TERMINOLOGY

In relativity a *frame* is a view of objects in spacetime from an *inertial* (non-accelerated) viewpoint. Different frames in relative motion will observe the same objects having different spatial velocities and thus different velocities in time. Frames are used because views of spacetime remain consistent within unchanging frames.

Proper time is the current reading on a clock.

Note the elapsed times (distances in time) in the equations below are implicitly multiplied by the speed of light set = 1 to put them in the same units as the spatial distances. This simplifies the equations and puts both distances in space and time in units of distances traveled by light such as light years. Otherwise the equations are written as $cd\tau = \sqrt{(c^2dt^2 - dx^2)}$ and $cdt = \sqrt{(c^2d\tau^2 + dx^2)}$.

EVERYTHING MOVES THROUGH SPACETIME AT THE SPEED OF LIGHT

In special relativity $d\tau = \sqrt{(dt^2 - dx^2)}$. In any frame the elapsed proper time of a relatively moving clock is equal to the square root of the square of the elapsed time on a stationary (comoving with the frame) clock minus the square of the spatial distance traversed by the moving clock. This equation holds for every clock in every frame including the frame's stationary clocks whose relative velocity is zero. The greater distance traveled in space, the less distance traveled in time.

Rewriting this equation we see that $dt = \sqrt{(d\tau^2 + dx^2)}$. The square root of the sum of the squares of elapsed time (distance through time) and distance traveled through space of all clocks viewed from a frame is equal to the elapsed time on a clock moving with the frame. Or more simply the vector sum of velocities in space and time of all objects viewed from a frame is identical. Everything in the universe viewed from any frame continually moves the same distance through combined space and time.

Now if everything in a frame is continually moving the same distance through combined space and time then everything must necessarily be moving at the same velocity through combined space and time.

This holds for the clocks of everything in every frame including light itself whose intrinsic velocity in time is zero. This is why light continually moves at the speed of light just through space.

Now a fundamental principle of relativity is the speed of light is the same in all frames. Thus since everything moves through spacetime at the speed of light in every frame, and the speed of light is the same in all frames, it follows that everything in the universe has an identical combined velocity through space and time equal to that of light independent of any frame view. Thus everything in the universe continually moves the same distance at the same velocity

through combined spacetime as light. Only the distribution of this speed of light spacetime velocity to time or space depends on the frame from which it's viewed.

Thus if an object has no spatial velocity then it continually advances through time at the speed of light, but if it has spatial velocity its velocity through time is reduced so their vector sum always remains equal to the speed of light.

So as you sit here reading this on Earth, with only a negligible spatial velocity, you are actually hurtling through time at the speed of light! This is what we continually experience as the passage of time. We continually experience this fundamental process of the universe within us as a fundamental experience of our own existence.

THE UNIVERSAL PRESENT MOMENT

Now in every frame all clocks, even if they read different times, all exist in a single common present moment. If one of two twins leaves Earth, travels through space with high spatial velocity, and returns to Earth, he will return in the exact same current present moment as his Earth bound twin. And this is true no matter how long or short his trip was or how different their clocks read.

And the current present moment of all frames is also the same. This is because the current present moment is that in which all objects in the universe have traveled the same distance through spacetime. And we saw that everything in all frames continually travels the same spacetime distance at the same spacetime velocity as light in all frames since the speed of light is the same in all frames.

Thus the current present moment of all frames is the same, and is the current present moment of the entire universe. There is always a single universal current present moment across the entire universe that is shared by everything in the universe. The entire universe has a single common universal 'Now'.

The current universal present moment is the common identical distance that everything in the universe has traveled through spacetime. The current spatial locations can vary, and individual clock times can vary, but the total spacetime distance traveled is the same for everything in the universe because everything in the universe continually travels the same distance through spacetime at the same velocity as light does and the speed of light is the same in all frames. This is the current universal present moment shared by everything in the universe because it's where everything actually is, and where everything actually exists. It's the current common 'Now' of the entire universe, and it's the actual universe that currently exists. Our experience of the present moment is our conscious experience of existence within the actual presence of the universe that actually exists right now.

Now in every current universal present moment every clock in the universe has its own current proper time reading. Thus there is a current proper time correlation among all the clocks in the universe, no matter what times they read or what their relative time dilations are. This unique

proper time correlation among all clocks exists but is in general unobservable due to the different time dilations of relatively moving clocks among different observers. However if the particulars of relative motion are known this correlation can be calculated by determining when clocks have traveled the same spacetime distances.

Since the total spacetime distance traveled is invariant this gives us a precise scientific definition of what the current present moment is, namely the identical spacetime distance everything in the universe has currently traveled in combined space and time. It's well known that individual distances in space and time can be frame dependent, but the total spacetime distance everything travels is identical, invariant, and equal to the distance light travels, which is the same in all frames. This appears to be the first precise scientific definition of the current present moment, which so far as I know is original with me.

TIME TRAVEL

Since only a current universal present moment exists, time travel to actual pasts or futures is impossible because neither exists. The only type of *time travel* possible is traveling at different proper time rates within the universal present moment by traveling at different velocities through space.

So no going back to watch dinosaurs, and no going back to kill your parents before you were born. The past is gone forever, and the future has not yet been created. However it is possible for a space traveler who lived in ancient Greece or anytime in the past to arrive here on Earth in the present with video records not much older than when he left. And it is possible for us to leave now on a space voyage and return in the current universal present moment of a far distant future not much older than when we left long after the current present moment of today has vanished. We would remain in the common current universal present moment during the entire trip but traveling at a much slower clock rate for a much longer time.

The slowing of time with relativistic spatial velocities also means that space travel to other planets or even distant galaxies is theoretically possible within a single human lifetime assuming even just a constant 1g acceleration, equal to that of Earth's gravitation.