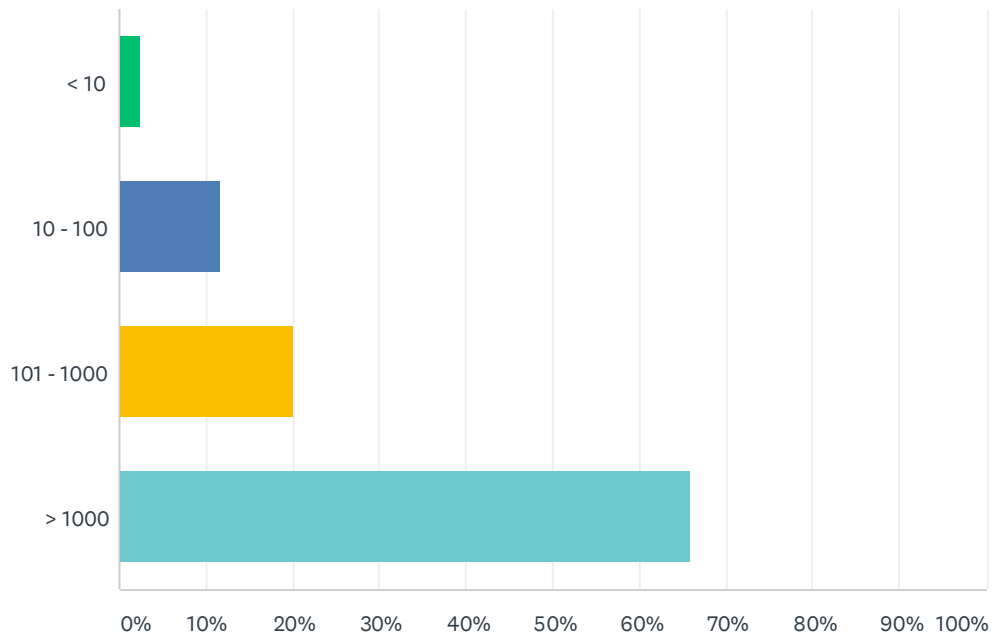


Q1 How many employees does your organization have?

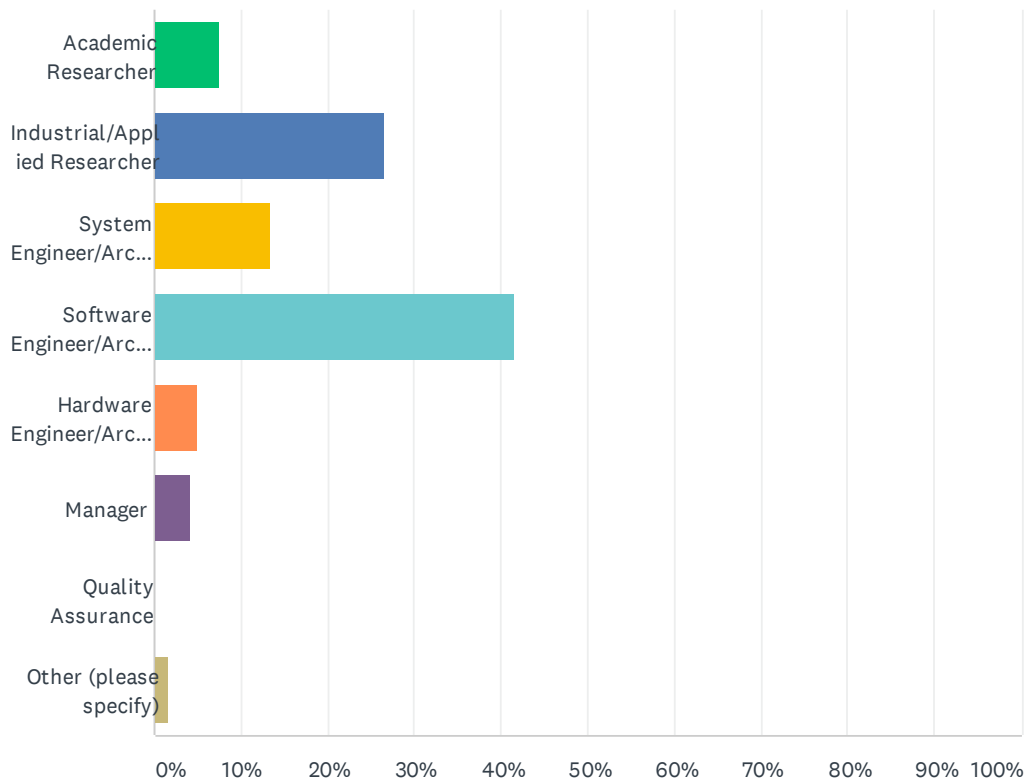
Answered: 120 Skipped: 0



ANSWER CHOICES	RESPONSES	
< 10	2.50%	3
10 - 100	11.67%	14
101 - 1000	20.00%	24
> 1000	65.83%	79
TOTAL		120

Q2 Which position below best describes your current role in your organization?

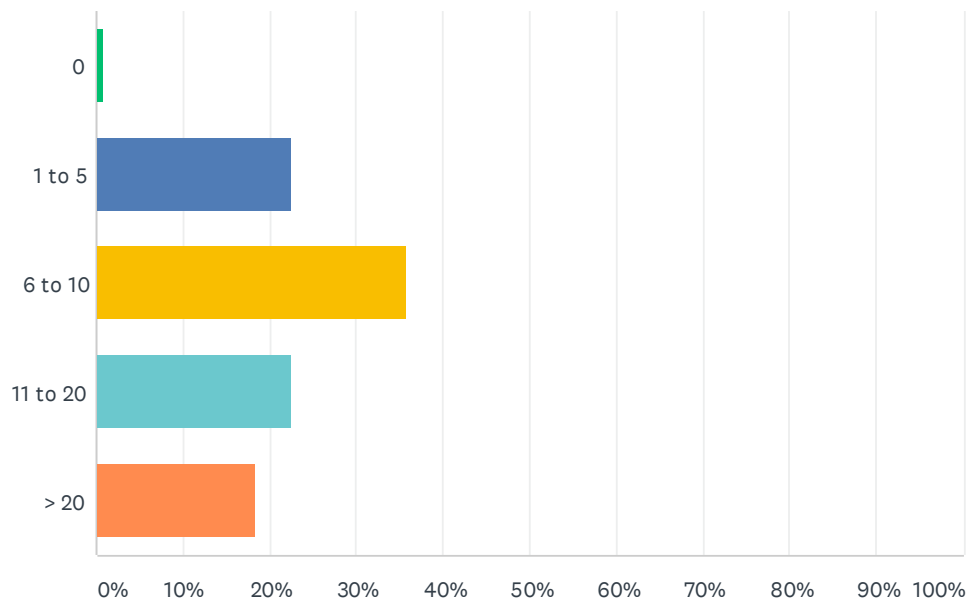
Answered: 120 Skipped: 0



ANSWER CHOICES	RESPONSES	
Academic Researcher	7.50%	9
Industrial/Applied Researcher	26.67%	32
System Engineer/Architect	13.33%	16
Software Engineer/Architect	41.67%	50
Hardware Engineer/Architect	5.00%	6
Manager	4.17%	5
Quality Assurance	0.00%	0
Other (please specify)	1.67%	2
TOTAL		120

Q3 How many years of industrial experience do you have?

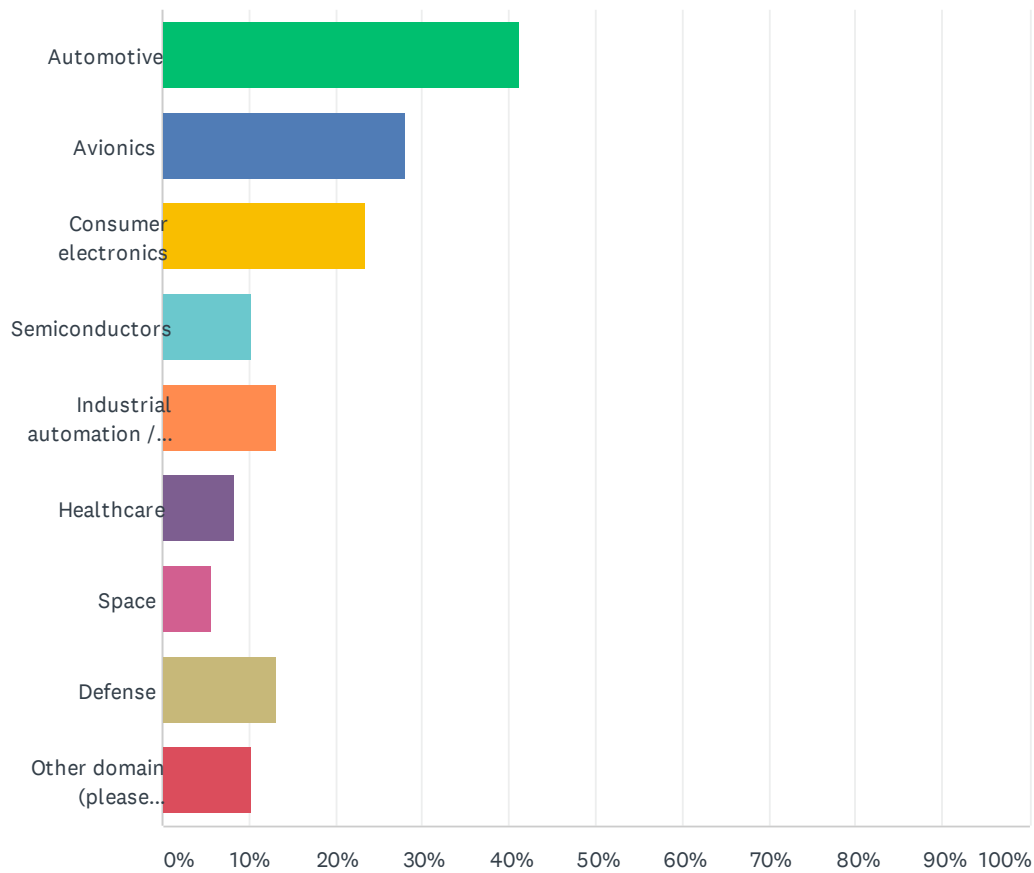
Answered: 120 Skipped: 0



ANSWER CHOICES	RESPONSES	
0	0.83%	1
1 to 5	22.50%	27
6 to 10	35.83%	43
11 to 20	22.50%	27
> 20	18.33%	22
TOTAL		120

Q4 To what domain(s) does the considered system belong? Select all options that apply.

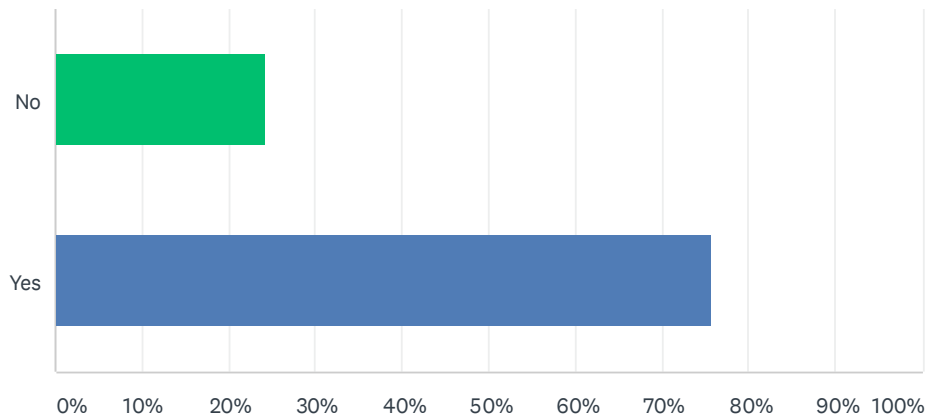
Answered: 107 Skipped: 13



ANSWER CHOICES	RESPONSES	
Automotive	41.12%	44
Avionics	28.04%	30
Consumer electronics	23.36%	25
Semiconductors	10.28%	11
Industrial automation / Manufacturing	13.08%	14
Healthcare	8.41%	9
Space	5.61%	6
Defense	13.08%	14
Other domain (please specify)	10.28%	11
Total Respondents: 107		

Q5 Is (parts of) the considered system safety-critical?

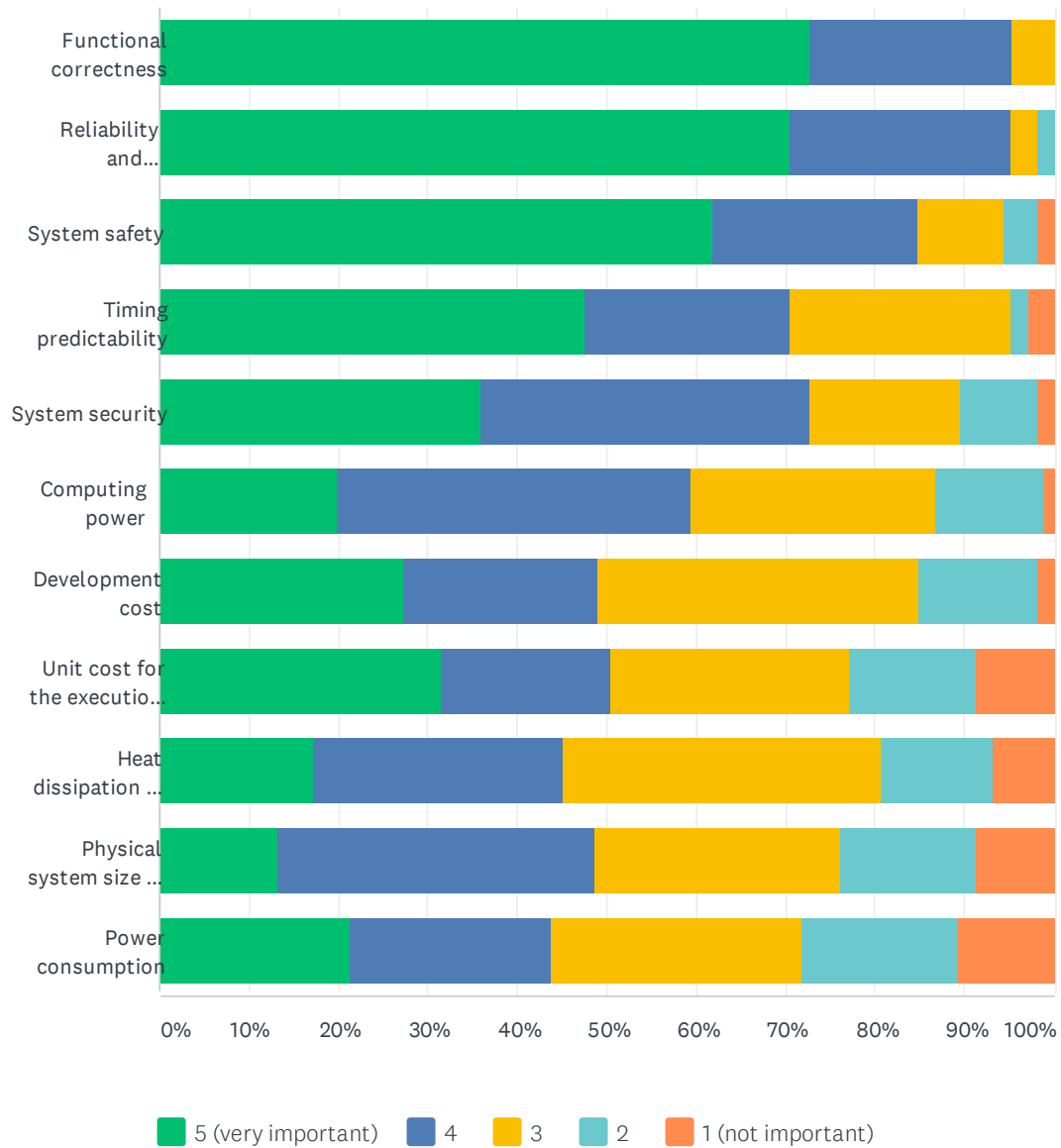
Answered: 107 Skipped: 13



ANSWER CHOICES	RESPONSES	
No	24.30%	26
Yes	75.70%	81
TOTAL		107

Q6 Give a score to the importance of different system aspects for the considered system.

Answered: 107 Skipped: 13

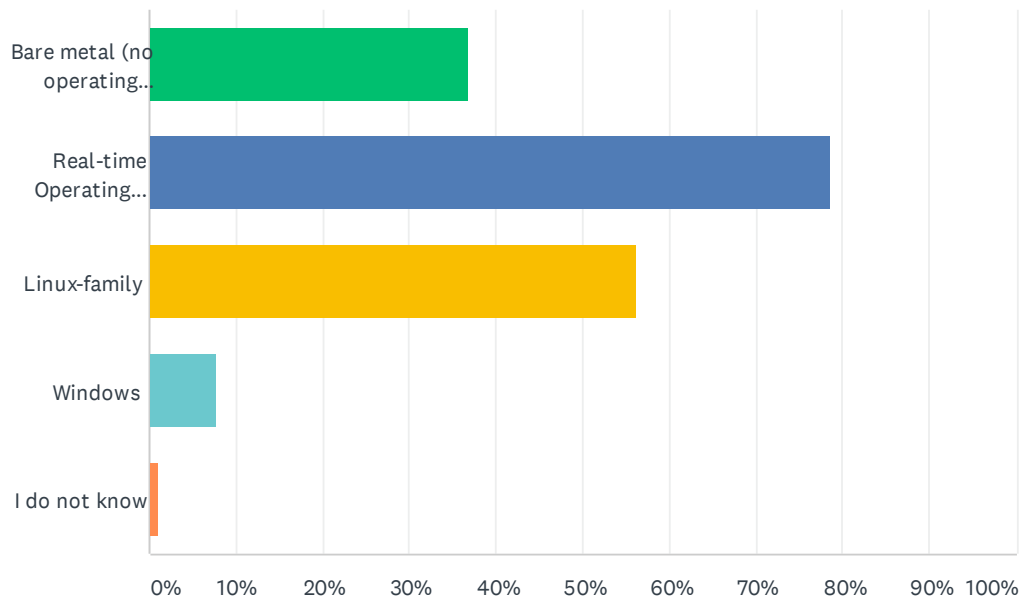


Real-time Systems Survey

	5 (VERY IMPORTANT)	4	3	2	1 (NOT IMPORTANT)	TOTAL	WEIGHTED AVERAGE
Functional correctness	72.64% 77	22.64% 24	4.72% 5	0.00% 0	0.00% 0	106	4.68
Reliability and availability	70.48% 74	24.76% 26	2.86% 3	1.90% 2	0.00% 0	105	4.64
System safety	61.90% 65	22.86% 24	9.52% 10	3.81% 4	1.90% 2	105	4.39
Timing predictability	47.62% 50	22.86% 24	24.76% 26	1.90% 2	2.86% 3	105	4.10
System security	35.85% 38	36.79% 39	16.98% 18	8.49% 9	1.89% 2	106	3.96
Computing power	19.81% 21	39.62% 42	27.36% 29	12.26% 13	0.94% 1	106	3.65
Development cost	27.36% 29	21.70% 23	35.85% 38	13.21% 14	1.89% 2	106	3.59
Unit cost for the execution platform	31.43% 33	19.05% 20	26.67% 28	14.29% 15	8.57% 9	105	3.50
Heat dissipation / thermal constraints	17.31% 18	27.88% 29	35.58% 37	12.50% 13	6.73% 7	104	3.37
Physical system size / weight	13.33% 14	35.24% 37	27.62% 29	15.24% 16	8.57% 9	105	3.30
Power consumption	21.36% 22	22.33% 23	28.16% 29	17.48% 18	10.68% 11	103	3.26

Q7 What operating systems are running on the considered system? Select all options that apply.

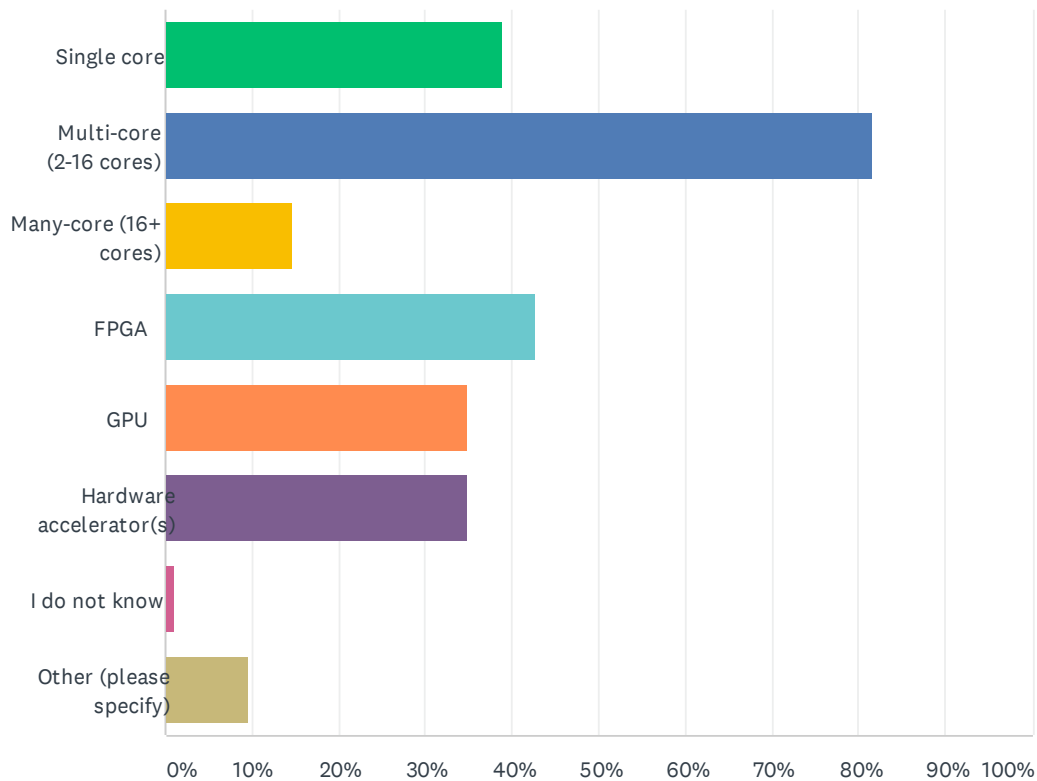
Answered: 103 Skipped: 17



ANSWER CHOICES	RESPONSES	
Bare metal (no operating system)	36.89%	38
Real-time Operating System, Micro kernel, or libraries	78.64%	81
Linux-family	56.31%	58
Windows	7.77%	8
I do not know	0.97%	1
Total Respondents: 103		

Q8 Please select the options that describe the processing hardware of the considered system. Select all options that apply.

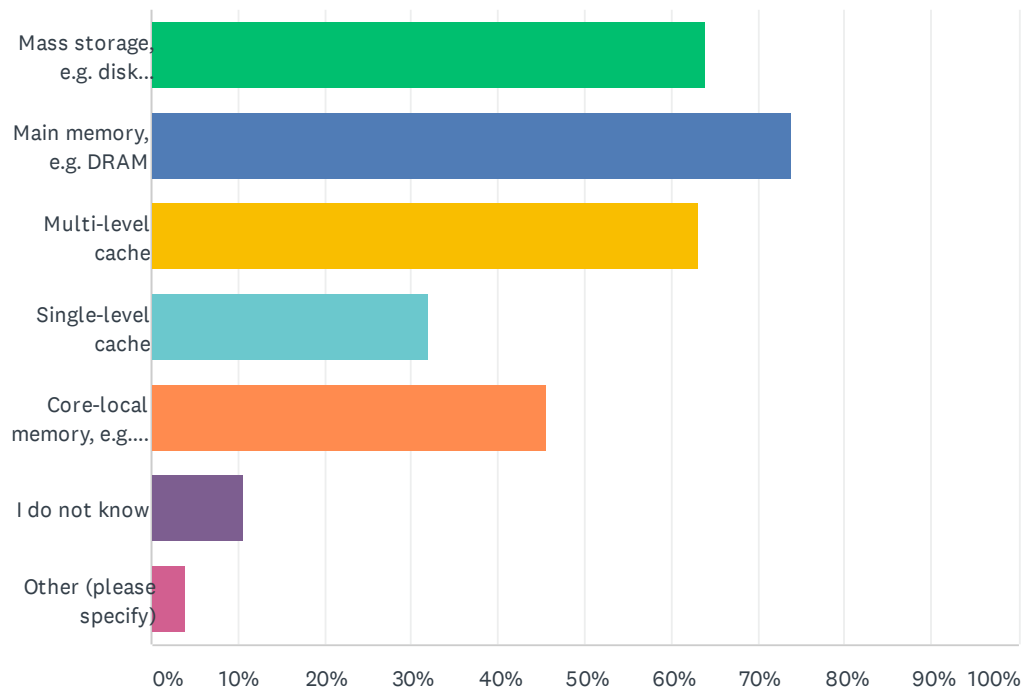
Answered: 103 Skipped: 17



ANSWER CHOICES	RESPONSES	
Single core	38.83%	40
Multi-core (2-16 cores)	81.55%	84
Many-core (16+ cores)	14.56%	15
FPGA	42.72%	44
GPU	34.95%	36
Hardware accelerator(s)	34.95%	36
I do not know	0.97%	1
Other (please specify)	9.71%	10
Total Respondents: 103		

Q9 Please select the options that describe the memory hierarchy of the considered system. Select all options that apply.

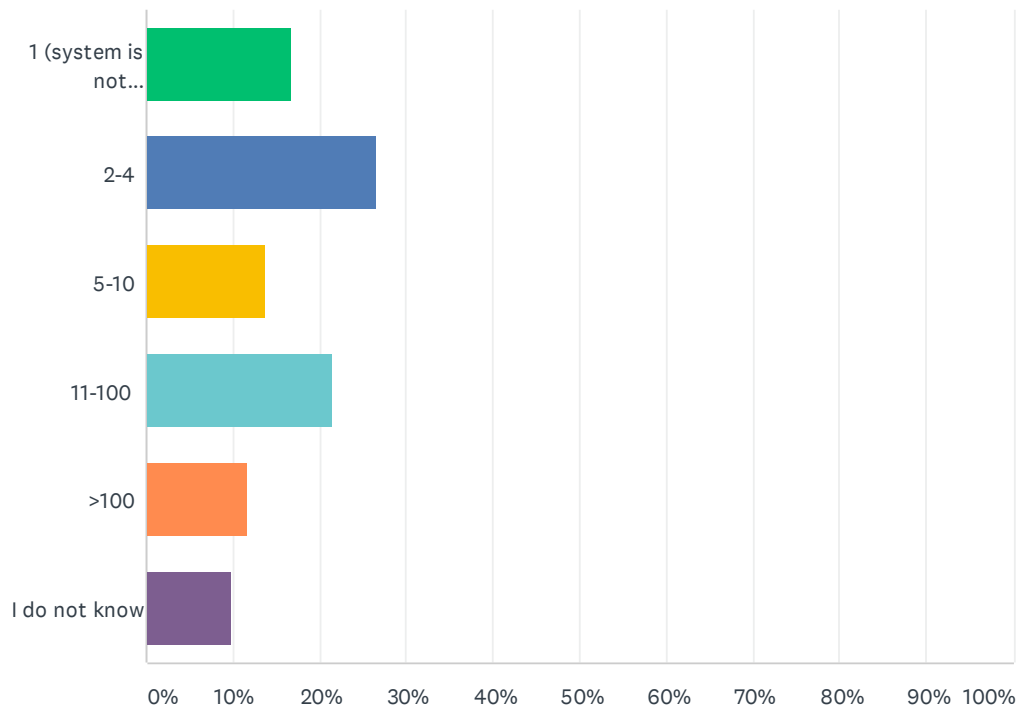
Answered: 103 Skipped: 17



ANSWER CHOICES	RESPONSES	
Mass storage, e.g. disk drive, flash	64.08%	66
Main memory, e.g. DRAM	73.79%	76
Multi-level cache	63.11%	65
Single-level cache	32.04%	33
Core-local memory, e.g. SRAM/BRAM scratchpad(s)	45.63%	47
I do not know	10.68%	11
Other (please specify)	3.88%	4
Total Respondents: 103		

Q10 How many distributed nodes (e.g. ECUs) are there in the considered system?

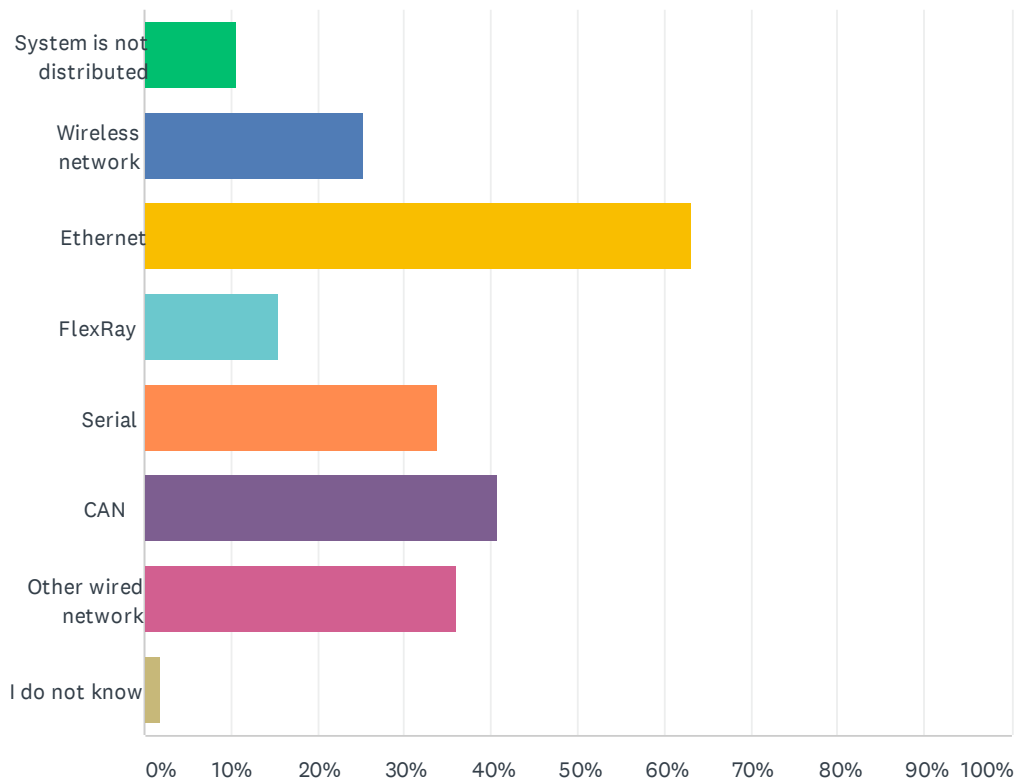
Answered: 102 Skipped: 18



ANSWER CHOICES	RESPONSES	
1 (system is not distributed)	16.67%	17
2-4	26.47%	27
5-10	13.73%	14
11-100	21.57%	22
>100	11.76%	12
I do not know	9.80%	10
TOTAL		102

Q11 Which of the following options describe the connectivity between the nodes within the (distributed) system? Select all options that apply.

Answered: 103 Skipped: 17

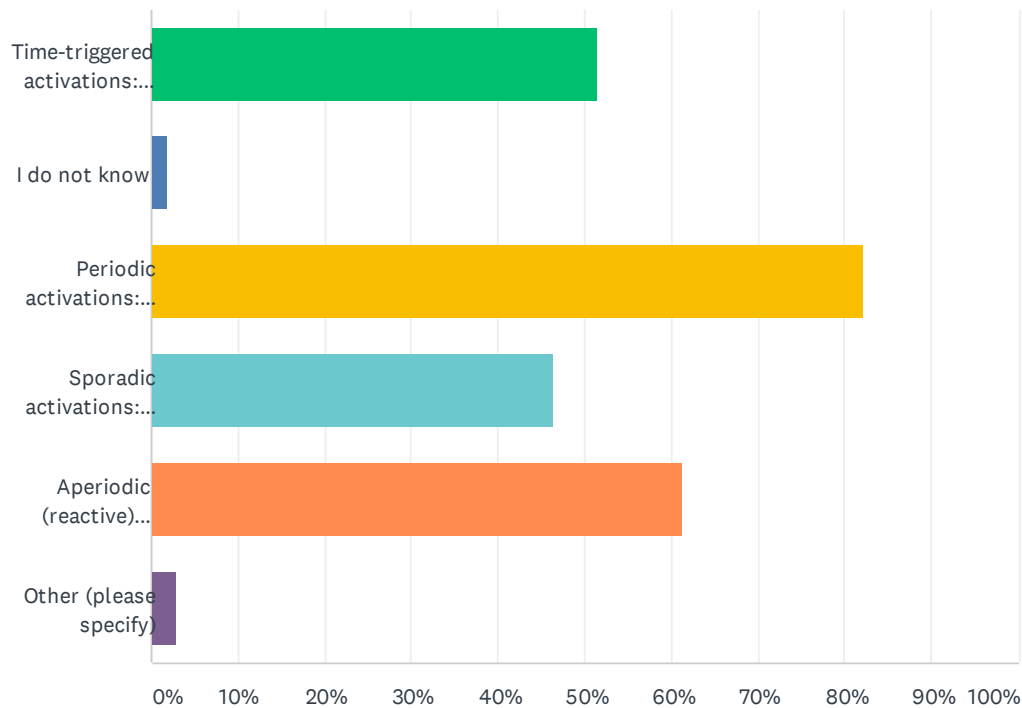


ANSWER CHOICES	RESPONSES	
System is not distributed (1)	10.68%	11
Wireless network (2)	25.24%	26
Ethernet (3)	63.11%	65
FlexRay (4)	15.53%	16
Serial (5)	33.98%	35
CAN (6)	40.78%	42
Other wired network (7)	35.92%	37
I do not know (8)	1.94%	2
Total Respondents: 103		

BASIC STATISTICS				
Minimum	Maximum	Median	Mean	Standard Deviation
1.00	8.00	4.00	4.38	1.85

Q12 Which of the following sentences are true about task activations in your system? Select all options that apply.

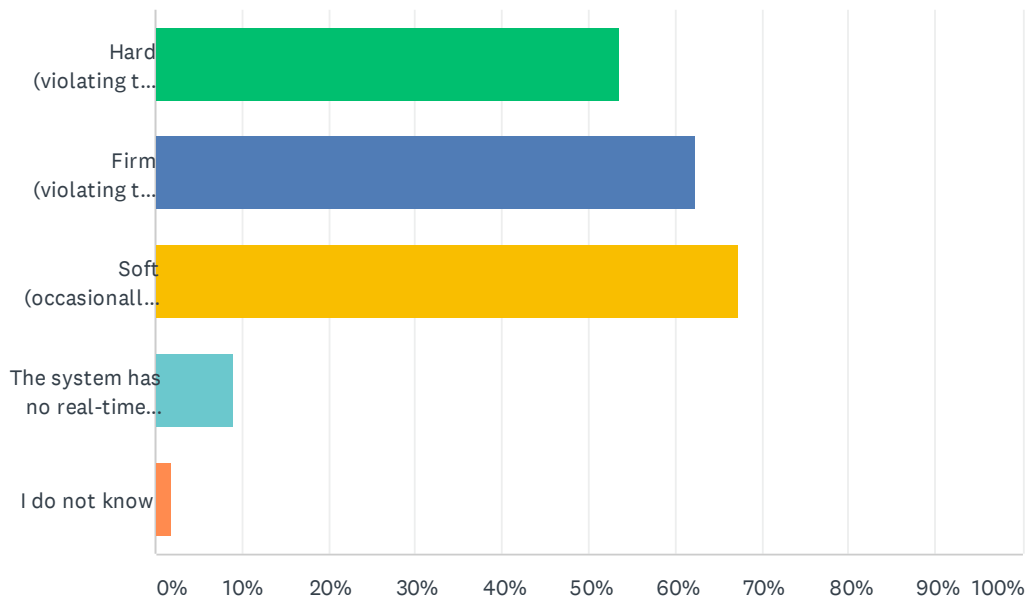
Answered: 101 Skipped: 19



ANSWER CHOICES	RESPONSES	
Time-triggered activations: Functionalities are activated at certain time instants according to a predefined time table.	51.49%	52
I do not know	1.98%	2
Periodic activations: Functionalities are activated periodically (e.g., using a timer interrupt)	82.18%	83
Sporadic activations: Functionalities may be activated at any time. However, every two activations are separated at least by a certain time interval	46.53%	47
Aperiodic (reactive) activations: Functionalities may be activated by internal or external events that may happen at any time (non-deterministic).	61.39%	62
Other (please specify)	2.97%	3
Total Respondents: 101		

Q13 Which of the following types of timing constraints exist(s) in the considered system? Select all options that apply.

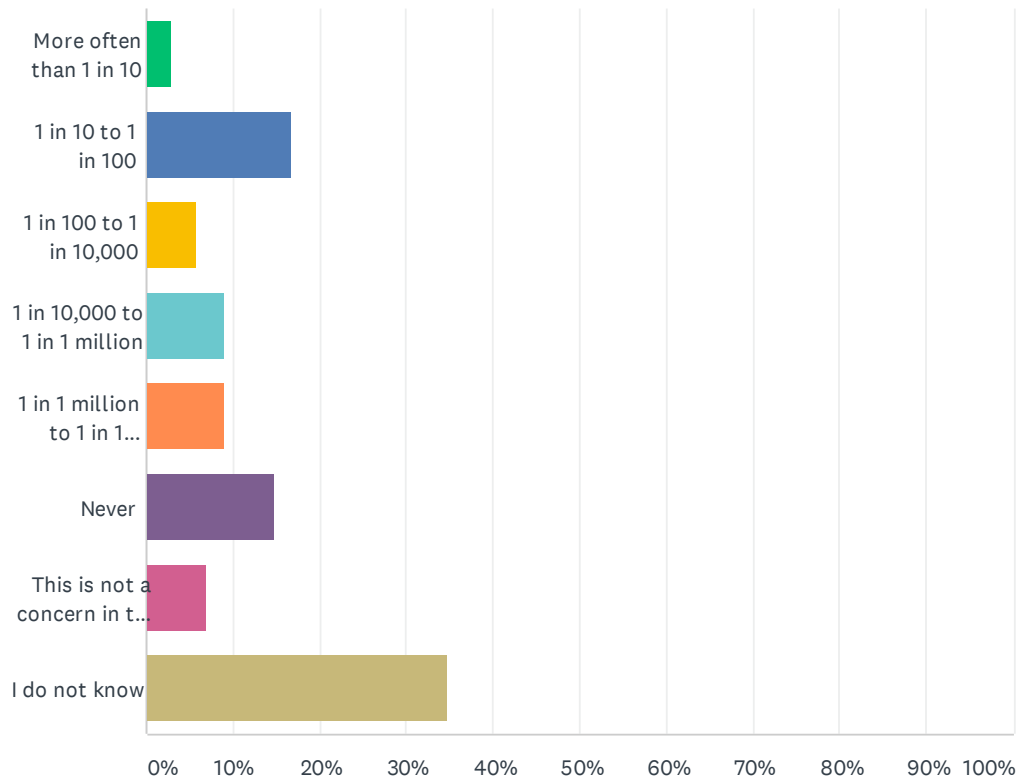
Answered: 101 Skipped: 19



ANSWER CHOICES	RESPONSES	
Hard (violating the timing constraint is considered a failure of the system)	53.47%	54
Firm (violating the timing constraint is highly undesirable)	62.38%	63
Soft (occasionally violating the timing constraint is acceptable, but it negatively impacts the perceived quality of the system)	67.33%	68
The system has no real-time constraints	8.91%	9
I do not know	1.98%	2
Total Respondents: 101		

Q14 For the most time-critical functions in the considered system, roughly how frequently can the deadline of a function be missed without causing a system failure?

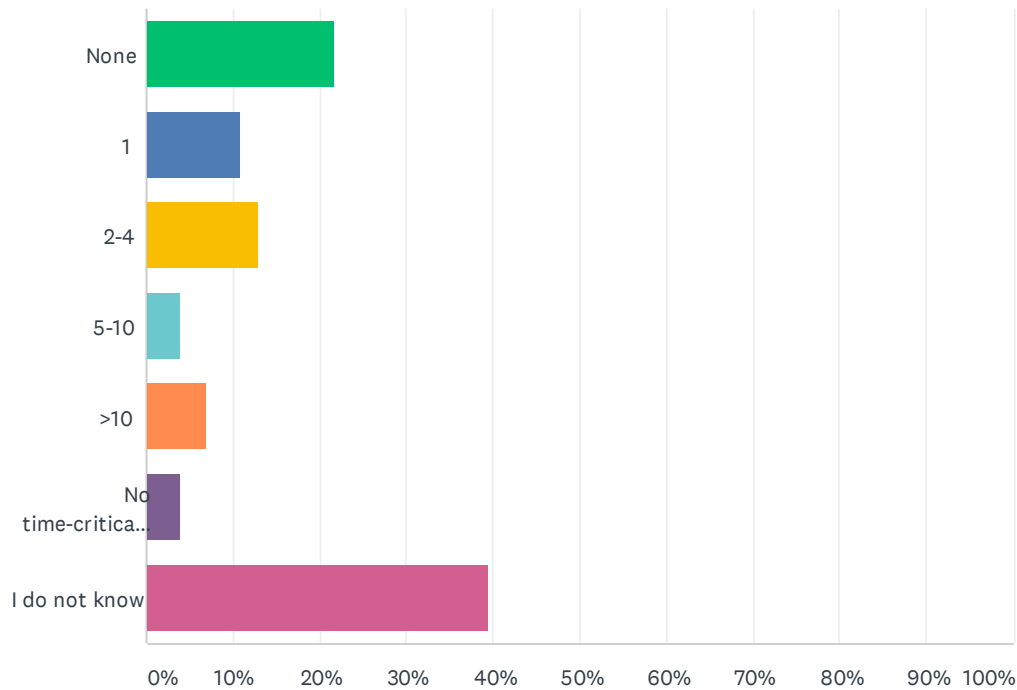
Answered: 101 Skipped: 19



ANSWER CHOICES	RESPONSES	
More often than 1 in 10	2.97%	3
1 in 10 to 1 in 100	16.83%	17
1 in 100 to 1 in 10,000	5.94%	6
1 in 10,000 to 1 in 1 million	8.91%	9
1 in 1 million to 1 in 1 billion	8.91%	9
Never	14.85%	15
This is not a concern in the system	6.93%	7
I do not know	34.65%	35
TOTAL		101

Q15 What is the largest number of consecutive deadline misses that could be tolerated by the most time-critical functions in the system, assuming that such a blackout does not reoccur for a very long time?

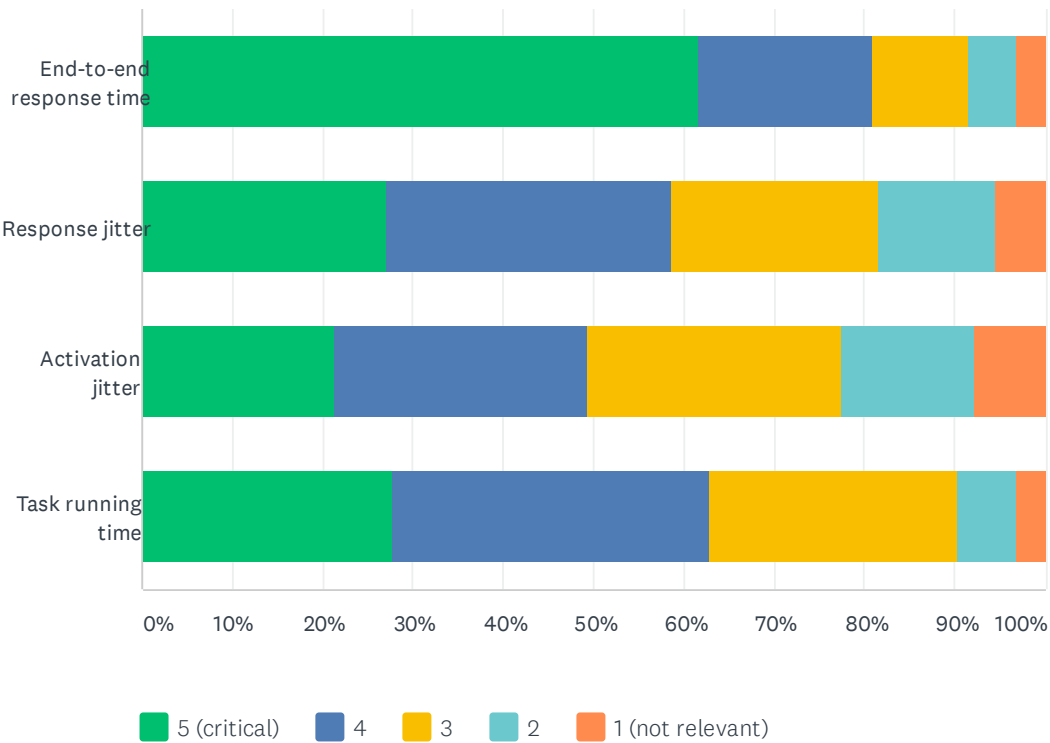
Answered: 101 Skipped: 19



ANSWER CHOICES	RESPONSES	
None	21.78%	22
1	10.89%	11
2-4	12.87%	13
5-10	3.96%	4
>10	6.93%	7
No time-critical functionality present	3.96%	4
I do not know	39.60%	40
TOTAL		101

Q16 What are relevant timing constraints in the considered system?

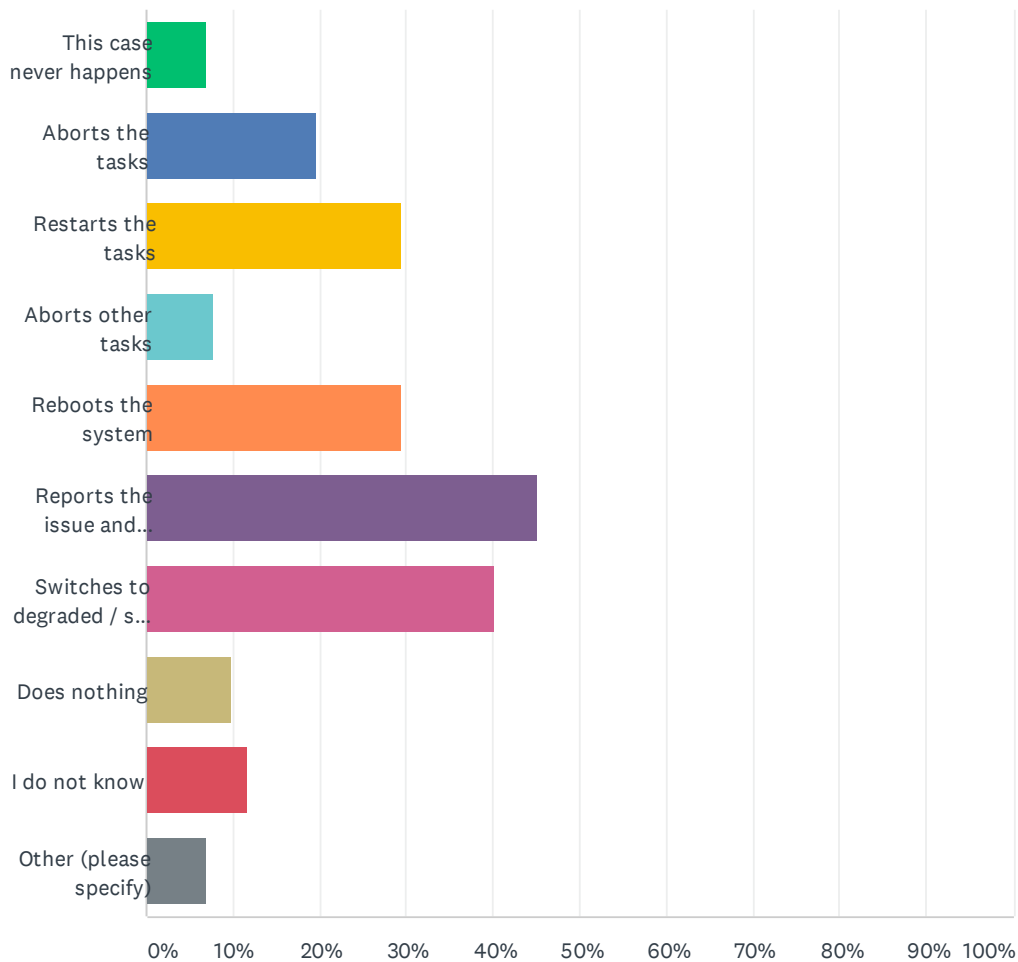
Answered: 99 Skipped: 21



	5 (CRITICAL)	4	3	2	1 (NOT RELEVANT)	TOTAL	WEIGHTED AVERAGE
End-to-end response time	61.70% 58	19.15% 18	10.64% 10	5.32% 5	3.19% 3	94	4.31
Response jitter	27.17% 25	31.52% 29	22.83% 21	13.04% 12	5.43% 5	92	3.62
Activation jitter	21.35% 19	28.09% 25	28.09% 25	14.61% 13	7.87% 7	89	3.40
Task running time	27.66% 26	35.11% 33	27.66% 26	6.38% 6	3.19% 3	94	3.78

Q17 How does the considered system react if tasks miss deadlines? Select all options that apply.

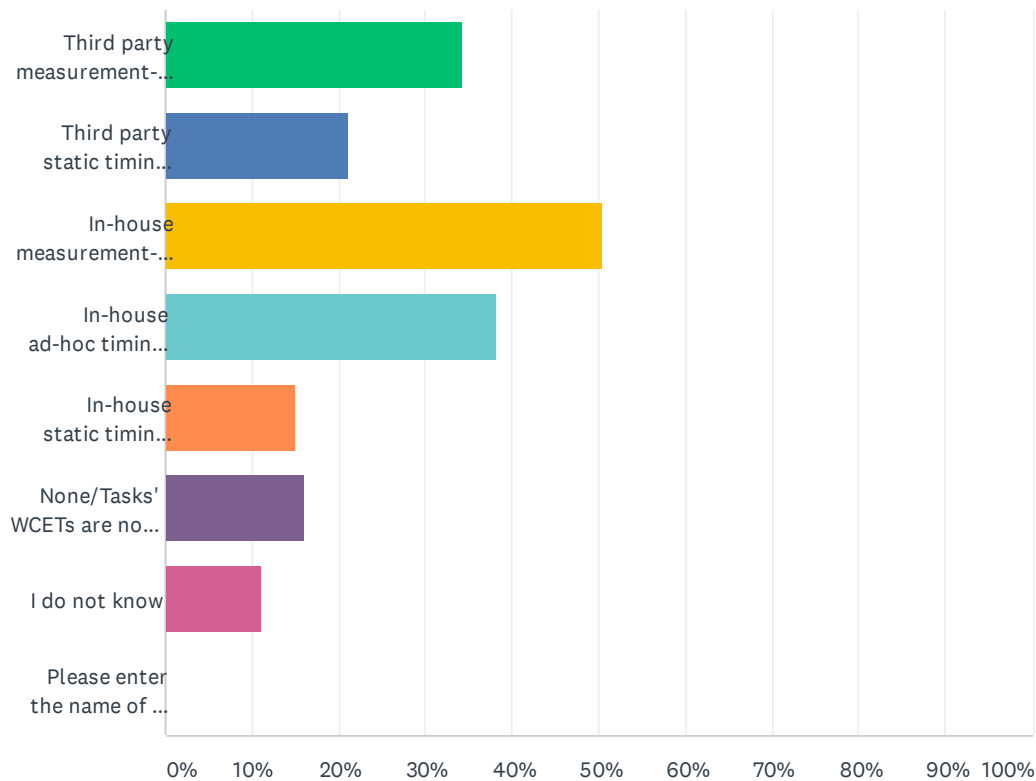
Answered: 102 Skipped: 18



ANSWER CHOICES	RESPONSES	
This case never happens	6.86%	7
Aborts the tasks	19.61%	20
Restarts the tasks	29.41%	30
Aborts other tasks	7.84%	8
Reboots the system	29.41%	30
Reports the issue and continues	45.10%	46
Switches to degraded / safe mode	40.20%	41
Does nothing	9.80%	10
I do not know	11.76%	12
Other (please specify)	6.86%	7
Total Respondents: 102		

Q18 Which methods are used for Worst-Case Execution Time (WCET) estimation in the considered system? Select all options that apply.

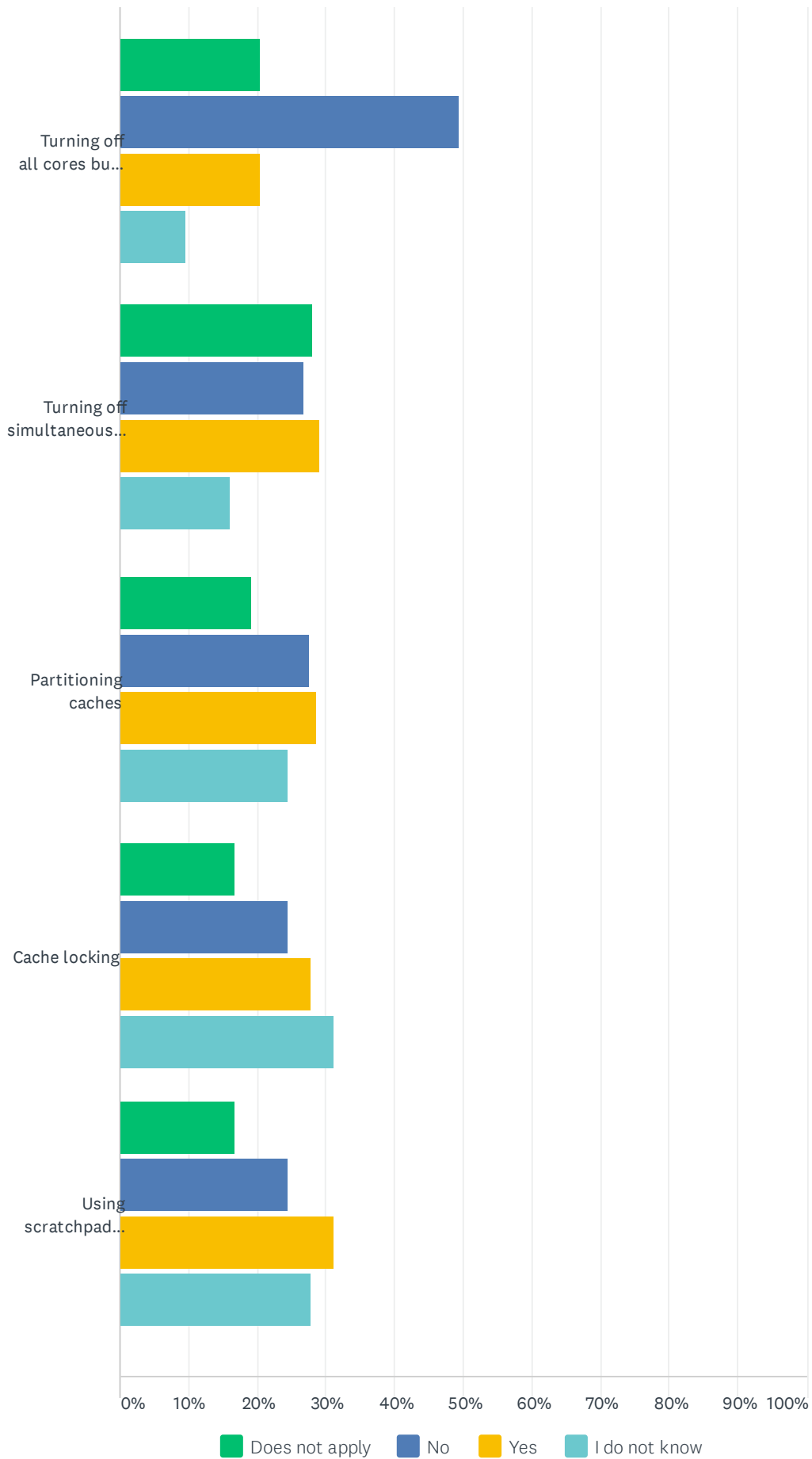
Answered: 99 Skipped: 21



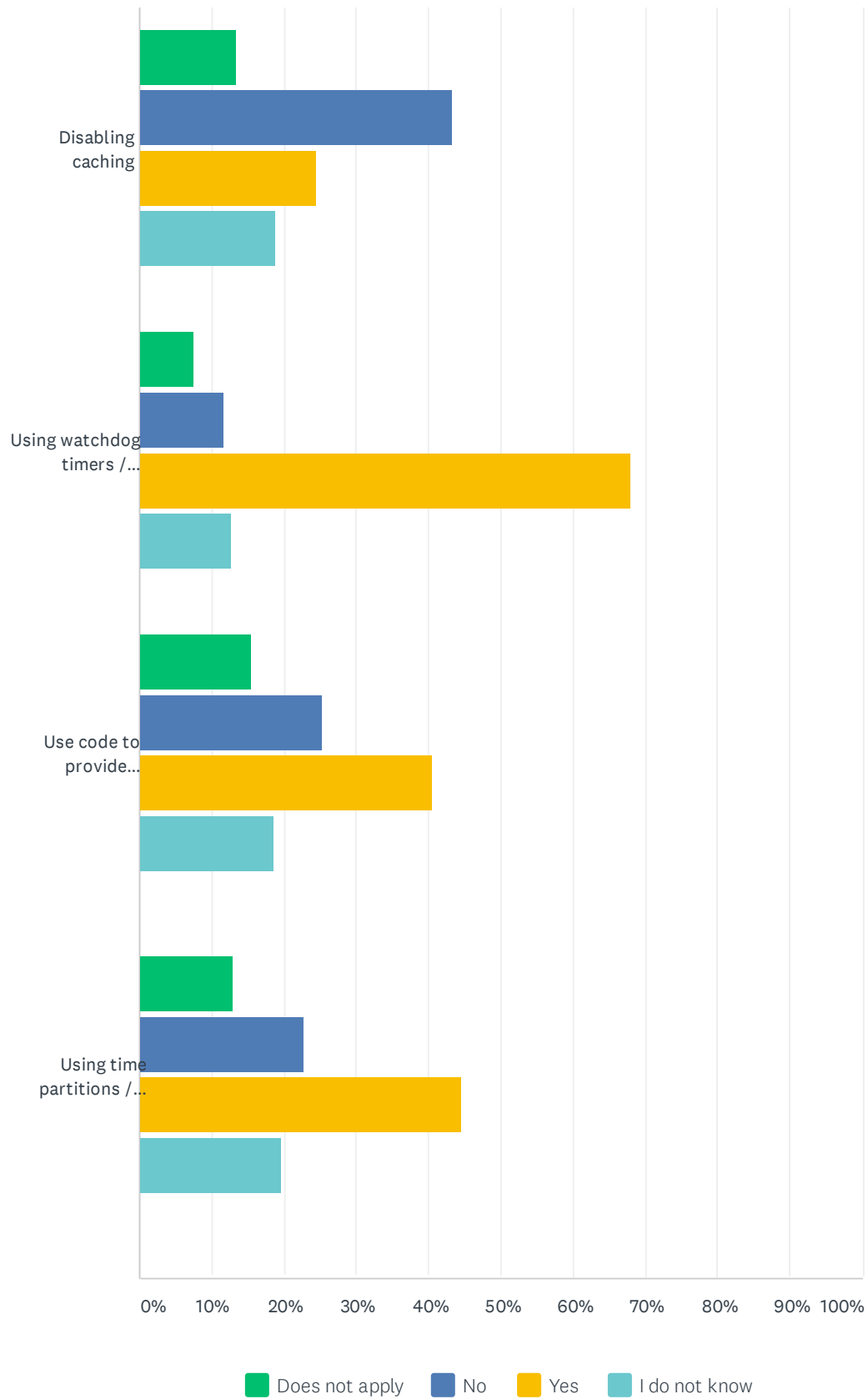
ANSWER CHOICES	RESPONSES	
Third party measurement-based timing analysis tool	34.34%	34
Third party static timing analysis tools	21.21%	21
In-house measurement-based timing analysis tool	50.51%	50
In-house ad-hoc timing measurements	38.38%	38
In-house static timing analysis tool	15.15%	15
None/Tasks' WCETs are not estimated	16.16%	16
I do not know	11.11%	11
Please enter the name of the used WCET estimation tool, if any	0.00%	0
Total Respondents: 99		

Q19 What steps are taken to help increase timing predictability?

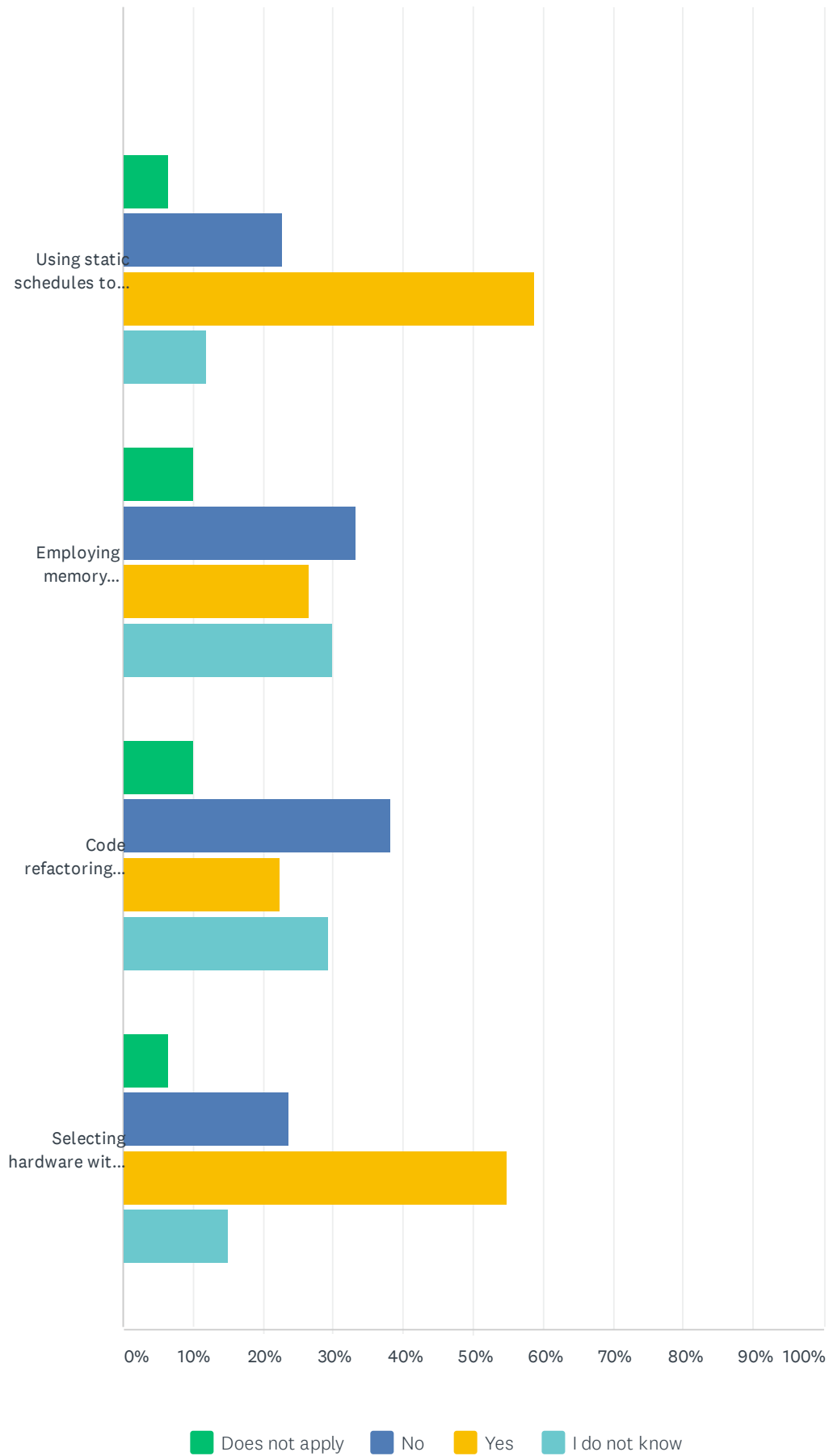
Answered: 97 Skipped: 23



Real-time Systems Survey



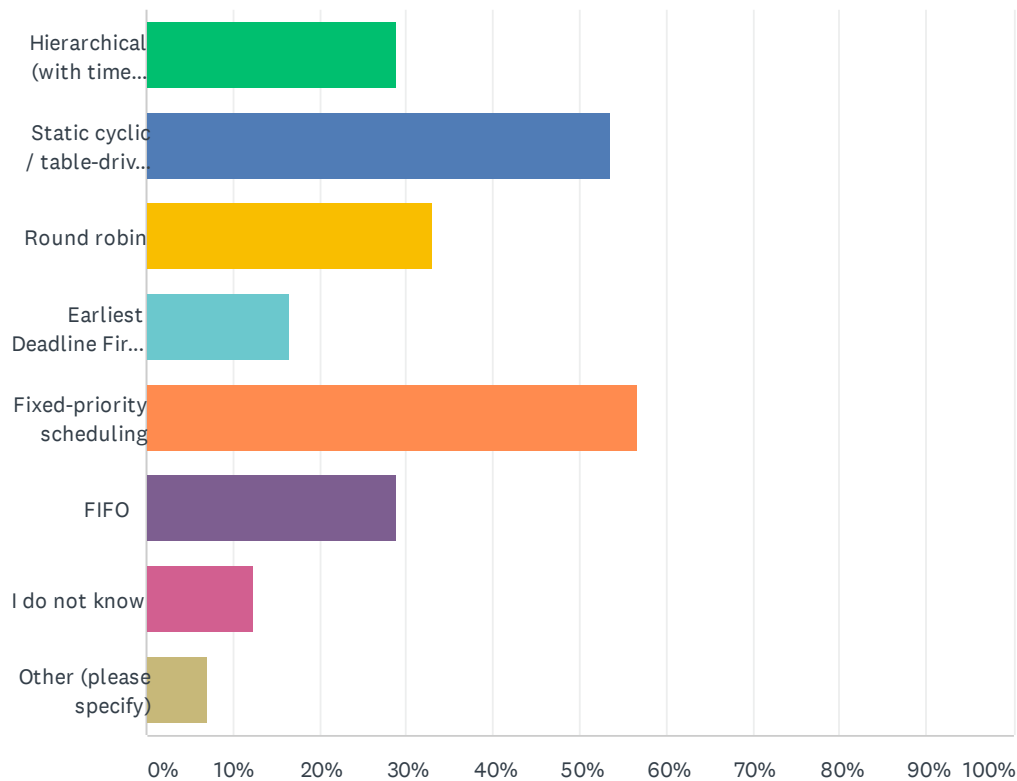
Real-time Systems Survey



	DOES NOT APPLY	NO	YES	I DO NOT KNOW	TOTAL
Turning off all cores but one	20.43% 19	49.46% 46	20.43% 19	9.68% 9	93
Turning off simultaneous multi-threading (e.g. Hyperthreading)	27.96% 26	26.88% 25	29.03% 27	16.13% 15	93
Partitioning caches	19.15% 18	27.66% 26	28.72% 27	24.47% 23	94
Cache locking	16.67% 15	24.44% 22	27.78% 25	31.11% 28	90
Using scratchpad memory instead of caches	16.67% 15	24.44% 22	31.11% 28	27.78% 25	90
Disabling caching	13.33% 12	43.33% 39	24.44% 22	18.89% 17	90
Using watchdog timers / runtime monitors	7.45% 7	11.70% 11	68.09% 64	12.77% 12	94
Use code to provide degraded, but usable, outputs in the event of overruns	15.38% 14	25.27% 23	40.66% 37	18.68% 17	91
Using time partitions / reservations / servers	13.04% 12	22.83% 21	44.57% 41	19.57% 18	92
Using static schedules to control execution	6.52% 6	22.83% 21	58.70% 54	11.96% 11	92
Employing memory bandwidth regulation	10.00% 9	33.33% 30	26.67% 24	30.00% 27	90
Code refactoring into separate memory access phases and computation phases	10.11% 9	38.20% 34	22.47% 20	29.21% 26	89
Selecting hardware with better time-predictability	6.45% 6	23.66% 22	54.84% 51	15.05% 14	93

Q20 Which task scheduling policy/policies are used in the considered system? Select all options that apply.

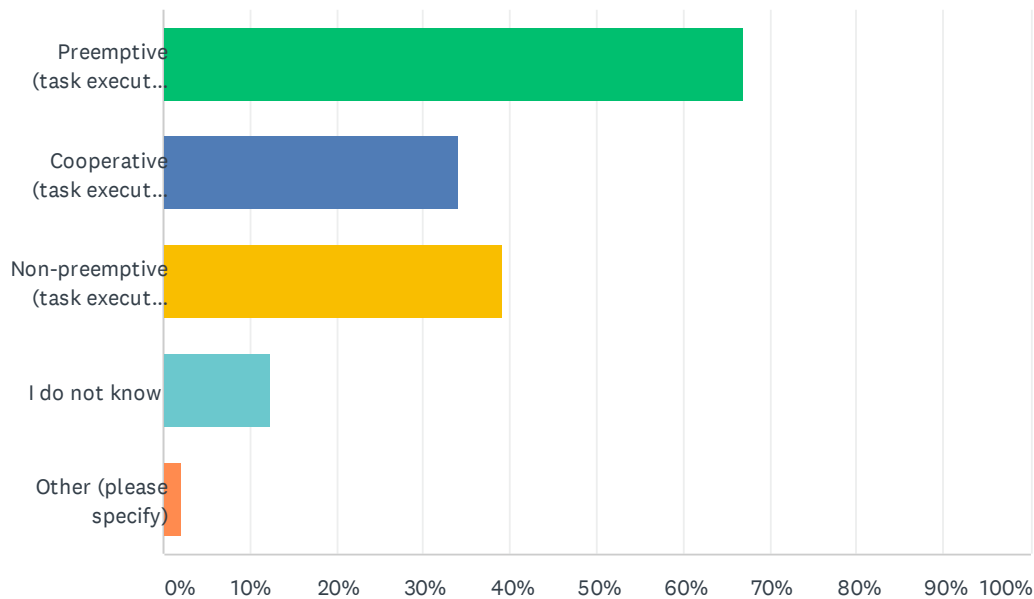
Answered: 97 Skipped: 23



ANSWER CHOICES	RESPONSES	
Hierarchical (with time partitions or reservations)	28.87%	28
Static cyclic / table-driven / time-triggered scheduling	53.61%	52
Round robin	32.99%	32
Earliest Deadline First (EDF)	16.49%	16
Fixed-priority scheduling	56.70%	55
FIFO	28.87%	28
I do not know	12.37%	12
Other (please specify)	7.22%	7
Total Respondents: 97		

Q21 Please indicate the types of preemption that are supported in the considered system. Select all options that apply.

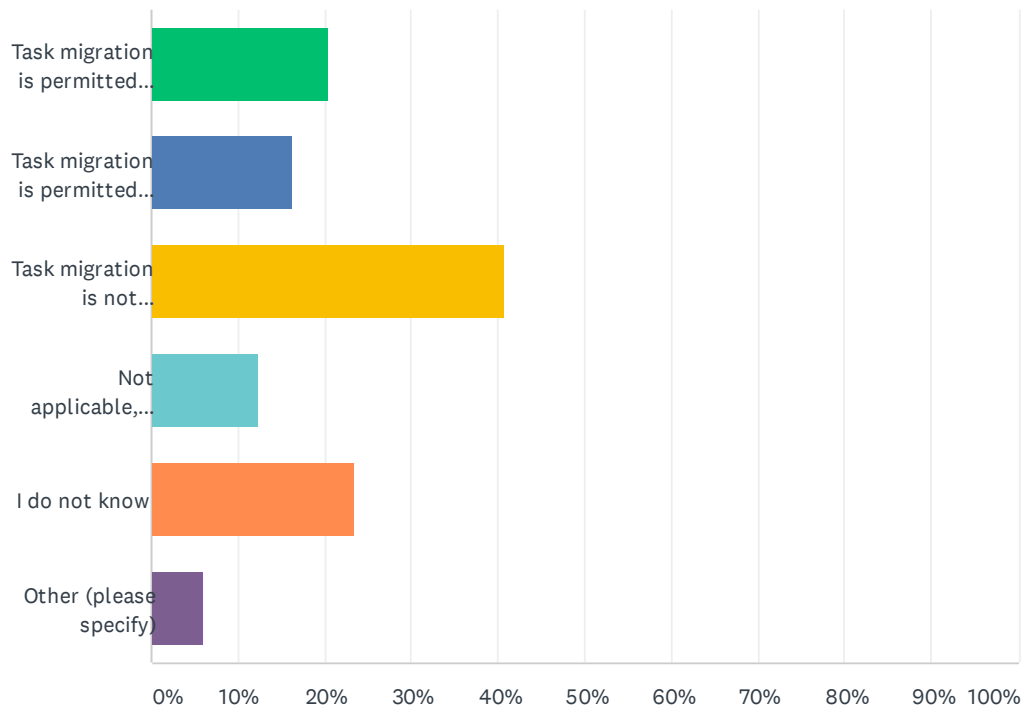
Answered: 97 Skipped: 23



ANSWER CHOICES	RESPONSES	
Preemptive (task execution can be preempted by other tasks at any time)	67.01%	65
Cooperative (task execution can be preempted by other tasks, but only at predefined preemption points)	34.02%	33
Non-preemptive (task execution cannot be preempted by other tasks before completion)	39.18%	38
I do not know	12.37%	12
Other (please specify)	2.06%	2
Total Respondents: 97		

Q22 Please indicate how task migration can take place between different cores in the considered system. Select all options that apply.

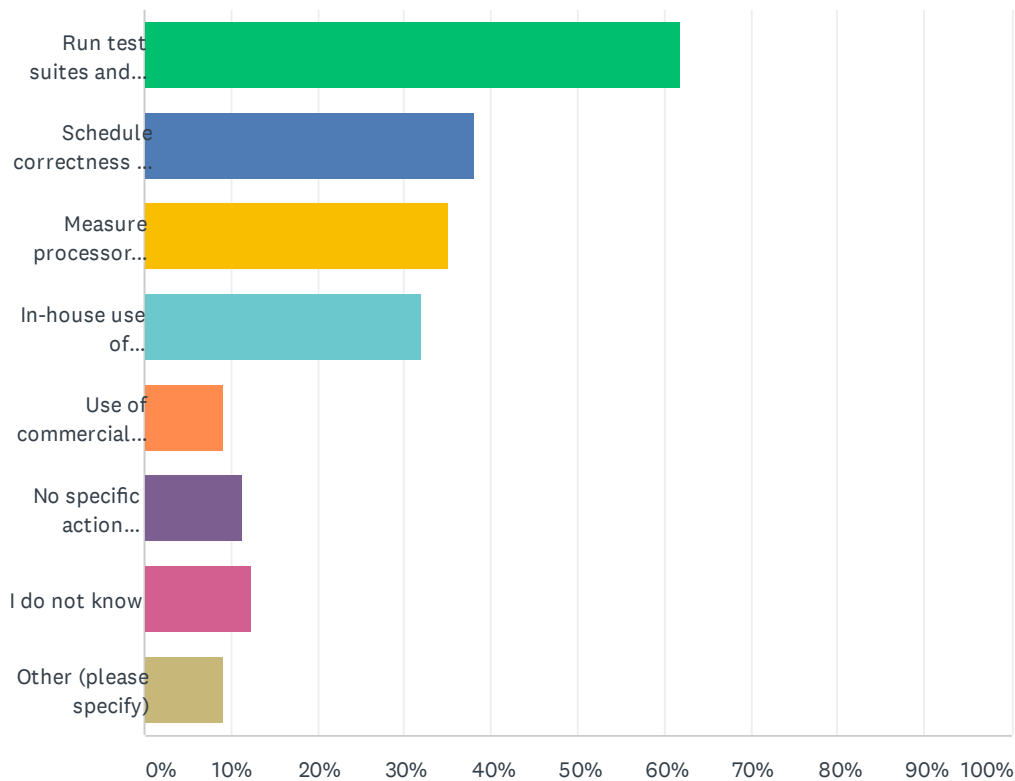
Answered: 98 Skipped: 22



ANSWER CHOICES	RESPONSES	
Task migration is permitted while the task is executing	20.41%	20
Task migration is permitted between two invocations of the function	16.33%	16
Task migration is not permitted	40.82%	40
Not applicable, single core system	12.24%	12
I do not know	23.47%	23
Other (please specify)	6.12%	6
Total Respondents: 98		

Q23 How do you ensure that the functions in the considered system respect their deadlines? Select all options that apply.

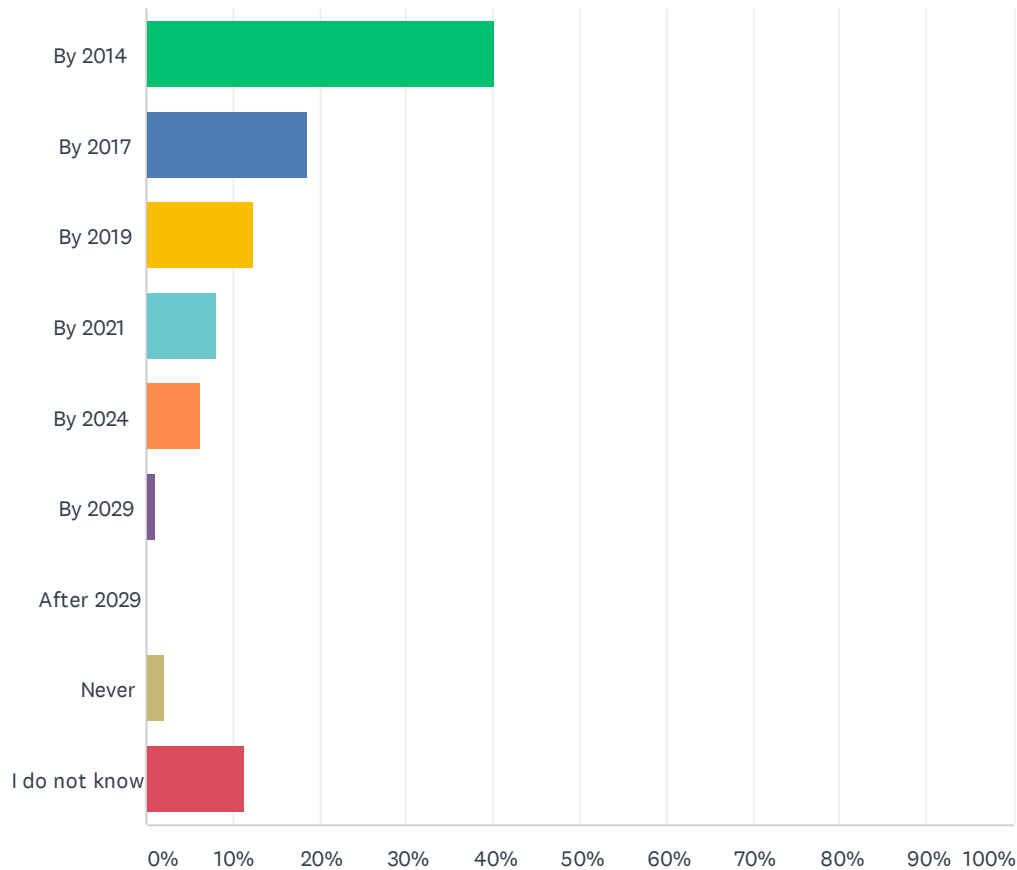
Answered: 97 Skipped: 23



ANSWER CHOICES	RESPONSES	
Run test suites and check for any overruns	61.86%	60
Schedule correctness is by construction. With a static schedule, provided execution time budgets hold for each software component / task, no deadlines will be missed.	38.14%	37
Measure processor utilization and ensure it is always below a predefined threshold, e.g. 50%	35.05%	34
In-house use of schedulability analysis	31.96%	31
Use of commercial schedulability analysis tools	9.28%	9
No specific action undertaken	11.34%	11
I do not know	12.37%	12
Other (please specify)	9.28%	9
Total Respondents: 97		

Q24 By which year did or do you expect development projects for real-time embedded systems in your department to begin using multi-core embedded processors (i.e. processors with 2 to 16 cores)?

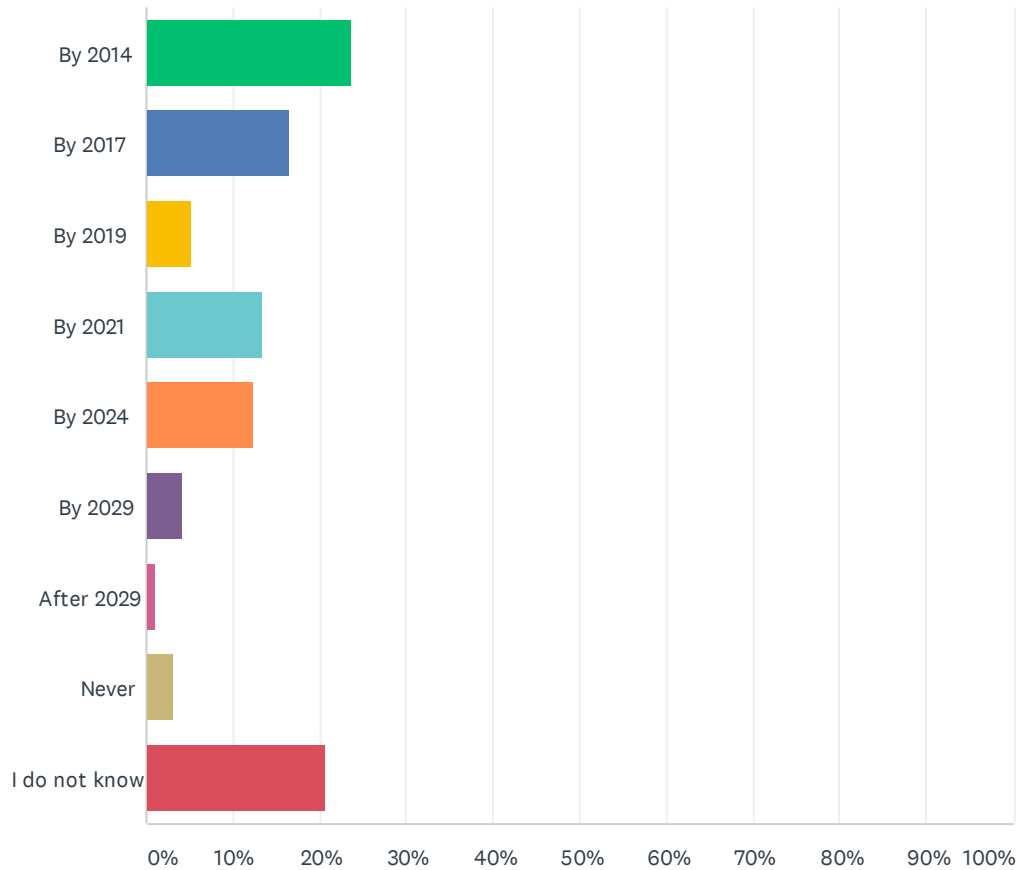
Answered: 97 Skipped: 23



ANSWER CHOICES	RESPONSES	
By 2014	40.21%	39
By 2017	18.56%	18
By 2019	12.37%	12
By 2021	8.25%	8
By 2024	6.19%	6
By 2029	1.03%	1
After 2029	0.00%	0
Never	2.06%	2
I do not know	11.34%	11
TOTAL		97

Q25 By which year did or do you expect development projects for real-time embedded systems in your department to begin using heterogeneous multi-cores with different types of CPUs, GPUs, and other accelerators?

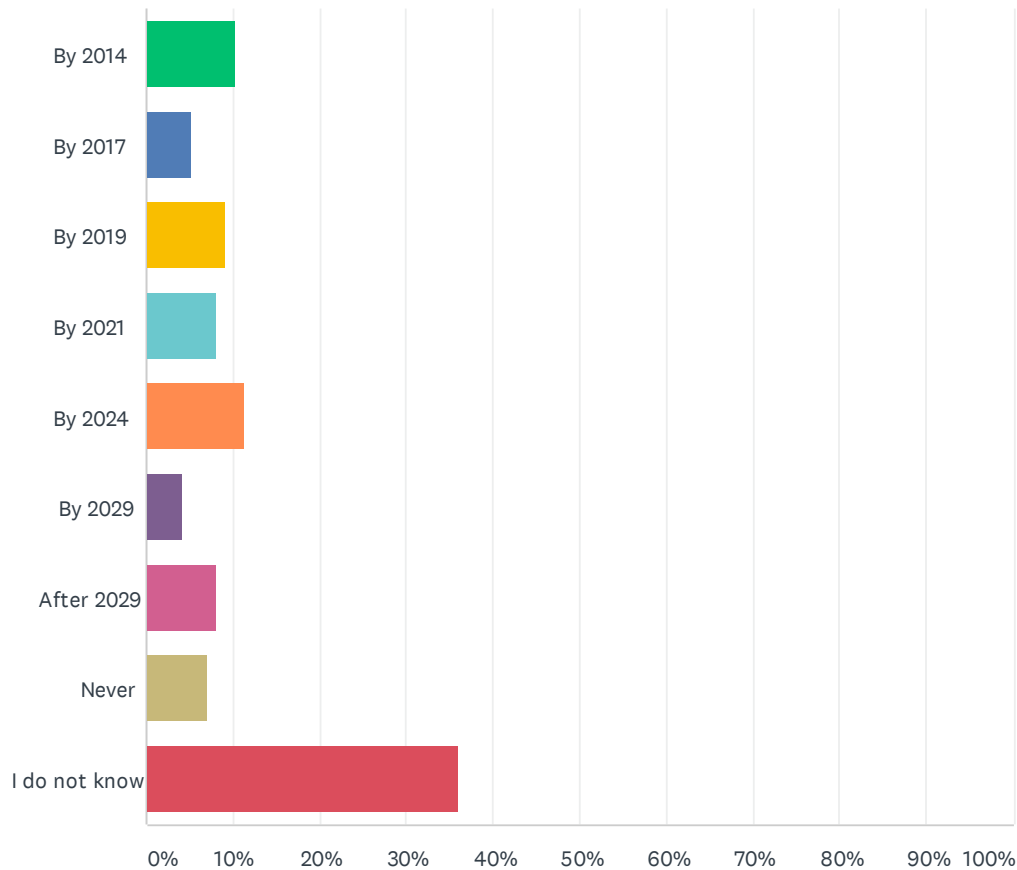
Answered: 97 Skipped: 23



ANSWER CHOICES	RESPONSES	
By 2014	23.71%	23
By 2017	16.49%	16
By 2019	5.15%	5
By 2021	13.40%	13
By 2024	12.37%	12
By 2029	4.12%	4
After 2029	1.03%	1
Never	3.09%	3
I do not know	20.62%	20
TOTAL		97

Q26 By which year did or do you expect development projects for real-time embedded systems in your department to begin using many-core embedded processors (i.e. processors with more than 16 cores)?

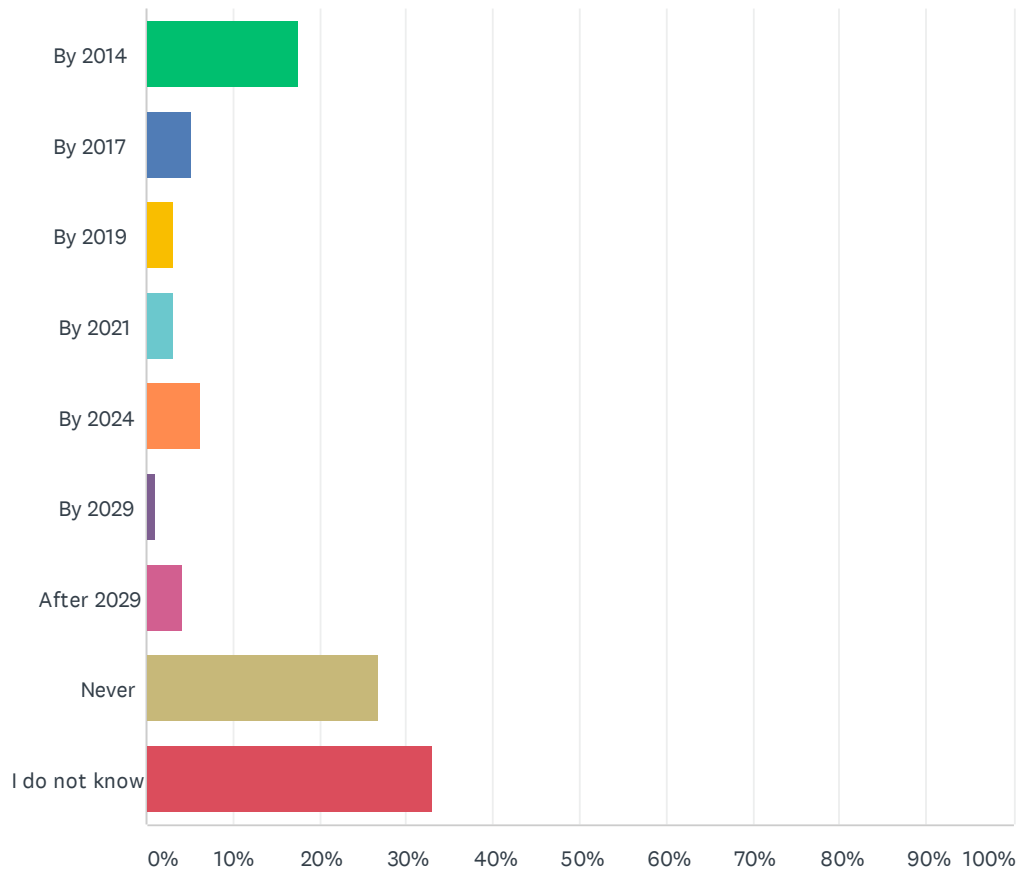
Answered: 97 Skipped: 23



ANSWER CHOICES	RESPONSES	
By 2014	10.31%	10
By 2017	5.15%	5
By 2019	9.28%	9
By 2021	8.25%	8
By 2024	11.34%	11
By 2029	4.12%	4
After 2029	8.25%	8
Never	7.22%	7
I do not know	36.08%	35
TOTAL		97

Q27 By which year did or do you expect development projects for real-time embedded systems in your department to stop using single-core embedded processors (i.e. processors with 1 core)?

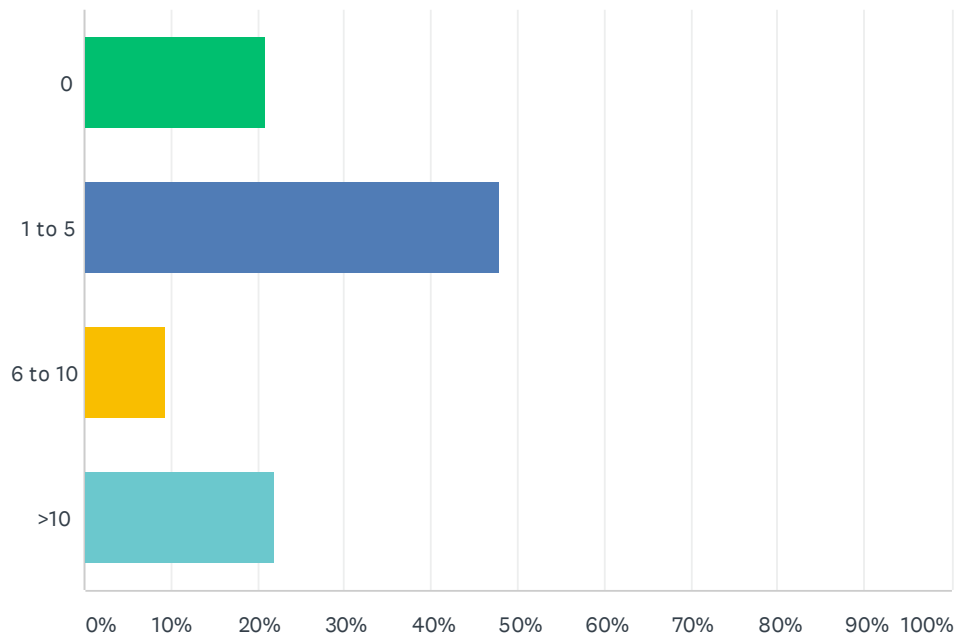
Answered: 97 Skipped: 23



ANSWER CHOICES	RESPONSES	
By 2014	17.53%	17
By 2017	5.15%	5
By 2019	3.09%	3
By 2021	3.09%	3
By 2024	6.19%	6
By 2029	1.03%	1
After 2029	4.12%	4
Never	26.80%	26
I do not know	32.99%	32
TOTAL		97

Q28 How many research publications (e.g. conference or journal papers) in the real-time systems field have you read in the last year?

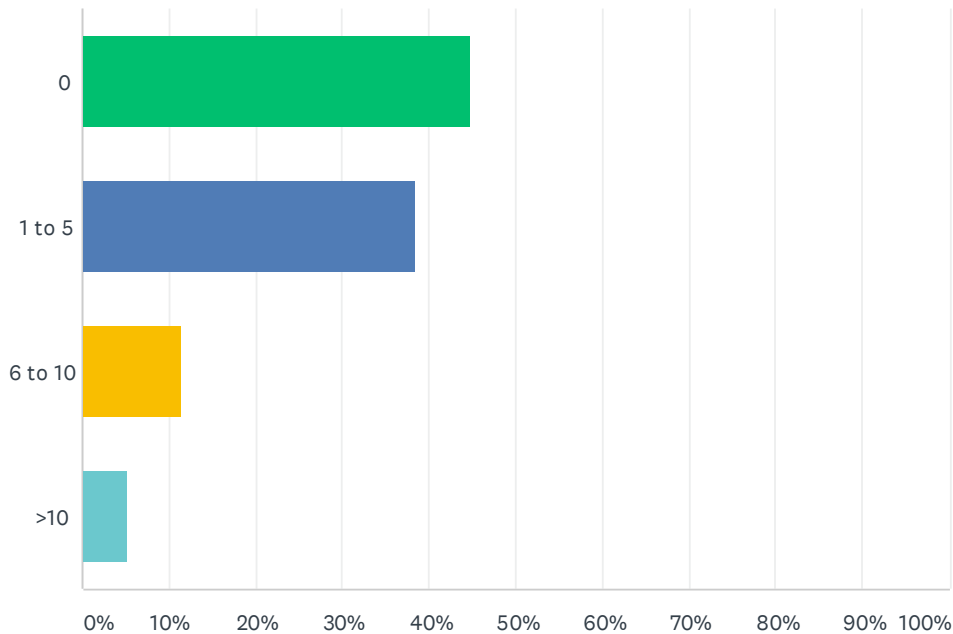
Answered: 96 Skipped: 24



ANSWER CHOICES	RESPONSES	
0	20.83%	20
1 to 5	47.92%	46
6 to 10	9.38%	9
>10	21.88%	21
TOTAL		96

Q29 How many real-time systems research publications (e.g. conference or journal papers) have you published as a (co-)author in the last 5 years?

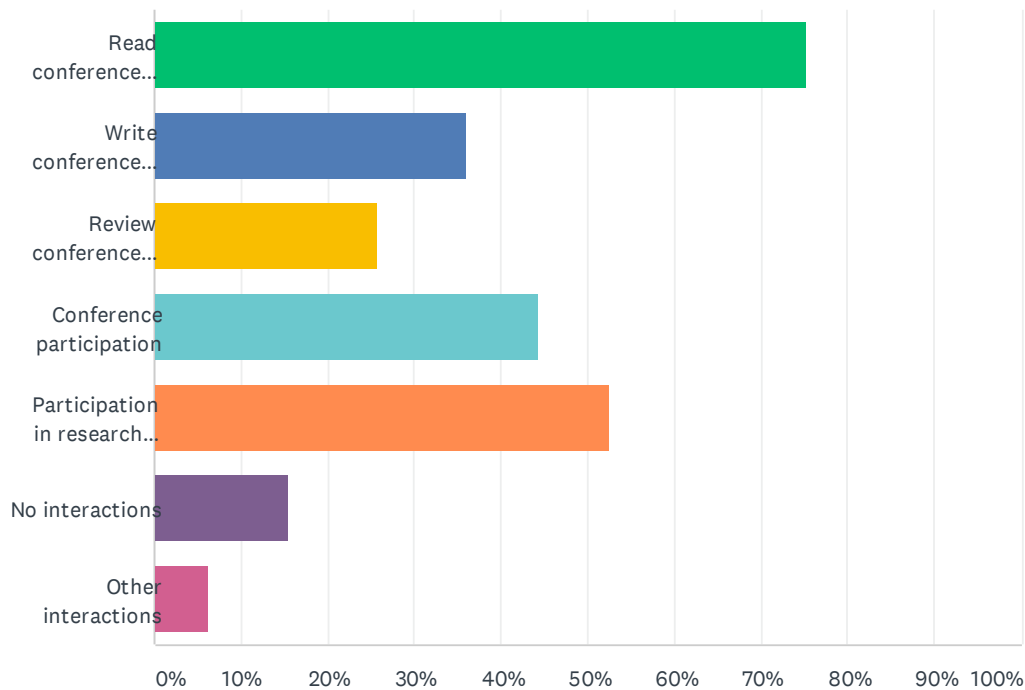
Answered: 96 Skipped: 24



ANSWER CHOICES	RESPONSES	
0	44.79%	43
1 to 5	38.54%	37
6 to 10	11.46%	11
>10	5.21%	5
TOTAL		96

Q30 How do you interact with the real-time research community? Select all options that apply.

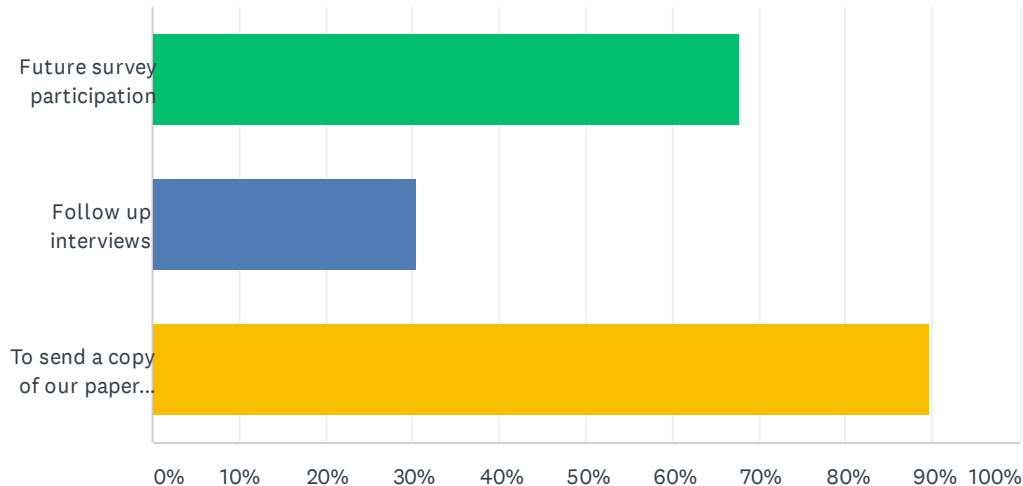
Answered: 97 Skipped: 23



ANSWER CHOICES	RESPONSES	
Read conference papers and journal articles	75.26%	73
Write conference papers and journal articles	36.08%	35
Review conference papers and journal articles	25.77%	25
Conference participation	44.33%	43
Participation in research projects with academics	52.58%	51
No interactions	15.46%	15
Other interactions	6.19%	6
Total Respondents: 97		

Q31 Please indicate the purposes for which we may contact you again, if any. If we may contact you again, but you do not want your e-mail address to identify your responses in the survey, you can instead e-mail your preferences to benny.akesson@tno.nl . We will not share or use your e-mail for any other purposes.

Answered: 59 Skipped: 61



ANSWER CHOICES	RESPONSES	
Future survey participation	67.80%	40
Follow up interviews	30.51%	18
To send a copy of our paper when it is published	89.83%	53
Total Respondents: 59		

Q32 Please enter any feedback or remarks on this survey.

Answered: 23 Skipped: 97