Resemblance of graphs of Dark Energy's rate of expansion and link counts of fully-meshed networks.

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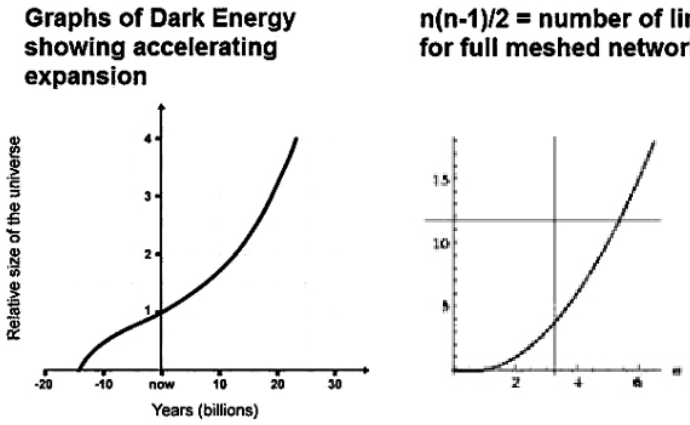
> *"...if complexity does underlie spatial volume in black holes, Susskind envisions consequences for our understanding of cosmology in general. "It's not only black hole interiors that grow with time. The space of cosmology grows with time," he said. "I think it's a very, very interesting question whether the cosmological growth of space is connected to the growth of some kind of complexity. And whether the cosmic clock, the evolution of the universe, is connected with the evolution of complexity. There, I don't know the answer.""*
> *-- Interview with Dr. Leonard Susskind in Quanta Magazine, https://www.quantamagazine.org/why-black-hole-interiors-grow-forever-20181206*

A few years ago I had noted in a post that, at least in regards to the expansion of the Universe (as observed in work to measure the acceleration expansion rate of Dark Energy), the graphs used were rather close to the n(n-1)/2 computer networking graph (perhaps analogous to the number of quantum entanglements) of the number of links (total connections/relationships) required to maintain a fully-meshed network as the number of nodes in the network increased.

While particles, change location in space and position in time, they also change in a degree of complexity or inter-connectedness or the number of relations or nodes "connected" to it (or maybe with quantum entanglement the total count of entanglements now and in the past). Thus maybe the increasing rate of expansion of the Universe via Dark Energy could be actually just space-time itself with increasing connections or perhaps the entire Universe literally is a fully-meshed network perhaps with quantum entanglements starting at the Big Bang.

Think about how computer network nodes that are in a fully-meshed design. In this network, the number of links (i.e. the accelerating "complexity") increases almost exponentially as you add more nodes. Is this rate of number of links required as you add more nodes, the same rate as dark energy expansion? The graphs have a striking resemblance (Fig. 1).

Fig. 1



Perhaps, Dark Energy (something increasing (accelerating) the rate of expansion of the Universe) could be expanding at an increasing rate literally as any observers simply start to observe deeper into the Universe and as light from the Big Bang expands as it "interacts" (establishes more relations) between all the

quantum level "nodes." Then perhaps time is simply what "happens" or what we "experience" as relations are added between particles. Then maybe the increasing rate of expansion of the Universe via Dark Energy could be actually just space-time itself with increasing connections (almost as if by analogy space-time is "making room" for all the "connections" being established).

More can be said regarding the idea of "relations," and relations only, as the foundation of the Universe. So maybe we can add another variable to space and time as the fundamental properties of physical reality. As when we describe a quark or fundamental particle or object like an electron as a set of numbers showing a location in space and in time. We say that particle undergoes "change" or flow of time into the future. While these particles, change location in space and position in time, they also change in a degree of complexity or inter-connected-ness or the number of relations or nodes connected to it (or maybe with quantum entanglement the total count particles that have been entangled to our particle under question now and in the past). Now "rates" of changes are literally derivative from space and time, etc... and come into play with Relativity, but the idea of using relations as a fundamental metric is not a minor one.

At the foundations of reality perhaps there is an intrinsic value, perhaps similar to the number of connections in a human brain or the number of connections in a brain needed for consciousness, where we have a value from discrete math at any given time of the total number of connections (neurons) in a brain. So why not a value of the count of connections in space-time of all fundamental particles as well? In fact, maybe we even skip the count of particles and just count the relations as the fundamental "metric" or value. One problem is how small do you go? Likely at the level of quarks is where location, time, and "number of relations" become the ONLY fundamental concepts, but others say it will be below this level perhaps a the Planck Scale or String Theory scale etc... Perhaps it is even possible that time is eliminated now. That we have space or space-time and, as the number of relations increases or even the length or size of relations increases, that this, and this alone, "is" time itself. Time could be the increase in relations of fundamental particles in the Universe (similar to recent papers about quantum entanglement creating space-time).

Now "why" a network must grow or add links may be an argument for metaphysics or even something associated with entropy or decoherence, or even a Universe as a cellular automata, but such might be the nature of our Universe. We believe we "exist" in time but could time just be an increase in the number of relations that thus looks like change we see as "time"? Others have had similar ideas regarding relations as the fundamental entity of the Universe (see *No place for particles in relativistic quantum theories?* https://arxiv.org/abs/quant-ph/0103041 and *What is real?* By Meinard Kuhlmann from Scientific American August 2013) but perhaps the idea of simply the "adding of relations" or adding quantum entanglements is the passage of time itself and/or Dark Energy period.