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DesignNews

How to Select the Right Microcontrollers for an Application

DAY 2 : MCU Selection Criteria

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Course Sessions

- The Microcontroller Industry Today
- **MCU Selection Criteria**
- The Modern MCU Selection Process
- Microcontroller Selection Use Cases
- Microcontroller Selection Best Practices

1

The KT Matrix

Unbiased decision making . . .

KT Matrix

The **Kepner Tregoe (KT) Matrix** is a step-by-step approach for systematically solving problems, making decisions, and analyzing potential risks.

- Situation appraisal
- Problem Analysis
- Decision Analysis
- Potential Problem Analysis

KT Matrixes limit conscious and unconscious **biases** that tend to steer a decision away from its primary objectives.

Example KT Matrix for Selecting an RTOS

			RTOS #1						RTOS #2						RTOS #3					
	Criteria	Weight	Rating 1	Rating 2	Rating 3	Rating 4	Rating 5	Weighted Rating Total	Rating 1	Rating 2	Rating 3	Rating 4	Rating 5	Weighted Rating Total	Rating 1	Rating 2	Rating 3	Rating 4	Rating 5	Weighted Rating Total
Performance	Smallest RAM footprint	4	3	3	3	3	3	60	2	2	2	2	2	40	1	1	1	1	1	20
	Smallest ROM footprint	4	2	2	2	2	2	40	1	1	1	1	1	20	3	3	3	3	3	60
	Highest degree of determinism	5	2	1	1	1	2	35	1	2	2	2	1	40	3	3	3	3	3	75
	Best meets reliability requirements	5	1	2	2	1	1	35	3	1	1	3	2	50	2	3	3	2	3	65
	Minimal context switch times	5	1	1	1	1	1	25	2	2	2	2	2	50	3	3	3	3	3	75
	Minimal interrupt latency	5	1	2	1	1	1	30	2	3	3	3	3	70	3	1	2	2	2	50
	Lowest energy consumption	4	3	3	3	3	3	60	2	2	2	2	2	40	1	1	1	1	1	20
Features	Best Real-time trace capabilities	3	2	1	2	3	1	27	1	2	3	1	2	27	3	3	1	2	3	36
	Supports static allocation of RTOS objects	4	3	3	3	3	3	60	2	2	2	2	2	40	1	1	1	1	1	20
	Most efficient memory protection	4	2	3	1	2	3	44	3	1	2	3	1	40	1	2	3	1	2	36
	Easiest to scale	5	3	2	3	2	3	65	1	3	1	3	1	45	2	1	2	1	2	40
	Easiest to configure features	5	2	2	3	1	1	45	1	1	2	2	2	40	3	3	1	3	3	65
	Processor derivative fully supported	5	2	2	2	2	2	50	1	1	1	1	1	25	3	3	3	3	3	75
	Conforms to required interface standards (i.e. POSIX, DO-178B)	3	1	1	1	1	1	15	3	3	3	3	3	45	2	2	2	2	2	30
	Easiest to port to other MCU's and architectures	3	1	2	3	1	2	27	2	3	1	2	3	33	3	1	2	3	1	30
	Most relevent safety certifications	4	3	2	3	2	3	52	2	3	1	3	1	40	1	1	2	1	2	28
Cost	Lowest upfront licensing costs	5	3	3	3	3	3	75	1	1	1	1	1	25	2	2	2	2	2	50
	Lowest royalty cost per unit	3	3	3	3	3	3	45	2	2	2	2	2	30	1	1	1	1	1	15
	Greatest familiarity with this RTOS	4	3	2	1	1	2	36	1	3	2	2	3	44	2	1	3	3	1	40
	Lowest time to get up to speed with RTOS specifics	3	1	2	3	3	2	33	2	3	1	1	3	30	3	1	2	2	1	27
	Smallest tool investment	4	3	2	2	3	3	52	1	3	3	1	1	36	2	1	1	2	2	32
	Lowest training investment	5	2	1	3	2	1	45	1	3	2	1	3	50	3	2	1	3	1	50
	Lowest cost of middleware (price and integration effort vs quality	5	2	1	2	2	2	45	3	2	3	3	1	60	1	3	1	1	3	45
	Least open source (minimize new IP release)	3	1	1	1	1	1	15	2	3	3	2	2	36	3	2	2	3	3	39
EcoSystem	Highest adoption rate in target industry	3	3	2	3	2	3	39	1	3	1	3	2	30	2	1	2	1	1	21
	Most architectures supported	3	2	2	2	2	2	30	3	3	3	3	3	45	1	1	1	1	1	15
	Largest and most vibrant forum community (fast to respond)	4	2	3	2	3	1	44	1	2	1	1	3	32	3	1	3	3	2	48
	Fastest technical support available	5	1	2	1	2	1	35	2	3	2	3	2	60	3	1	3	1	3	55
	Highest quality professional training available	2	2	1	2	1	2	16	1	3	1	3	1	18	3	2	3	2	3	26
	Example projects and source available	4	2	3	2	3	2	48	3	1	3	1	3	44	1	2	1	2	1	28
	Integrated development tools and plugins	4	2	1	3	2	1	36	1	3	1	1	3	36	3	1	3	3	1	44

KT Matrix Set Up

1) Identify the categories that will be evaluated
2) Create the criteria that will be evaluated
3) Provide a weight from 1 – 5 for each factor
4) Develop the MCU Selection Matrix
5) Distribute to each decision maker
6) Calculate the weighted sums
7) The highest value is the selected MCU

What is your experience level using a KT-Matrix?

- Just heard about them
- Aware of them but don't use them
- Use them to make decisions within our team
- Other

2 Identifying Categories / Criteria

Category Factors

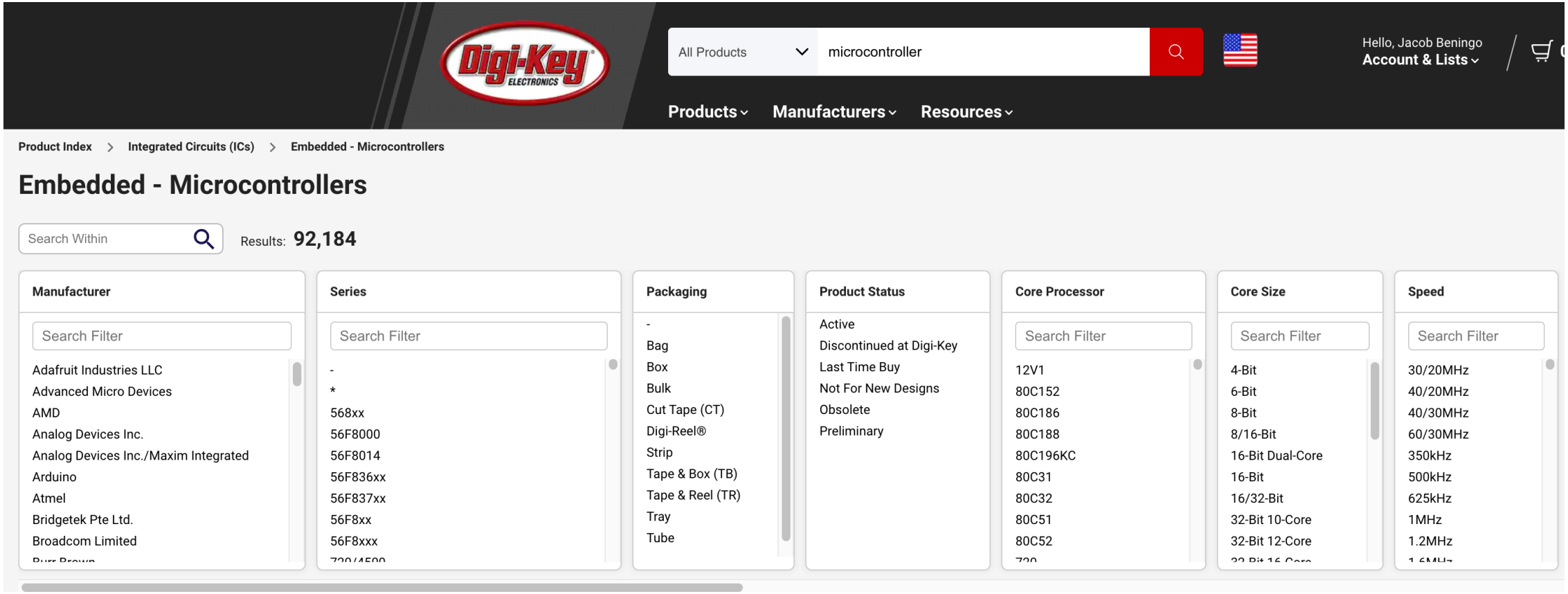
Categories are general high-level groups of decision-making criteria used to organize the decision-making process.

Criteria are specific features that are weighed as part of the decision-making process.

Categories to Evaluate

- Hardware
- Peripheral Features
- Cost
- Ecosystem
- Middleware Support
- Vendor
- Security
- Experience

Category Tools



Criteria Selection

Identify what will help differentiate the various devices to best meet your needs i.e.:

- Cost
- Architecture
- Core bus speed
- Peripheral set
- Etc

Apply a 1 – 5 weighting to each.

Which criteria do you think is most important?
- Cost
- Processor architecture
- Peripheral set
- Other

3 The MCU Selection KT Matrix Example

A populated KT-Matrix

			Microcontroller #1						Microcontroller #2					
	Criteria	Weight	Rating 1	Rating 2	Rating 3	Rating 4	Rating 5	Weighted Rating Total	Rating 1	Rating 2	Rating 3	Rating 4	Rating 5	Weighted Rating Total
Hardware	32-bit Architecture	4	3	3	3	3	3	60	2	2	2	2	2	40
	Processor speed	4	2	2	2	2	2	40	1	1	1	1	1	20
	Instruction set	5	2	1	1	1	2	35	1	2	2	2	1	40
	Minimial interrupt latency	5	1	2	2	1	1	35	3	1	1	3	2	50
	Loweset energy consumption	5	1	1	1	1	1	25	2	2	2	2	2	50
	Part Availability	5	1	2	1	1	1	30	2	3	3	3	3	70
	Memroy footprint / speed	4	3	3	3	3	3	60	2	2	2	2	2	40
Middleware	File system best meets system requirements	4	2	1	2	2	1	32	3	2	3	3	1	48
	TCP/IP stack best meets system requirements	4	2	1	2	2	1	32	3	2	3	3	1	48
	USB stack best meets system requirements	4	2	1	2	2	1	32	3	2	3	3	1	48
	Graphics stack best meets system requirements	4	2	1	2	2	1	32	3	2	3	3	1	48
	Middleware requires minimal integration effort	4	2	1	2	2	1	32	3	2	3	3	1	48
	Additional 3rd party tools integrated seamlessly	3	1	2	1	2	1	21	2	3	2	3	2	36
Engineer	Maxmize professional growth potential	2	2	2	1	3	1	18	1	1	3	2	3	20
	Least amount of stress to implement	2	2	3	1	1	3	20	1	2	3	3	2	22
	Most fun / interesting	1	2	3	3	1	2	11	3	1	1	2	3	10
	Minimized labor intensity	3	1	2	3	1	3	30	2	3	1	2	1	27
	Least deadline constrained to get up to speed	2	2	1	2	1	3	18	3	2	3	2	1	22
	Most internal resources available	3	1	2	3	3	3	36	2	3	1	1	1	24
Security	Security Certified RTOS	5	2	2	1	3	1	45	3	3	2	1	2	55
	Supports Arm TrustZone	4	1	1	2	1	1	24	2	2	3	2	2	44
	Supports TF-M	5	1	1	1	2	2	35	2	2	2	3	3	60
	Secure OTA / Bootloader support	3	2	2	1	2	2	27	1	1	2	3	3	30
	Total	198	98	94	101	101	95	1852	104	113	109	116	102	2059
			Microcontroller #1						Microcontroller #2					

Would you consider using a KT Matrix in the future?
- Yes
- No
- Maybe
- Already use them

4 Going Further

Thank you for attending

Please consider the resources below:

- www.beningo.com
  - Blog, White Papers, Courses
  - Embedded Bytes Newsletter
    - http://bit.ly/1BAHYXm
  - Embedded Software Design
    - https://bit.ly/3PZCtNO

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