Final Exam
– (Special Topics in Computer Architecture)

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목차

Step #1

Commercial products 총 8개 선정 및 선정 배경 설명
(Smartphone, Smartpad, Laptop, Desktop별로 2개씩)

Step #2

- Commercial CPU Cache Memory 평가
- Commercial CPU Micro-architecture 평가

Step #3

- Embedded 제품 performance, power 평가 및 비교
- Nonembedded 제품 power 평가 및 비교

Smart Phone

Samsung
Z flip LTE

Samsung
Z flip 5G

Smart Pad

iPad Pro (3rd)

iPad Air (2nd)

Step #1

Laptop

삼성전자 노트북5 NT500R5W-KD3S WIN10 (SSD 128GB)

삼성전자 노트북 플러스 NT550XCR-AD3A (SSD 256GB)

Desktop

삼성전자 데스크탑5 DM500SCA-A58BA (8GB, M2 256GB)

삼성전자 데스크탑5 DM500T9Z-AD5A-ONLine (16GB, SSD 256GB + 1TB)

Type	Sub Type	Product Name	Release date (Year, month)	SoC(System-on-Chip) = CPU+GPU+HW Accelerators										
				Fab. Tech	Power	Name	CPU							
							Micro-architecture	Bit-Width	Clock Freq.	ISA	No, of Cores	L1 Cache	L2 Cache	L3 Cache
Embedded Computer Systems	Smart Phone	Samsung galaxy z flip (4g)	2020.02	7nm	?	Qualcomm Snapdragon 855+	1x prime Kryo 485 Gold (Cortex-A76)	64	2.95 GHz	ARMv8.2-A	8	Per-core: I-64KB, D-64KB	Per-core: 512KB	2MB shared
							3x high-performance Kryo 485 Gold (Cortex-A76)		2.41 GHz			Per-core: I-192KB, D-192KB	Per-core: 768KB	
							4x Kryo 485 Silver high-efficiency(Cortex-A55)		1.78 GHz			Per-core: I-256KB, D-256KB	Per-core: 512KB	
		Samsung galaxy z flip (5g)	2020.08	7nm	?	Qualcomm Snapdragon 865+	1x prime Kryo 585 Gold (Cortex-A77)	64	3.09 GHz	ARMv8.2-A	8	Per-core: I-64KB, D-64KB	Per-core: 512KB	4MB shared
							3x high-performance Kryo 585 Gold (Cortex-A77)		2.40 GHz			Per-core: I-192KB, D-192KB	Per-core: 768KB	
							4x Kryo 585 Silver high-efficiency cores (Cortex-A55)		1.8 GHz			Per-core: I-256KB, D-256KB	Per-core: 512KB	
	Smart Pad	iPad Pro (3rd generation)	2018.11	7nm	?	Apple A12X Bionic	4x high performance Vortex	64	2.49 GHz	ARMv8.3-A	8	Per-core: I-128KB, D-128KB	8MB shared	None
							4x high efficiency Tempest		1.52 GHz			Per-core: I-32KB, D-32KB	2MB shared	
		iPad Air (2th generation)	2017.3	20nm	?	Apple A8X	Typhoon	64	1.5 GHz	ARMv8.0-A	3	Per-core: I-64KB, D-64KB	2MB shared	4MB shared by the entire SoC

Type	Sub Type	Product Name	Release date (Year, month)	SoC(System-on-Chip) = CPU+GPU+HW Accelerators									
				Fab. Tech	Power	Name	CPU						
							Micro-architecture	Bit-Width	Clock Freq.	ISA	No, of Cores	L1 Cache	L2 Cache	L3 Cache
General PC	Laptop	Samgsung notebook plus NT550XCR-AD3A	2020.04	14nm	15W	Intel® Core™ i3-10110U	10th Gen. Comet Lake	64	2.10 GHz ~4.10 GHz	x86-64	2	Per-core: I-32KB, D-32KB	Per-core: 256KB	Per-core: 2MB
		Samgsung notebook5 NT500R5W-KD3S WIN10	2017.04	14nm	15W	Intel® Core™ i3-7100U	7th Gen. Kaby Lake	64	2.4GHz	x86-64	2	Per-core: I-32KB, D-32KB	Per-core: 256KB	Per-core: 2MB
	Desktop	Samsung desktop5 DM500SCA-A58BA	2020.07	14nm	65W	Intel® Core™ i5-10400	10th Gen. Comet Lake	64	2.90 GHz ~4.30 GHz	x86 -64	6	Per-core: I-32KB, D-32KB	Per-core: 256KB	Per-core: 2MB
		Samsung desktop5 DM500T9Z-AD5A-ONLine	2019.09	14nm	65W	Intel® Core™ i5-9400	9th Gen. Coffee Lake	64	2.90 GHz ~4.10 GHz	x86 -64	6	Per-core: I-32KB, D-32KB	Per-core: 256KB	Per-core: 2MB

Type	Sub Type	Product Name	Release date (Year, month)	SoC(System-on-Chip) = CPU+GPU+HW Accelerators										
				Fab. Tech	Power	Name	CPU							
							Micro- architecture							
							Name	Intro Date (Year, Month)	Type	Spec. of Superscalar processor				Pipeline depth
										No. of Issues (Decodes)	Out of Order execution	Branch Prediction (speculation)	No. of Execution ports	
Embedded Computer Systems	Smart Phone	Samsung galaxy z flip (4g)	2020.02	7nm	?	Qualcomm Snapdragon 855+	1x prime Kryo 485 Gold (Cortex-A76)	2018.05	Super scalar	4	YES	YES	8	13
							3x high-performance Kryo 485 Gold (Cortex-A76)	2018.05		4	YES	YES	8	13
							4x Kryo 485 Silver high-efficiency(Cortex-A55)	2017.05		2	NO	YES	2	8
		Samsung galaxy z flip (5g)	2020.08	7nm	?	Qualcomm Snapdragon 865+	1x prime Kryo 585 Gold (Cortex-A77)	2018.05	Super scalar	4	YES	YES	12	11-13
							3x high-performance Kryo 585 Gold (Cortex-A77)	2018.05		4	YES	YES	12	11-13
							4x Kryo 585 Silver high-efficiency cores (Cortex-A55)	2017.05		2	NO	YES	2	8
	Smart Pad	iPad Pro (3rd generation)	2018.11	7nm	?	Apple A12X Bionic	4x high performance Vortex	2018. ?	Super scalar	7	Yes	Yes	13	16
							4x high efficiency Tempest	2018. ?		3	Yes	Yes	5	12
		iPad Air (2th generation)	2017.3	20nm	?	Apple A8X	Typhoon	2014.?	Super scalar	6	YES	YES	9	16

Type	Sub Type	Product Name	Release date (Year, month)	SoC(System-on-Chip) = CPU+GPU+HW Accelerators										
				Fab. Tech	Power	Name	CPU							
							Micro- architecture							
							Name	Intro Date (Year, Month)	Type	Spec. of Superscalar processor				Pipeline depth
										No. of Issues (Decodes)	Out of Order execution	Branch Prediction (speculation)	No. of Execution ports	
General PC	Laptop	Samgsung notebook plus NT550XCR-AD3A	2020.04	14nm	15W	Intel® Core™ i3-10110U	10th Gen. Comet Lake	2019.08	Super scalar	5	YES	YES	10	14-19
		Samgsung notebook5 NT500R5W-KD3S WIN10	2017.04	14nm	15W	Intel® Core™ i3-7100U	7th Gen. Kaby Lake	2016.08	Super scalar	5	YES	YES	8	14-19
	Desktop	Samsung desktop5 DM500SCA-A58BA	2020.07	14nm	65W	Intel® Core™ i5-10400	10th Gen. Comet Lake	2020.04	Super scalar	5	YES	YES	10	14-19
		Samsung desktop5 DM500T9Z-AD5A-ONLine	2019.09	14nm	65W	Intel® Core™ i5-9400	9th Gen. Coffee Lake	2017.10	Super scalar	5	YES	YES	8	14-19

Smart Phone

L1 Cache	L2 Cache	L3 Cache
Per-core: I-64KB, D-64KB	Per-core: 512KB	2MB shared
Per-core: I-192KB, D-192KB	Per-core: 768KB	
Per-core: I-256KB, D-256KB	Per-core: 512KB	
Per-core: I-64KB, D-64KB	Per-core: 512KB	4MB shared
Per-core: I-192KB, D-192KB	Per-core: 768KB	
Per-core: I-256KB, D-256KB	Per-core: 512KB	

Spec. of Superscalar processor				Pipeline depth
No. of Issues (Decodes)	Out of Order execution	Branch Prediction (speculation)	No. of Execution ports	
4	YES	YES	8	13
4	YES	YES	12	11-13

Fab. Tech
7nm
7nm

Clock Freq.
2.95 GHz
2.41 GHz
1.78 GHz
3.09 GHz
2.40 GHz
1.8 GHz

Improvement of Fabrication Process Technology — Yes / No

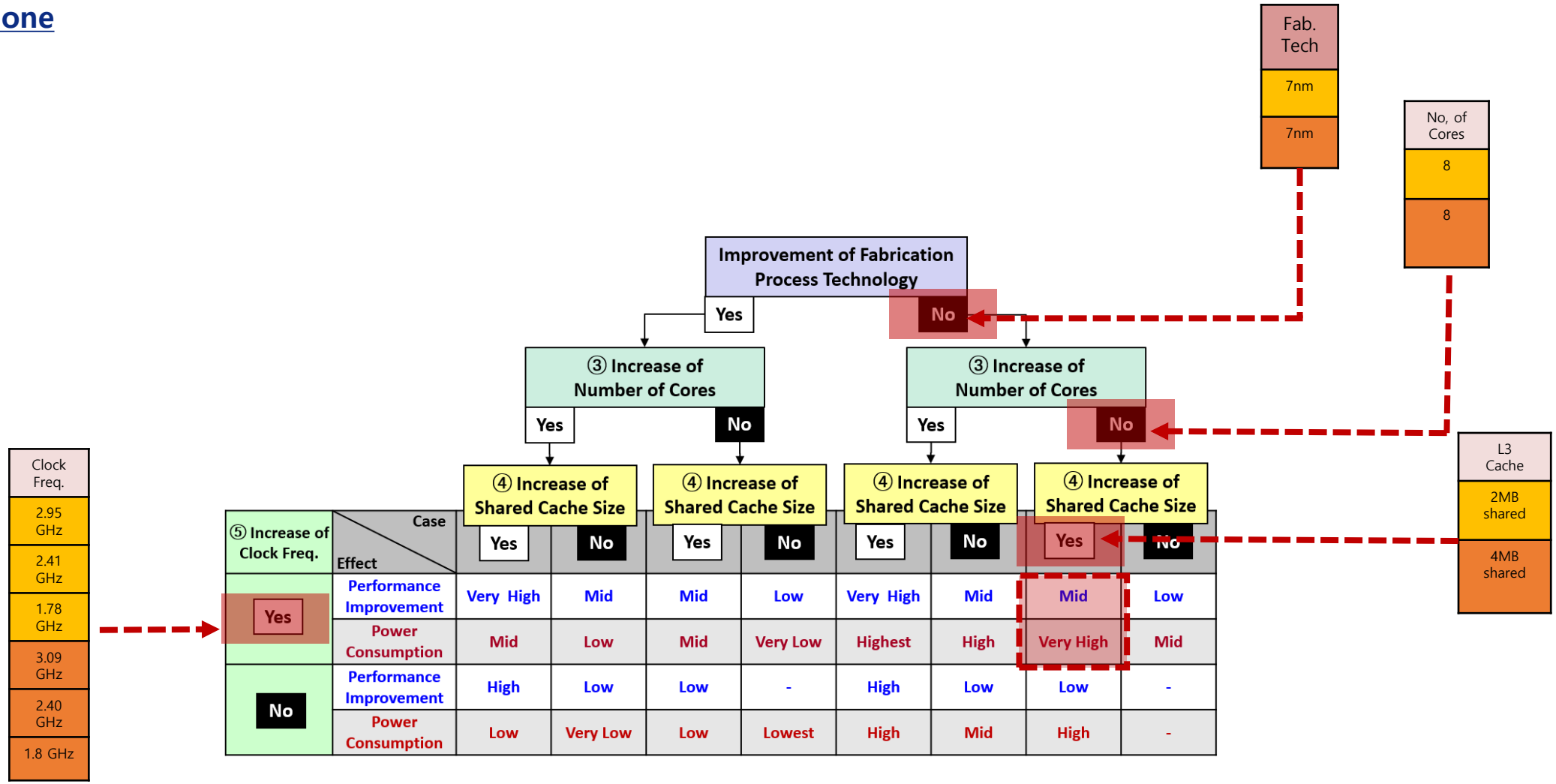
① Improvement of Micro-Architecture — Yes / No

② Increase of Private Cache Size — Yes / No

⑤ Increase of Clock Freq. — Yes / No

⑤ Increase of Clock Freq.	Case / Effect	① Yes, ② Yes	① Yes, ② No	① No, ② Yes	① No, ② No	① Yes, ② Yes	① Yes, ② No	① No, ② Yes	① No, ② No
Yes	Performance Improvement	Very High	Mid	Mid	Low	Very High	Mid	Mid	Low
	Power Consumption	Mid	Low	Mid	Very Low	Highest	High	Very High	Mid
No	Performance Improvement	High	Low	Low	-	High	Low	Low	-
	Power Consumption	Low	Very Low	Low	Lowest	High	Mid	High	-

Smart Phone


Fab. Tech
7nm
7nm
No, of Cores
8
8
L3 Cache
2MB shared
4MB shared
Clock Freq.
2.95 GHz
2.41 GHz
1.78 GHz
3.09 GHz
2.40 GHz
1.8 GHz
Improvement of Fabrication Process Technology
Yes
No
③ Increase of Number of Cores
Yes
No
③ Increase of Number of Cores
Yes
No
④ Increase of Shared Cache Size
④ Increase of Shared Cache Size
④ Increase of Shared Cache Size
④ Increase of Shared Cache Size
⑤ Increase of Clock Freq.
Case
Effect
Yes
No
Yes
No
Yes
No
Yes
No
Yes
No
Yes
No
Yes
No
Yes
Performance Improvement
Very High
Mid
Mid
Low
Very High
Mid
Mid
Low
Power Consumption
Mid
Low
Mid
Very Low
Highest
High
Very High
Mid
No
Performance Improvement
High
Low
Low
-
High
Low
Low
-
Power Consumption
Low
Very Low
Low
Lowest
High
Mid
High
-

Smart Pad

Spec. of Superscalar processor			
No. of Issues (Decodes)	Out of Order execution	Branch Prediction (speculation)	No. of Execution ports
7	Yes	Yes	13
6	YES	YES	9

L1 Cache	L2 Cache	L3 Cache
Per-core: I-128KB, D-128KB	8MB shared	None
Per-core: I-64KB, D-64KB	2MB shared	4MB shared by the entire SoC

Fab. Tech
7nm
20nm

Clock Freq.
2.49 GHz
1.5 GHz

Improvement of Fabrication Process Technology: Yes / No

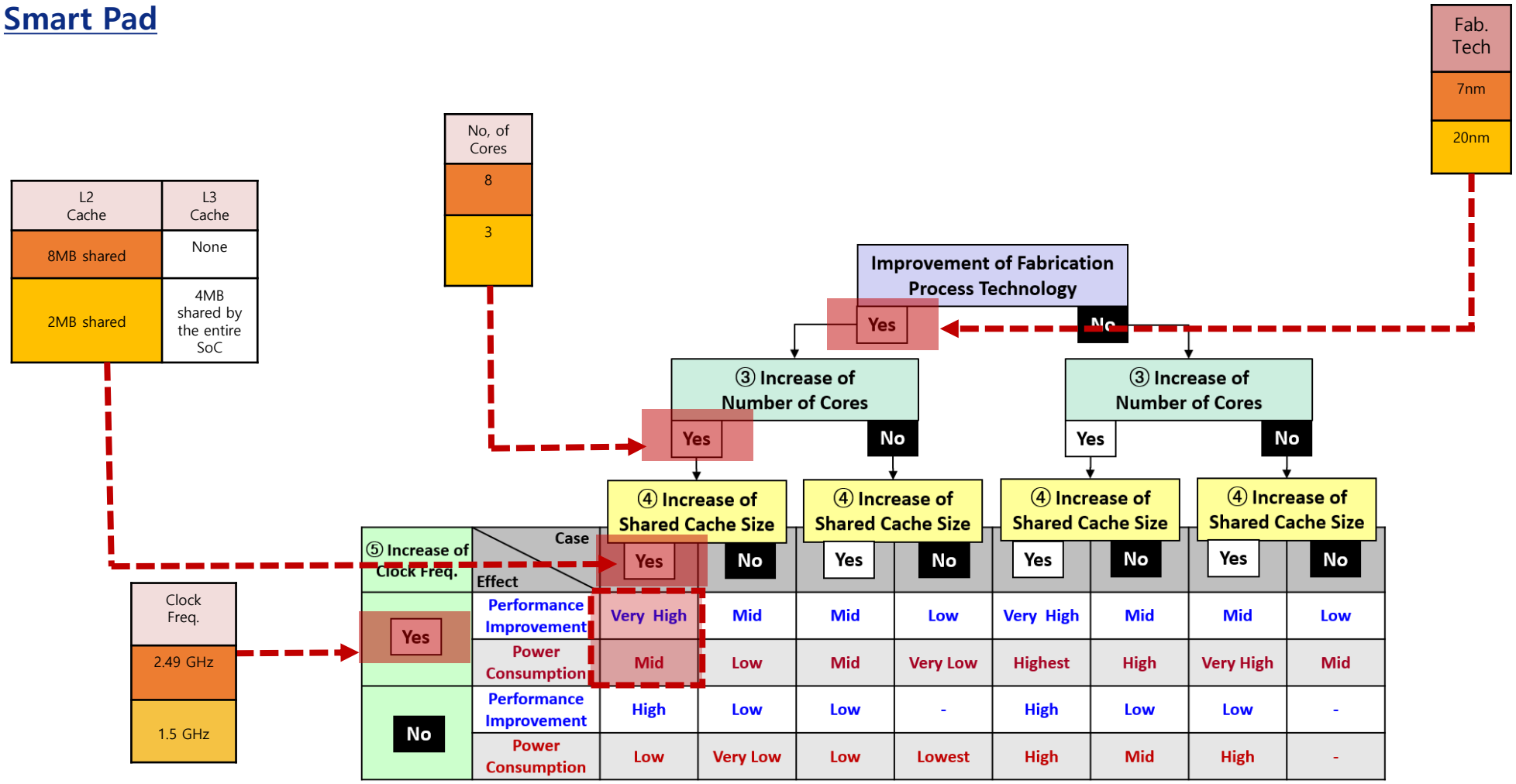
① Improvement of Micro-Architecture: Yes / No

② Increase of Private Cache Size: Yes / No

⑤ Increase of Clock Freq.: Yes / No

⑤ Increase of Clock Freq.	Effect \ Case	① Yes, ② Yes	① Yes, ② No	① No, ② Yes	① No, ② No	① Yes, ② Yes	① Yes, ② No	① No, ② Yes	① No, ② No
Yes	Performance Improvement	Very High	Mid	Mid	Low	Very High	Mid	Mid	Low
	Power Consumption	Mid	Low	Mid	Very Low	Highest	High	Very High	Mid
No	Performance Improvement	High	Low	Low	-	High	Low	Low	-
	Power Consumption	Low	Very Low	Low	Lowest	High	Mid	High	-

Smart Pad


Fab. Tech
7nm
20nm
No, of Cores
8
3
L2 Cache
L3 Cache
8MB shared
None
2MB shared
4MB shared by the entire SoC
Improvement of Fabrication Process Technology
Yes
No
③ Increase of Number of Cores
Yes
No
③ Increase of Number of Cores
Yes
No
④ Increase of Shared Cache Size
④ Increase of Shared Cache Size
④ Increase of Shared Cache Size
④ Increase of Shared Cache Size
⑤ Increase of Clock Freq.
Case
Effect
Clock Freq.
2.49 GHz
1.5 GHz
Yes
No
Performance Improvement
Power Consumption
Performance Improvement
Power Consumption
Very High
Mid
Mid
Low
Very High
Mid
Mid
Low
Mid
Low
Mid
Very Low
Highest
High
Very High
Mid
High
Low
Low
-
High
Low
Low
-
Low
Very Low
Low
Lowest
High
Mid
High
-

Laptop

Spec. of Superscalar processor			
No. of Issues (Decodes)	Out of Order execution	Branch Prediction (speculation)	No. of Execution ports
5	YES	YES	10
5	YES	YES	8

L1 Cache	L2 Cache	L3 Cache
Per-core: I-32KB, D-32KB	Per-core: 256KB	Per-core: 2MB
Per-core: I-32KB, D-32KB	Per-core: 256KB	Per-core: 2MB

No, of Cores
2
2

① Improvement of Micro-Architecture

Yes / No

② Increase of Private Cache Size

Clock Freq.	⑤ Increase of Clock Freq.	Case / Effect	Yes	No
2.10 GHz ~4.10 GHz	Yes	Performance Improvement	Very High	Mid
2.4GHz	No	Performance Improvement	High	Low

② Increase of Private Cache Size

Yes	No
Mid	Low
Low	-

Clock Freq.	⑤ Increase of Clock Freq.	Case / Effect	Yes	No
2.10 GHz ~4.10 GHz	Yes	Performance Improvement	Very High	Mid
2.4GHz	No	Performance Improvement	High	Low

③ Increase in the Number of Cores

Yes / No

④ Increase of Shared Cache Size

Yes	No
Mid	Low
Low	-

④ Increase of Shared Cache Size

Yes	No
Mid	Low
Low	-

Desktop

Spec. of Superscalar processor			
No. of Issues (Decodes)	Out of Order execution	Branch Prediction (speculation)	No. of Execution ports
5	YES	YES	10
5	YES	YES	8

L1 Cache	L2 Cache	L3 Cache
Per-core: I-32KB, D-32KB	Per-core: 256KB	Per-core: 2MB
Per-core: I-32KB, D-32KB	Per-core: 256KB	Per-core: 2MB

No, of Cores
6
6

① Improvement of Micro-Architecture

Yes → ② Increase of Private Cache Size

No → ② Increase of Private Cache Size

Clock Freq.	⑤ Increase of Clock Freq.	Case / Effect	② Yes	② No	② Yes	② No
2.90 GHz ~4.30 GHz	Yes	Performance Improvement	Very High	Mid	Mid	Low
2.90 GHz ~4.10 GHz	No	Performance Improvement	High	Low	Low	-

③ Increase in the Number of Cores

Yes → ④ Increase of Shared Cache Size

No → ④ Increase of Shared Cache Size

Clock Freq.	⑤ Increase of Clock Freq.	Case / Effect	④ Yes	④ No	④ Yes	④ No
2.90 GHz ~4.30 GHz	Yes	Performance Improvement	Very High	Mid	Mid	Low
2.90 GHz ~4.10 GHz	No	Performance Improvement	High	Low	Low	-

THANK YOU!