oueees-202106 topic 01:
Latency and Laws of Physics

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Lecture notes and reporting

- https://github.com/jj1bdx/oueees-202106-public/
- Check out the README.md file and the issues!
- Keyword at the end of the talk
- URL for submitting the report at the end of the talk

Topic of this video:

Latency and Laws of Physics

Speed of light in vacuum c

299 792 458 [m/s]

This is a definition, *not* a measured value

Refractive indices of materials

- v: speed of light in a material
- Refractive index $n = c/v$, always $n \geq 1$!
- Air: 1.000279 for λ=0.50 μm [1] -> 299709 km/s
- Water: 1.3330 for λ=589.3 nm [1] -> 224901 km/s
- Silica glass (optic fiber): 1.45 [2] -> 206753 km/s

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[1] 理科年表2021、丸善、ISBN: 978-4-621-30560-7, pp. 477-479

[2] https://apniphysics.com/classroom/optical-fiber-refractive-index/

Distance latency and timing

- Osaka to Tokyo: ~400km = ~1.3ms (in vacuum/air)
- Tokyo, Japan to San Francisco, CA, USA: ~8300km ~= 28ms (in vacuum/air), 41ms (in silica glass)
- Japan <-> USA in optic fiber, round trip: ~100ms or more
- *Synchronization is hard*

Light traveling time and distance

wiring and wavelength matter

- ~300km in 1ms aka 1kHz
- ~300m in 1μs aka 1MHz
- ~30cm in 1ns aka 1GHz
- ~3mm in 1ps aka 1THz

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