A capacitor connected to a constant voltage source.

Short circuit …a device which **CAN TAKE ANY CURRENT AT ZERO VOLTAGE.**
Open circuit…a device which **CAN TAKE ANY VOLTAGE AT ZERO CURRENT.**
Voltage source.. a device that can supply constant voltage at any current.
Current source.. a device that can supply constant current at any voltage.

But there is **MUCH** more to it, as an ideal voltage source should have an **INTERNAL SHORT CIRCUIT** plus a **VOLTAGE SOURCE** as otherwise every time it supplies current there will be a voltage drop a its output terminals.

An ideal current source should have an **INTERNAL OPEN CIRCUIT** plus a **CURRENT SOURCE** as otherwise when there is a load connected the current would change. There is much more than this as one would need to explain how come a current would flow in an open circuit that is contained in a **CURRENT GENERATOR**. Well the manner in which a current generator using an internal open circuit operates in a different manner from a a voltage generator which uses an internal short circuit as found in copper(rotary generators) and chemical(batteries). A current generator uses a **VERY POWERFUL GUN** to shoot electrons through an **OPEN CIRCUIT**, an insulator, vacuum, or a bulk semiconductor where the electrons that flow must not touch one another as they would destroy the insulation or the open circuit effect in the open circuit. No arc must ever be produced within the bulk material of the insulator making the final path of a current generator. Please look up valves, BJT, FETs as these may all be used as current generators ONLY **BECAUSE THEY HAVE THEIR OUTPUT PATH AT VERY HIGH IMPEDANCE SIMULATING AN OPEN CIRCUIT** which is very necessary to claim that one has a current generator.

So when a capacitor is connected to a Voltage source with zero output impedance and a powerful potential source the short circuit presented by the capacitor would mean that there are **TWO SHORT CIRCUITS** applied to the voltage source so an **INFINITE** current would flow. The voltage across the capacitor is not commanded by the current flow but by the voltage source. Please understand this. Everything that is connected to an Ideal Voltage source, the voltage is commanded by the voltage source while the current is commanded by the Load. When a circuit is connected to an Ideal Current source, the current flow is commanded by the current source while the voltage is commanded by the Load. Here you may find it difficult to understand that when using a **CURRENT SOURCE** feeding an open circuit, **THE CURRENT SOURCE STILL COMMANDS THE SITUATION AND CURRENT STILL FLOWS** producing an infinite voltage, while if a V**OLTAGE SOURCE IS CONNECTED TO A SHORT CIRCUIT**, there will be a voltage across a short circuit producing an **INFINITE CURRENT** passing through a short circuit to make up the voltage at the terminals of an ideal voltage source. It may sound a like a fairy tale but we are dealing with **IDEAL SITUATIONS** so anything which does not sound right may in fact be right.
Well, knowing this it is now clear that when an ideal voltage source is connected to a capacitor, the voltage across the capacitor is commanded by the voltage source and not the current in the capacitor so it goes **BOOM**. instant voltage appears across the capacitor with an infinity current passing the capacitor have no say in it and if it cannot withstand that punishment it will blow up…. that is what happens. No one plays about with an **IDEAL VOLTAGE SOURCE** at infinite current, not even a

capacitor, it is not that it decides its voltage but the voltage source and if it does not like it, it will suffer.

When a current source is applied to a capacitor , the current flow is commanded by the current source as that wonderful and magical open circuit in the last path of a current source is there to see that the current in a current source remains constant. As the current goes through the capacitor, it " charges" the capacitor and the voltage will start rising depending on the rate of the current flow to time. If the capacitor is left charging with a DC current from a current source with a **well insulated open circuit in it**, then the voltage at the capacitor will reach a **very high voltage, even close to infinity**, where an ideal current source can take this but a capacitor cannot so it may blow up through insulation breakdown.

No one plays about with current generators when they reach a high voltage output, as that internal open circuit is pretty good you know. It is not so good in Valves and transistors as in BJTs and FETs as it is about 50,000 and 150,000 ohms accordingly, but engineers are beggars and not choosers but still we do pretty well with what nature gives as as ……well we just know what we are doing through understanding such **unbelievable facts** that a short circuit and an open circuit as applied in ideal voltage and current sources where we can have a voltage across a **short circuit,** and a current through an **open circuit**. That is perhaps the most important issue to learn in all branches of Electrical Engineering, whose phenomena passes through **copper as short circuits and space as open circuits, its not rocket science.**

Then the **STEAP TPU** was born, which is as close to ideal as one can get in our present time, and with the materials that we have available to us.