

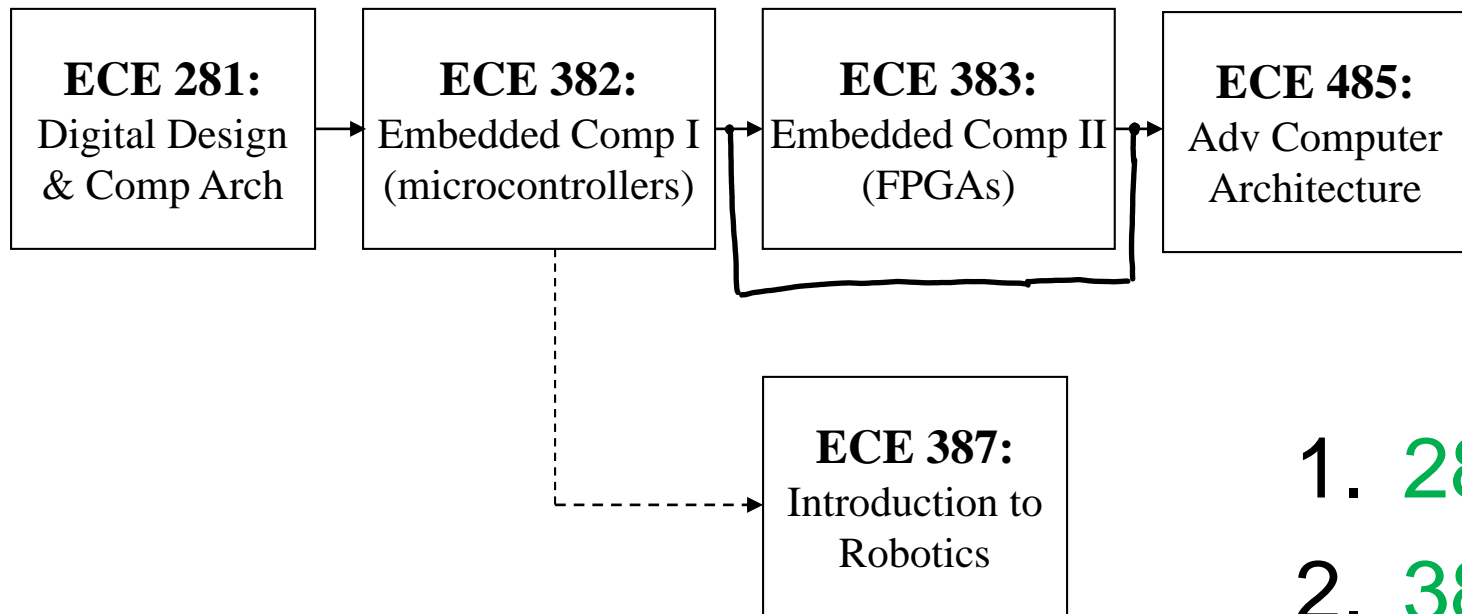
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# ECE485 Computer Architecture

## Lesson 1

# Computer Systems Courses

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Which is the Best ECE CompE class?

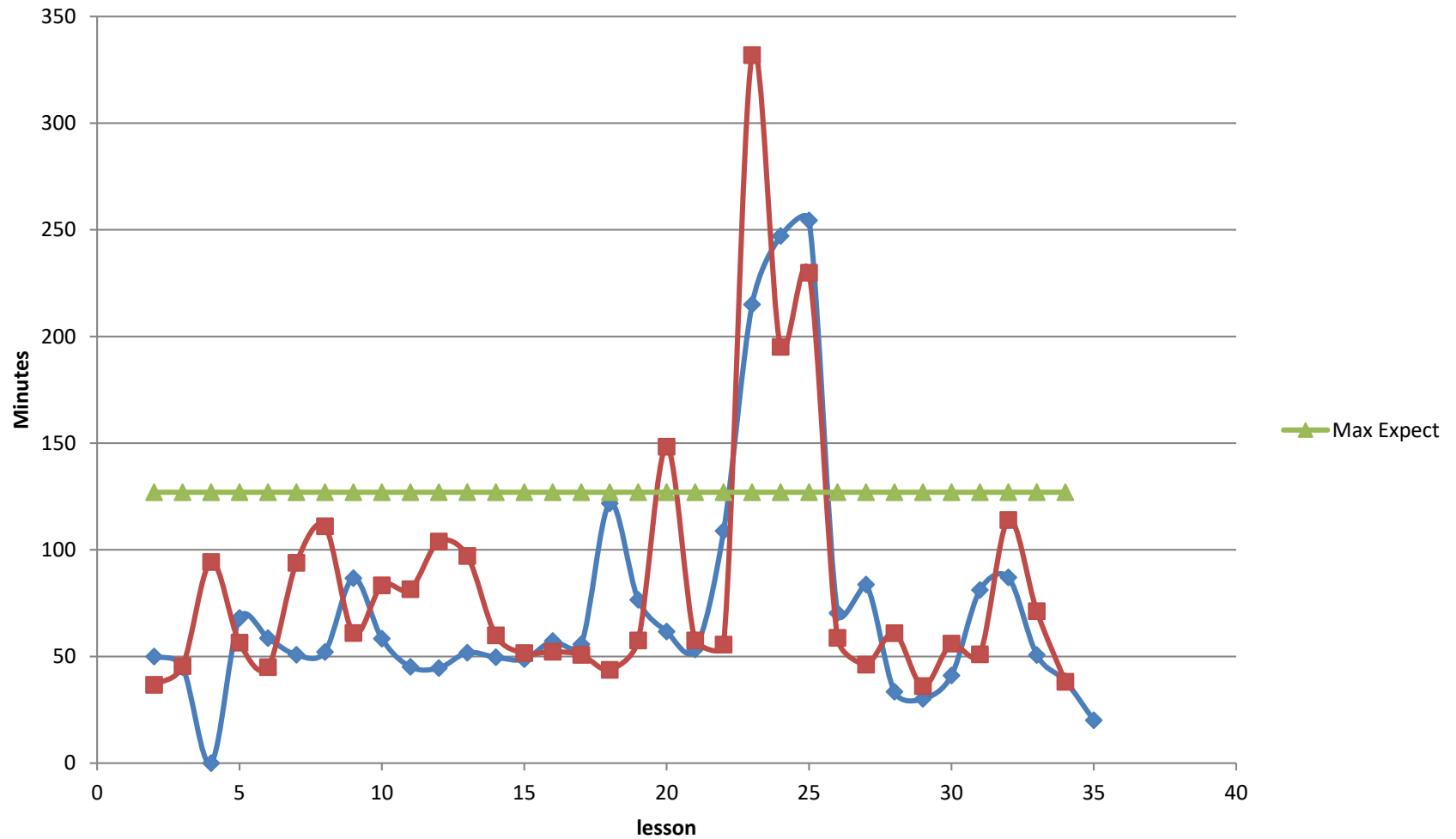
1. 281
2. 382
3. 383
4. 387
5. 485

# Course Overview

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- Assess Architectures of Various Computers and their Subsystems
- Evaluate Architecture Performance Quantitatively
- Transition to Graduate Level Work
  - Resolve ill-Defined Problems
  - ~~Research paper~~
  - ~~Oral Presentation~~

## Timelogs--ECE485



# What is the textbook for this course?

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1. *Computer Architecture and Organization*
2. *Computer Architecture: From Microprocessors to Supercomputers*
3. *Computer Architecture: A Quantitative Approach*

# Course Overview

- Textbook
  - *Computer Architecture: A Quantitative Approach*,  
★ Sixth Edition, 2019  
by John Hennessy & David Patterson
  - The **Definitive Text** on computer architecture

Berkley

• SPARC → SUN

• RAID

Stanford

• MIPS

President Stanford

Sixth Edition

John L. Hennessy | David A. Patterson

## COMPUTER ARCHITECTURE

A Quantitative Approach

MK  
MORGAN KAUFMANN

Copyrighted Material

# I have my textbook already?

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1. yes
2. no
3. It is in the mail
4. I do not plan on getting the textbook

# Course Website and Syllabus

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- [usafa-ece.github.io/ece485/intro.html](https://usafa-ece.github.io/ece485/intro.html)
- <https://usafa.blackboard.com>

202630-G-DFEC-ECE485-M2A : ADVANCED COMPUTER ARCHITECTURE

- Skills Review (due BOC M4)
- CPH (CPH1 due BOC M2)
- No extensions (like for TDYs) for assignment deadlines
  - Vivado → not need until lesson 19
  - Teams
  - Gradescope

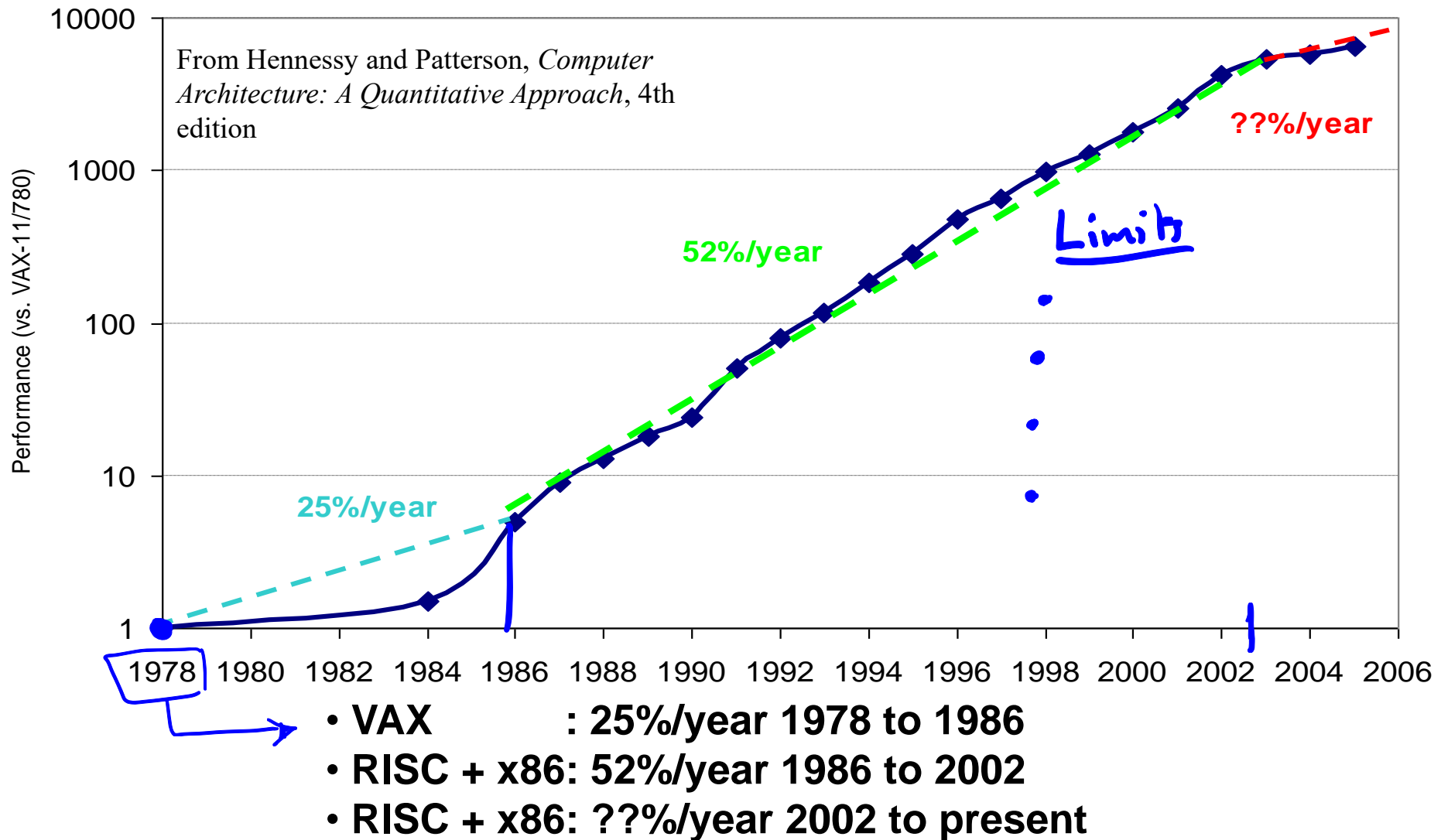


# Computer Generations

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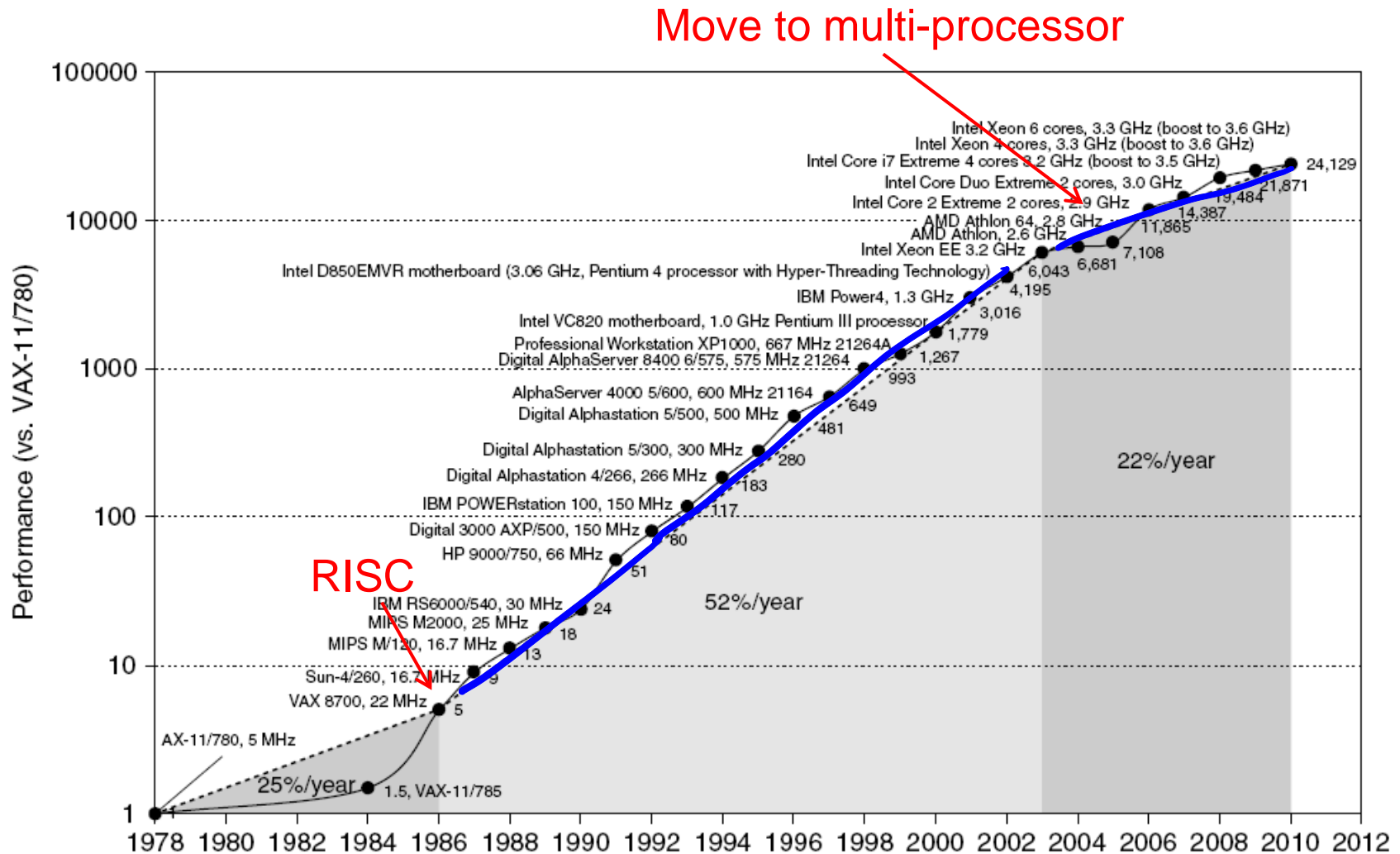
- 1<sup>st</sup> gen: vacuum tubes
- 2<sup>nd</sup> gen: transistors
- 3<sup>rd</sup> gen: MSI, LSI devices VLSI
- 4<sup>th</sup> gen: packing as many transistors onto one chip
- 5<sup>th</sup> gen: multiple cores

# Crossroads: Uniprocessor Performance (2006 textbook)



# Single Processor Performance

2012 textbook



The graph illustrates the exponential growth of computer performance over nearly four decades. The performance is measured on a logarithmic scale, with major grid lines at powers of 10. The growth rate starts at 25% per year from 1978 to 1986, then accelerates to 52% per year until 2003. From 2003 to 2018, the growth rate slows down, with a 23% annual increase until 2014, followed by a 12% annual increase until 2016, and finally a 3.5% annual increase until 2018. The graph shows a continuous upward trend, with performance increasing by a factor of 100,000 over the period.

Year	Computer Model / Specification	Performance (approx.)
1978	AX-11/780, 5 MHz	1
1986	VAX 8700, 22 MHz	5
1988	Sun-4/260, 16.7 MHz	9
1990	MIPS M/120, 16.7 MHz	13
1992	MIPS M2000, 25 MHz	18
1994	IBM RS6000/540, 30 MHz	24
1996	HP 9000/750, 66 MHz	51
1998	Digital 3000 AXP/500, 150 MHz	80
2000	IBM POWERstation 100, 150 MHz	117
2002	Digital Alphastation 4/266, 266 MHz	183
2004	Digital Alphastation 5/300, 300 MHz	280
2006	AlphaServer 4000 5/600, 600 MHz	481
2008	Professional Workstation XP1000, 667 MHz	649
2010	Digital AlphaServer 8400 6/575, 575 MHz	993
2012	Intel VC820 motherboard, 1.0 GHz Pentium III processor	1,267
2014	Intel D850EMVR motherboard (3.06 GHz, Pentium 4 processor with Hyper-Threading Technology)	1,779
2016	Intel Core i7 4 cores 4.0 GHz (Boost to 4.2 GHz)	3,016
2018	Intel Core i7 4 cores 4.0 GHz (Boost to 4.2 GHz)	4,195

# Bandwidth versus Latency?

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1. Latency is the time it takes from the beginning to the end of an individual task
2. Bandwidth is the average throughput for all the tasks
3. If you increase the bandwidth, you also decrease the latency
4. 1 and 2 above
5. All the above

# Trends in Hardware

Log-log plot of bandwidth and latency milestones

Which is easier to improve?

1. Bandwidth
2. Latency

