	+0.8
CeBIT	5.6	6.8	+1.2
Embedded Systems Conference (India)	5.2	7.5	+2.3
Embedded Systems Expo (Japan)	4.2	2.5	-1.7
Android Builders Summit	3.5	3.2	-0.3
Mobile World Congress	3.1	5.7	+2.6
SAE Convergence	3.1	3.9	+0.8
IIC (China)	2.8	3.9	+1.1
Embedded Systems Conference (Brazil)	1.0	2.5	+1.5
Other	7.3	4.6	-2.7
2019	N = 286	N = 280	

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# What are the most effective ways that you systematically or formally maintain, educate, and advance your professional skills?

Online training/webinars provided by vendors Technical white papers from vendors Professional/technical journals Online training/webinars by media orgs (EE Times) Professional devlpmnt courses by private cos Online training/webinars provided by distributors Online training/webinars by profnl assoc (like IEEE) On-site seminars given by vendors

#### Books

Conferences-seminars provided by vendors Professional devlpmnt courses by university online Certification training Professional devlpmnt courses by univ ext progs Conf/seminars provided by professional assocns Conferences-seminars by media orgs (like ESC) No formal advancing of my professional skills Other

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■ 2019 (N = 590)

40%

38%

37%

34%

32%

31%

43% 43%

2017 (N = 799)

Technical Reading	2019	2017	2015	2014	APAC
Average days per year spent on career training	8.1	9.7	9.5	9.2	9.7
Hours per week spent reading technical publications	4.7	4.8	4.6	5.2	6.5
Technical books read in full or in substantial part per year	3.2	3.2	3.7	3.9	4.5

#### Top four

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### **Embedded Design Challenges**

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- Challenges Meeting schedules (22%) and debugging (22%).
- Stages Detailed design (31%) & testing/debugging (19%) take most time.
- Vendors Work with 2.7 outside vendors on average (same as 2017).
- Most Need to Improve Engineering team skill level (20%), debugging tools (20%), and schedule (12%). Team skills for EMEA (24%) and APAC (26%).
- Sources of Info Vendor websites (83%) leads all others by far. Search engines (54%) and technical white papers (51%) also important.
- **Technical Challenges for Next Year –** Top three: Integrating new technology (20%), managing code size and complexity (16%) and security (15%).
- Favorite Tools Top four: Oscilloscope (43%), debugger (41%), compiler (35%) and IDE (32%).
- Maintaining professional skills Top four: Vendor online training/webinars (43%), vendor technical white papers (40%), professional/technical journals (34%) and online training/webinars by media organizations (32%).
- **Training/reading:** 8.1 days/year career training; 26.3 years out of school; 4.7 hours per week reading technical publications; read 3.1 books per year.

## **OPERATING SYSTEMS**

# Does your current embedded project use an operating system, RTOS, kernel, software executive, or scheduler of any kind?



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## My current embedded project uses:

My next embedded project will likely use:







## Which factors most influenced your decision to use a commercial operating system?





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





## What are your reasons for not using a commercial operating system?

Current solution works fine Commercial alternatives too expensive Avoid reliance on commercial supplier No need for mulithreading multitasking Too much trouble to learn commercial alternative No need for real time Incompatible for existing software, apps or drivers Commercial alternatives use too much memory Security concerns with commercial Safety concerns with commercial alternatives Commercial alternatives lack features I need Other



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?



Base: Those who use operating systems



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### Why did you use the same operating system?

Happy with current one, no reason to switch Wanted to maintain software compatibility Wanted to make use of expertise/familiarity Wanted to maintain the same tools or software Wanted to keep same Operating System Switching OS too expensive / time-consuming Happy with supplier No other suitable alternatives available Not my choice/operating system chosen for me Other



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

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### Why did you switch operating systems?

Hardware or processor changed Not my choice/OS chosen for me New OS had better features New OS had better SW/dev tools New OS is cheaper New OS had better growth path New OS had OTS modules (apps, tools) Previous OS no longer available Previous OS too slow Unhappy with previous OS supplier Other

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### What are the most important factors in choosing an operating system?





์ 39%

Base: Currently using an operating system



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### **Please select ALL of the operating systems** you are currently using.

Embedded Linux				21	.%		
In-house/custom				19%			
FreeRTOS				18%			
Ubuntu			14%				
Android			13%				
Debian (Linux)			13%				
Microsoft (Windows 10)		10%					
Microsoft (Windows Embedded 7/Standard)	6%						
Texas Instruments RTOS	6%						
Wind River (VxWorks)	5%						
Green Hills (INTEGRITY)	5%						
Texas Instruments (DSP/BIOS)	5%		<b>Regional Bre</b>	eakout			
Micrium (uC/OS-II)	4%		FMFA uses Emb	hedded Lin	ux much more	than othe	r regions
AnalogDevices (VDK)	4%		APAC uses And	roid much	more than oth	er regions	and uses
Keil (RTX)	4%		Embedded Linu	x much les	is that others.		
Red Hat (IX Lunix)	3%				<u> </u>		
Microsoft (Windows 7 Compact or earlier)	3%		Most Used	World	Americas	ΕMΕΔ	ΔΡΔΟ
Express Logic (ThreadX)	3%		Most oscu	wona	Americas		
Micrium (uC/OS-III)	3%		Embedded	21%	21%	20%	15%
QNX (QNX)	3%		Linux	21/0	21/0	3070	17/0
Android Go (Google)	2%		Android	1 20/	00/	1 4 0 /	370/
Freescale MQX	2%		(Google)	13%	9%	14%	21%
Wittenstein High Integrity Systems	2%						
CMX	2%		20	19 (N = 4	468)		
Segger (embOS)	2%		Only Opera	ating Syst	ems with		
LynuxWorks (LynxOS)	2%		2% or m	nore are s	hown.		
Wind River (Linux)	2%						
OSEK	2%						
Base: Currently using an operating system ECos	2%						



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### Please select ALL of the operating systems you are considering using in the next 12 months.

Embedded Linux			
FreeRTOS			
In-house/custom		16%	
Debian (Linux)		15%	
Ubuntu		14%	
Android		14%	
Microsoft (Windows 10)		12%	
Texas Instruments RTOS	9%	, )	
Keil (RTX)	6%		
Other	6%		
Micrium (uC/OS-III)	5%	Regional B	rea
Red Hat (IX Lunix)	5%	<b>APAC</b> users v	vill
Texas Instruments (DSP/BIOS)	5%	than other re	egio
Wind River (VxWorks)	5%	EMEA will us	e A
Green Hills (INTEGRITY)	5%	B d a st l l a s d	
QNX (QNX)	5%	Most Used	V
Express Logic (ThreadX)	4%	Embedded	
Angstrom (Linux)	4%	Linux	
Wittenstein HIS(OpenRTOS/SAFERTOS	4%	FreeRTOS	
Micrium (uC/OS-II)	4%		
Freescale MQX	3%	Android	
AnalogDevices (VDK)	3%		
Segger (embOS)	3%	Only	Op
Wind River (Linux)	3%		3%
Microsoft (Windows 7 Compact or earlier)	3%		

Base: Those who are considering an operating system in any project in the next 12 months



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#### akout

use FreeRTOS and Android much more ons and use Embedded Linux much less. ndroid less than other regions.

31%

27%

World	Americas	EMEA	APAC
31%	32%	31%	<b>26%</b>
27%	25%	24%	37%
14%	12%	<b>10%</b>	<b>26%</b>
	World 31% 27% 14%	World Americas   31% 32%   27% 25%   14% 12%	World Americas EMEA   31% 32% 31%   27% 25% 24%   14% 12% 10%

erating Systems with more are shown

### Are you currently using embedded virtualization/hypervisors or will you likely use them in the next 12 months?



Top reasons for using virtualization/hypervisors	
Separation of multiple applications	45
Need to support multiple guest operating systems (e.g., Android, VxWorks, Linux)	40
Need to support hard real-time application(s) and guest operating system	32
Processor consolidation	26
Need to support legacy and new applications on the same system	26

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### **Operating Systems**

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- **OS/RTOS usage –** 65% overall usage, down from 2017 (67%) and 2015 (72%).
- **Open Source OS/RTOS usage –** 41%, projected for next project at 49%. Usage of commercial OSes (24%) dipped to an all time low from 40% in 2012.
- Used same OS 60% used the same OS, same as 2017. Reasons for using the same OS: happy (69%), compatibility (37%), familiarity (37%), same tools (33%).
- Reasons for Switching OS Hardware/processor changed (36%), chosen for me (24%), new one had better features (16%).
- Reason for choosing OS Full source code (35%), tech support (31%), compatibility (29%), no royalties (29%). Same as 2017, slightly different rankings.
- **OS/RTOS used –** Embedded Linux (21%), Inhouse (19%), FreeRTOS (18%). EMEA uses Embedded Linux (30%). APAC uses Android (27%).
- OS/RTOS considering Embedded Linux (31%), FreeRTOS (27%), Inhouse (16%) were top three RTOSes being considered. APAC users will consider FreeRTOS (37%) and Android (26%).
- Embedded virtualization/hypervisor usage 17%, up from 15% in 2017. Use it mostly for separation of multiple applications (45%) and multiple guest OSes (40%).

## MICROPROCESSORS



## Who were the greatest influences on the choice of the processor for your current project?

33% Hardware engineering staff 28% 26% 26% Group decision in engineering 22% Hardware engineering mngr 21% 22% Software engineering staff 22% 14% Software engineering mngr 15% 11% Corporate mgmt. 11% 9% Same processor as in previou project 11% 9% Systems engineering staff 11% 8% Systems engineering mngr 7% 8% Outside influence/ customer/stndrds 6% 4% Purchasing mgr. or dept. 4% 4% Marketing mngr or dept. 3% 2019 (N = 556) 4% 5% Other 2017 (N = 758)

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Americas (N = 350)

EMEA (N = 110)

APAC (N = 96)



HW Group HW SW SW enginrg decision enginrg enginrg enginrg staff in enginrg manager staff manager

13%





Americas top two influences

1. HW engineering STAFF

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2. Group decision in Engineering

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EMEA top two influences

- 1. HW engineering MANAGERS
- 2. Group decision in Engineering

#### APAC top two influences

- 1. HW engineering MANAGERS
- 2. Group decision in Engineering

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34%

63



### My current embedded project contains:



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### Does your embedded project contain...

Multiple different processor chips from diff. vendors

Single chip/SoC with multiple identical processor cores

Multiple identical processor chips

Multiple different processor chips (same vendor)

Single chip/SoC with multiple different processor cores

FPGA with a single hard/soft processor core

FPGA with a multiple hard/soft processor cores

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### My current embedded project's main processor is a:



#### 71% of EMEA users use 32-bit chips as their main processor.

Additional chips to the main processor	
Primarily 8-bit processors	19%
Primarily 16-bit processors	15%
Primarily 32-bit processors	55%
Primarily 64-bit processors	12%

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## My current embedded project's main processor clock rate is:



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67

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## Did you use the same processor as in your previous embedded project?

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### Why did you use the same processor?

Happy with current processor/supplier To maintain software compatibility To make use of expertise/familiarity To maintain the same tools or software To use same operating system Switching too expensive/time consuming Not my choice/processor chosen for me No other suitable processors available Other



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

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### What were your reasons for switching processors?

New processor has better features Too slow: needed increased performance/bit width New processor has better future growth path / roadmap New processor has better software / development tools Previous processor too slow (needed higher clock speed) Not my choice / processor chosen for me Previous processor no longer available Needed a lower power processor To change operating system Previous processor too expensive Unhappy with previous processor's supplier Other



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



6

### Did you...



■ 2019 (N = 239) ■ 2017 (N = 370) ■ 2015 (N = 473) ■ 2014 (N = 687) ■ 2013 (N = 1088)

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

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## What's most important when choosing a microprocessor?

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### Which vendor has the best ecosystem for your needs?



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## What are the most important factors in choosing a processor?



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## Please select the processor vendors you are <u>familiar with.</u>





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### Please select the processor vendors you are currently using.



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Merged Brands Combined	%		
Microchip/Atmel/Microsemi (Net)	40		
NXP/Freescale (Net)			
Intel/Altera (Net)			
Silicon Labs/Energy (Net)	10		
Cypress/Spansion (Net)	9		

76

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Top Four Brands by Region: Americas: TI, Microchip, STMicro, Atmel EMEA: STMicro, NXP, TI, Atmel APAC: TI, Atmel, Freescale, STMicro

2019 (N = 458)

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### Please select the processor vendors you are considering using on your next project.



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## Which of the following 32-bit chip families would you consider for your next embedded project?

	L			TI C2000 MCUs		5%
STMicroelectronics STM32 (ARM)			31%	TI TM4Cx (ARM)		5%
Atmel/Microchip SAMxx (ARM)	ARM) 21%		1%	Renesas RZ (ARM Cortex-A)		5%
				Xilinx Virtex-5 (with PowerPC 405)		5%
Microchip PIC 32-bit (MIPS)		19	%	Energy Micro/SiLabs EFM32		4%
Freescale/NXP i.MX (ARM)		15%		Atmel/Microchip AT91xx		4%
		1=0/		Renesas RX		4%
NXP LPC (ARM)		15%		Microsemi/Microchip SmartFusion SoC FPGA (Cortex		3%
Freescale/NXP Kinetis (ARM/Cortex-M4/M0)		14%		Microsemi/Microchip SmartFusion2 SoC FPGA		3%
Vilian Zung (with dual ARM Carton AQ)		1 / 0/				3% 20/
Annix Zynq (with dual Anni Cortex-A5)		14%		Freescale/NXP PowerPC 55xx		3%
TI MSP432		13%		Microsemi/Microchip EPGA (Cortex-M1, softcore)		3%
Atmel/Microchin (AVR32)		12%		NVIDIA Tegra		3%
/		12/0		SiLABS Precision32 (ARM)		3%
Altera (Intel FPGA) SoC-FPGA (with dual ARM Cortex-A9)		12%		TI Hercules (ARM)		3%
Altera (Intel FPGA) Nios II (soft core)		11%		AMD Fusion, Athlon, Sempron, Turion, Opteron,		3%
				Xilinx Virtex-4 (with PowerPC 405)	- :	2%
Arduno		11%		Freescale/NXP PowerPC 5xx, 6xx	2	2%
TI Sitara (ARM)		11%		Infineon Tricore	2	2%
Atmal/Microship ATO100/ATSANA00 (ADM)		100/		Infineon XMC4000 (ARM)	2	2%
Atmen/Microchip AT91XX/ATSAWIXX (ARM)	10%			Marvell		2%
Cypress PSOC 4 (ARM Cortex-M0) / PSoC 5 (ARM	ARM 9%			Freescale/NXP POwerPC /XX, 8XX	-	2% 20/
Intel Atom Pentium Celeron Core 2 Core iX	e iX			Infineon ALIRIX (TriCore-based)		270 7%
	0/0			Renesas RH850		2%
SiLABS EFM32/Tiny or Giant Gecko		8%		Freescale/NXP Vybrid (ARM)	1	-/0
TI SimpleLink (ARM)		7%		Infineon XMC1000 (ARM Cortex-M0)	1	1%
		===		AMD Alchemy (MIPS)	1	.%
Xilinx MicroBlaze (soft-core) 7%			Freescale/NXP PowerQUICC	1	%	
Broadcom (any)	m (any) 6%			Spansion/Cypress FM3 (ARM)	1	%
		6%		AMCC PowerPC 4xx	19	%
		070	= 2019 (N = 469)	IBM PowerPC 4xx, 7xx	19	%
Renesas Synergy (ARM Cortex-M)	·M) 6% SPARC		SPARC (any)	19	%	
ΤΙ ΟΜΑΡ	P 6%			inimeon other incore-based 32-bit families (i.e	%	

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## Which of the following 16-bit chip families would you consider for your next embedded project?



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APAC

39%

23%

28%

**EMEA** 

52%

43%

31%

## Which of the following 8-bit chip families would you consider for your next embedded project?

Atmel/Microchip AVR **Microchip PIC** STMicroelectronics ST8 TI TMS370, 7000 Freescale/NXP HC Intel 80xx, '251 Atmel/Microchip 80xx **Renesas H8** Xilinx PicoBlaze (soft core) SiLabs 80xx NXP/Philips P80x, P87x, P89x CypressPSoC 1 (M8C) / PSoC 3 (8051) Zilog Z8, Z80, Z180, eZ80 Parallax Maxim 80xx Infineon XC800, C500 EFM8 Digi / Rabbit 2000, 3000 Toshiba

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Americas

44%

41%

22%

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## Have you upgraded from an 8-bit or 16-bit chip to a 32-bit design in the last 12 months?



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## Which of the following DSP chip families would you consider for your next embedded project?



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### **Microprocessors**





- Deciders for chips Overall: Hardware engineers (33%) and engineering group (26%).
  - > Americas top 2 influencers: 1. Hardware engineering staff; 2. Engineering group.
  - **EMEA** top 2 influencers: 1. Hardware engineering **managers**, 2. Engineering **group**.
  - > APAC top 2 influences: 1. Hardware engineering managers, 2. Engineering group.
- Single processor usage 57% worldwide (65% in EMEA) with 2.2 processors per design on average.
- Chip Mix: Multiple different processors from different vendors (29%). Single chip/multiple cores (26%).
- Chip Type In 2019: 32-bit (61%), 64bit (15%), 16-bit (11%), 8-bit (10%).
- **Clock speeds** Now averages 462 MHz, up from 445 MHz in 2017.
- Same processor used Now 53%, up 6% from 2017. Reasons: Happy, compatibility, familiarity, same tools.
- Family 58% chose main chip from different family, 42% chose different processor from the same family.
- Ecosystem 60% say "ecosystem" outweighs "the chip" (31%). Best ecosystems are TI (16%), Microchip (15%).
- Most important in chip decision 1. Software development tools (63%), 2. Chip performance (41%).
- Top five Vendors Familiar With TI, Atmel, Microchip, Freescale, STMicroelectronics.
- **Top five Vendors Currently Using** TI, STMicroelectronics, Atmel, Microchip, Freescale.
- Top six Vendors Considering Using TI, STMicroelectronics, Microchip, Atmel, Altera, Freescale
- Top three 32-bit chips considering STMicro STM32 (ARM), Atmel SAMxx (ARM), Microchip PIC 32-bit.
- Top two 16-bit chips considering TI MSP430 and Microchip PIC 24 (dsPIC) (same, but reversed from 2017).
- Top two 8-bit chips considering Atmel AVR and Microchip PIC (same, but reversed from 2017).
- Upgraded from 8 or 16-bit to 32-bit Overall 23%. For APAC 39% upgraded.
- Top four DSP chips considering Microchip dsPIC, Analog Devices Blackfin, TI DaVinci, Analog Devices SHARC

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**FPGA CHIPS** 

### Does your current embedded project incorporate an FPGA chip?



27% of all respondents said they would use an FPGA in their next project.
Those not using FPGAs in the future say they "don't need the functionality,"
"FPGAs are too expensive," "consume too much power," "are too difficult to program."

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## Which of the following vendors does your current embedded project use for FPGAs?



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## Which of the following FPGA vendors <u>will you</u> <u>consider</u> in your next embedded project?





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### **FPGAs, Memories, LCDs**

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- Current FPGA usage 33% used in current project.
- Next Project FPGA usage 27% will likely use an FPGA in their next project. Again strong competition from Altera and Microchip will heat up this market.
- Why FPGAs NOT used Don't need this functionality, too expensive, use too much power, and too difficult to program no change from 2017.
- Built-in Multicore Trend 13% say it will encourage them to use FPGAs.
- Vendors currently used Xilinx (58%) and Altera (50%) dominate, but the difference is the tightest its ever been in this study's history. Lattice is a distant third at 17%. Altera has increased its usage, and Microchip is starting to show some gains as well due to its mergers with Atmel and Microsemi
- Vendors will consider Xilinx (70%) and Altera (59%). Altera/Intel and Atmel/Microsemi brands under Microchip portend a possible challenge to Xilinx and Lattice market share.

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Hardware IP Reuse, Design Techniques, System Level Tools, Project & Version Control

### Does your current embedded project reuse hardware or hardware IP from a previous project?



Over three quarters (77%) of embedded developers reuse hardware or hardware IP. 63% reuse hardware or hardware IP that was developed in house. Possibly a slight trend towards using more in-house hardware or hardware IP in future designs.

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Which of the following design techniques will become more important to your designs in the future?



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## What system level design tools do you or your organization currently use?



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#### **NEW IN 2019**

## What cloud integration tools do you or your organization currently use?





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# Who were the three greatest influencers on the choice of the system-level tools for your current project?



Software engineering staff Hardware engineering staff Software engineering manager Hardware engineering manager Hardware architects Corporate management Systems engineering staff Systems engineering manager Outside influence, customer, standards Purchasing manager Marketing manager Other





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### Who were the three greatest influencers on the choice of the <u>system-level tools</u> for your current project? (Regional Detail)

Americas (N = 265) EMEA (N = 73)APAC (N = 65)37% 35% 33% 29% 28% 23% 22% 22% 19% 18% 16% 15% 15% 14% 12% SW HW SW нw нw SW НW SW HW HW SW нw SW НW нw enginrg enginrg architects enginrg enginrg architects enginrg enginrg enginrg architects enginrg enginrg enginrg enginrg enginrg staff staff staff staff staff staff manager manager manager manager manager manager

Americas top two influences

- 1. SW engineering STAFF
- 2. HW engineering STAFF

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**EMEA** top two influences

- 1. SW engineering STAFF
- 2. HW engineering STAFF

#### **APAC** top two influences

- 1. HW engineering MANAGERS
- 2. SW engineering MANAGERS

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## Which of the following project management software packages do you currently use?



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## Which of the following Version Control software systems do you currently use?



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### Hardware IPs, System Level Design, GUIs

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- Reuse of Hardware/Hardware IPs 77% trending up from 71% reuse in 2015.
- **Design Techniques Becoming More Important** Top three are Simulation (56% -- down 7 points from 2017), emulation (33%) and modelling (28%).
- System Level Design Tools Used MATLAB (46%) is the big leader, but trending down some, followed by LabVIEW (34%), System C (32%) and Simulink (24%).
- Cloud Integration Tools Used: Firmware updates (61%), Device management (34%). Security management (31%).
- Deciders of Systems Level Tools Overall software engineers (33%) and hardware engineers (26%) are the top influencers on system level tools. But for APAC region hardware engineering managers (35%) and software engineering managers (28%) are the two leading influencers. Important when marketing to APAC.
- **Project Management** Excel (42%) & Microsoft Project (32%) are tops as previously.
- Version Control Software Git (46%) has completely overtaken Subversion (27%), and CVS (13%) is a distant third.

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## THANK YOU!