

Applications for Quantum Information Network: Promising Use Cases and its Profound Implications on Existing Internet Applications

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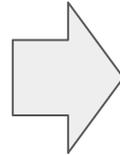
For The Quantum Internet Research Group at the IETF 107 (Virtual)

Overview - The Similarity between Lasers and Quantum Information Networks?

“The inventors of the laser probably didn't anticipate its use in things like rock shows or freaking out cats.”

But today...

Lasers “read CDs and bar codes, guide missiles, cut steel, perform eye surgery, make astronomical measurements and carry out myriad other tasks, from transmitting a thousand books a second over fiber optic lines to entertaining crowds with light shows.”



The same can be said of Quantum Information Network.

The Applications of Quantum Information Network might be very different from something we envision today in 2020.

Even the unknowns unknowns?

$P = NP?$

$P \neq NP?$

SOURCE:

<https://www.smithsonianmag.com/smart-news/today-we-use-lasers-almost-everything-they-took-long-time-seem-useful-180963956/>

<https://www.claymath.org/millennium-problems/p-vs-np-problem>

Me

- Nathan Aw Ming Kun
- An Emerging Technologies Digital Solution Technologist / Architect in the Financial Services Industry (FSI) focusing on leveraging Emerging Technologies (Serverless, etc) including Quantum Internet Applications to quantum leapfrog competitors
 - Previously worked in a leading bank in Asia experimenting and building full stack blockchain solutions plus emerging technologies
- Building a Software Based Quantum Simulator to simulate quantum behavior using classical hardware in free time
- Presented Twice at the IETF (2018, 2019)
 - <https://datatracker.ietf.org/meeting/103/materials/slides-103-dinrg-decentralized-identity-01>
 - <https://datatracker.ietf.org/meeting/104/materials/slides-104-dinrg-byzantine-agreement-protocols-for-large-scale-decentralized-identity-management>
- <https://www.linkedin.com/in/awnathan>
- Based in Singapore

Promising Use Cases

Use Case #1: Scaled Out Quantum Computers

- Instead of **Scaled Up** Quantum Computers (what we have today), we will see intelligent **Scaled-out** Quantum Computers leveraging fundamentally distribute algorithms (quantum backprop?) to learn and perform tasks such as intelligent network routing
- <https://github.com/MichaelBroughton/Quantum-Backpropagation>

Use Case #2: Datacentre-Less

- Similar to Serverless Computing, Datacentre-Less will become a reality
- These few Quantum computers in the world will drive all the workloads. It will drive the cost of classical computing to a negligible amount due to its sheer computing power

Use Case #3: Zero Latency Networks

- Enabled by Zero Latency Networks and these Scaled Out Quantum Computers, true real-time computation will enable real-time quantum sensing resulting in heightened human responses to almost everything

Profound Implications on Existing Internet Applications

Implications #1:

- When Quantum Sensing becomes a reality, these applications are able to sense and tell us what we don't know -- revealing the unknowns unknowns

E.g., <https://www.nytimes.com/2020/04/05/opinion/coronavirus-google-searches.html>

Implications #2:

- Applications that leverage quantum computation and its network will be able to respond in real-time in a way no classical computer and/or network could do so

Implications #3:

- Existing Application Architectures need to pivot -- first move towards one that is event-based/event-driven

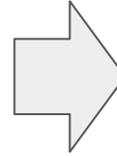
Parting Thoughts

"We cannot solve our problems with the same thinking we used when we created them." - Albert Einstein

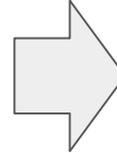
"Perfect is the enemy of good." - Voltaire

"Quantum Internet [and its applications] will further extend the Quantum Frontier. Perhaps even upending our current understanding. The search for Quantum Internet '**Killer App**' is ongoing." - Nathan M.K. Aw

Implications



Start on a new canvass, without the constraints and limitations of classical computers in mind



Improvise, improvise and improvise -- the outcome will look very different and even unexpected

References

The Cost of a Cloud: Research Problems in Data Center Network -

<https://www.microsoft.com/en-us/research/wp-content/uploads/2009/01/p68-v39n1o-greenberg.pdf>