Seminar Report

On

"STARLINK-INTERNET"

Submitted for partial fulfillment of requirement for the degree of

BACHELOR OF ENGINEERING

(Computer and Science)

Submitted By

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Certificate

This is to certify that the Seminar entitled

"STARLINK-INTERNET"

Is a bonafide work and it is submitted to the Sant Gadge Baba Amravati University, Amravati.

By

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For the partial fulfillment of the requirement for the degree of Bachelor of Engineering in Computer and Science, during the academic year 2021-2022

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Introduction

SpaceX:

SpaceX was formed by entrepreneur Elon Musk in the hopes of revolutionizing the aerospace industry and making affordable spaceflight a reality. The company entered the arena with the Falcon 1 rocket, a two-stage liquid-fueled craft designed to send small satellites into orbit. The Falcon 1 was vastly cheaper to build and operate than its competitors, a field largely populated by spacecraft built by publicly owned and government-funded companies such as Lockheed Martin and Boeing. Part of the rocket's cost-effectiveness was made possible by the SpaceX-developed Merlin engine, a cheaper alternative to those used by other companies. SpaceX also focused on making reusable rockets (other launch vehicles are generally made for one-time use). In March 2006 SpaceX made its first Falcon 1 launch, which began successfully but ended prematurely because of a fuel leak and fire. By this time, however, the company had already earned millions of dollars in launching orders, many of them from the U.S. government. In August of that year SpaceX was a winner of a NASA competition for funds to build and demonstrate spacecraft that could potentially service the ISS after the decommissioning of the space shuttle. Falcon 1 launches that failed to attain Earth orbit followed in March 2007 and August 2008, but in September 2008 SpaceX became the first privately owned company to send a liquid-fueled rocket into orbit. Three months later it won a NASA contract for servicing the ISS that was worth more than $1 billion.

In 2010 SpaceX first launched its Falcon 9, a bigger craft so named for its use of nine engines, and the following year it broke ground on a launch site for the Falcon Heavy, a craft the company hoped would be the first to break the $1,000-per-pound-to-orbit cost barrier and that might one day be used to transport astronauts into deep space. In December 2010 the company reached another milestone, becoming the first commercial company to release a spacecraft—the Dragon capsule—into orbit and successfully return it to Earth. Dragon again made history on May 25, 2012, when it became the first commercial spacecraft to dock with the ISS, to which it successfully delivered cargo. In August that year, SpaceX announced that it had won a contract from NASA to develop a successor to the space shuttle that would transport astronauts into space.

The Falcon 9 was designed so that its first stage could be reused. In 2015 a Falcon 9 first stage successfully returned to Earth near its launch site. Beginning in 2016, SpaceX also began using drone ships for rocket stage landings. A rocket stage that had returned to Earth was successfully reused in a 2017 launch. That same year, a Dragon capsule was reused on a flight to the ISS. The Falcon Heavy rocket had its first test flight in 2018. Two of the three first stages landed successfully; the third hit the water near the drone ship. That Falcon Heavy did not carry a satellite but instead placed into orbit around the Sun a Tesla Roadster with a mannequin in a space suit buckled into the driver's seat.


SPACEX
Ken Kremer
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The first crewed flight of a Dragon capsule to the ISS launched on May 30, 2020, with astronauts Doug Hurley and Robert Behnken. SpaceX also announced the successor to the Falcon 9 and the Falcon Heavy: the Super Heavy–Starship system (originally called the BFR [Big Falcon Rocket]). The Super Heavy first stage would be capable of lifting 100,000 kg (220,000 pounds) to low Earth orbit. The payload would be the Starship, a spacecraft designed for several purposes, including providing fast transportation between cities on Earth and building bases on the Moon and Mars. SpaceX planned to use the Starship for a flight around the Moon carrying Japanese businessman Maezawa Yusaku and several artists in 2023 and to launch settlers to Mars in the mid-2020s.

What is SpaceX ?

SpaceX is an American aerospace company founded in 2002 by Elon Musk that helped usher in the era of commercial spaceflight. Its name in full is Space Exploration Technologies Corporation.

Where is SpaceX located?

SpaceX is headquartered in Hawthorne, California. Its other sites include launch facilities in Cape Canaveral, Florida, and at Vandenberg Space Force Base in California.

What was SpaceX first rocket ?

SpaceX's first rocket was the Falcon 1, a two-stage liquid-fueled craft designed to send small satellites into Earth orbit. The Falcon 1 was significantly less expensive to build and operate than its competitors partly because of the SpaceX-developed Merlin engine. A Falcon entered Earth orbit successfully in 2008 for the first time.

Why was SpaceX created ?

In 2002 SpaceX was created by entrepreneur Elon Musk, whose stated goals were to revolutionize the aerospace industry and to make spaceflight more affordable.

Is a spaceX is public company ?

SpaceX is not a public company. Elon Musk suggested that the long-term goal of achieving regular flights to Mars could conflict with the short-term goals of making profits for public investors. Instead, SpaceX is funded by the U.S. government (National Aeronautics and Space Administration) and by institutional investors.

STARLINK

What is Starlink Internet by SpaceX

When you think of billionaire entrepreneur Elon Musk, chances are good that you think of his electric car company Tesla, his space exploration venture SpaceX or his stint hosting Saturday Night Live (to say nothing of his history of stirring up controversy on social media or smoking weed with Joe Rogan). Maybe you just know him as one of the richest people on Earth.

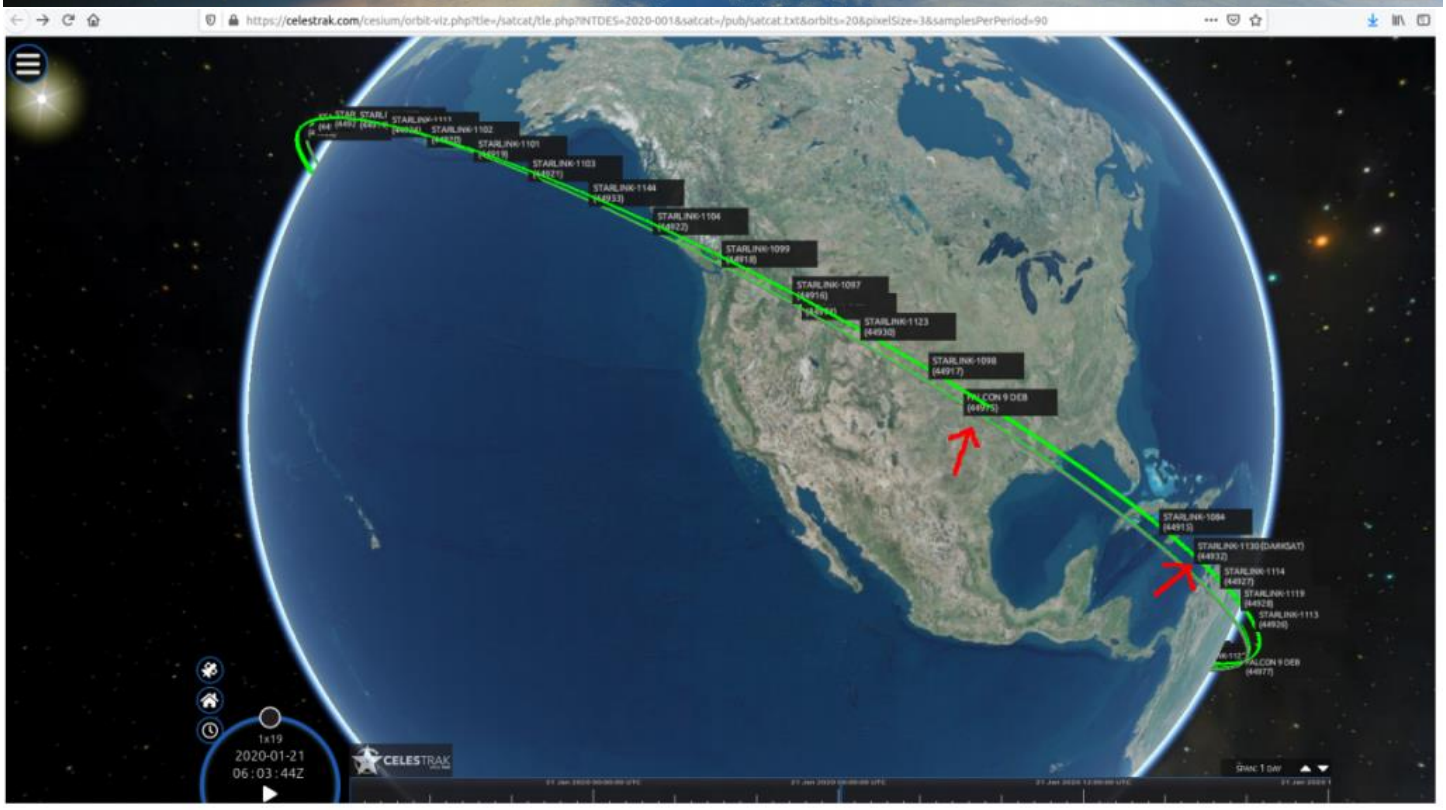
Something you might be less familiar with is a venture called Starlink, which aims to sell internet connections to almost anyone on the planet by way of a growing network of private satellites orbiting overhead.

After years of development within SpaceX -- and securing nearly $885.5 million in grant funds from the Federal Communications Commission at the end of 2020 -- Starlink picked up the pace in 2021. In January, after three years' worth of successful launches, the project surpassed 1,000 satellites delivered into orbit. And by June, SpaceX said the number was roughly 1,800. In February, Musk's company disclosed that Starlink was serving more than 10,000 customers. Now, after expanding preorders to even more potential customers and exploring the possibility of providing in-flight Wi-Fi for passenger aircraft, Musk says that Starlink has shipped more than 100,000 satellite internet terminals to customers in 14 countries.

SpaceX said that it expected Starlink to reach global serviceability sometime in fall 2021 -- though regional availability will depend on regulatory approval. During a talk at Mobile World Congress in June 2021, Musk told an audience that Starlink would be available worldwide except at the North and South Poles starting in August. In September, Musk tweeted that Starlink would exit its initial beta phase in October, which indicates that the service is continuing to ramp up and expand -- though the budding broadband provider faces a backlog of prospective customers waiting to receive equipment and start service.

Starlink isn't without its controversies. Members of the scientific community have raised concerns about the impact of Starlink's low-earth orbit satellites on night sky visibility. Meanwhile, satellite internet competitors including Viasat, HughesNet and Amazon's Project Kuiper have taken notice of Starlink's momentum, too, prompting plenty of regulatory jousting and attempts to slow Musk down.

All of that makes Starlink well worth keeping an eye on in 2021. For now, here's everything you should know about it.



What is Starlink?

Starlink aims to bring high-speed internet to regions where connectivity has typically been a challenge.

Unbounded by traditional ground infrastructure, Starlink can deliver high-speed broadband internet to locations where access has been unreliable or completely unavailable.

The price for the internet service is an upfront cost of $499 (Rs 37,000 approx) for hardware and a monthly cost of $99 (Rs 7000 approx) for internet service.

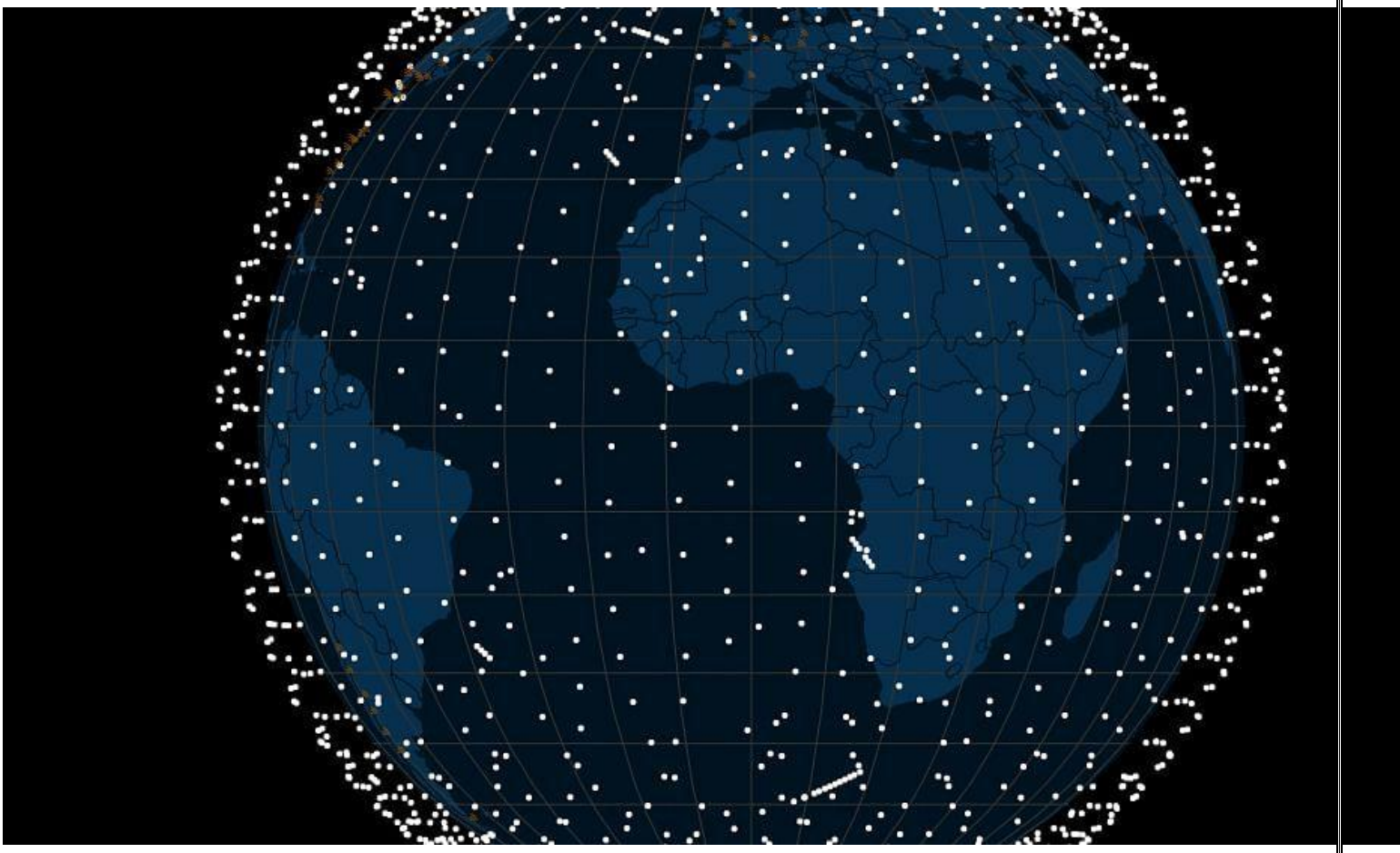
How does it work?

Starlink uses a network of low orbital satellites which were put in space by a SpaceX Falcon 9 rocket.

With lower satellites, the latency is reduced, which helps improve online buffering, gaming and video calling quality.

Interestingly, the working of Starlink is quite similar to TV cable services. To install Starlink, a dish has to be mounted by the user which receives signals from what is called a mini satellite.

As of June 2021, there are over 1,500 Starlink active satellites, making Starlink the largest satellite constellation around Earth.



Live Starlink Satellite Map. Whit dot represents Starlink satellites around the globe. (Photo: Satellitemap.space)
SpaceX now owns more than half of all active satellites circling our planet.

How is Starlink Different from Traditional Internet?

What sets Starlink apart from traditional internet services we have in our households is that it is a satellite-based internet service.

What this means is that Starlink requires an unobstructed view of the sky in order to function.

Most of the internet users in India rely on fibre-based technology, which gives higher speed as compared to satellite internet.

However, what gives Starlink's internet services an edge is that it does not need any wired connections, and can be easily accessed from anywhere around the globe.

How Does Starlink Compare With 5G?

5G has an edge over Starlink in terms of reliable service and speed, because it’s built on top notch cellular infrastructure.

However, in terms of connectivity, people living in rural towns and cities will have a better chance with Starlink as it does not require an infrastructure like cellular towers in the case of 5G.

The major problem with Starlink is when the load increases on its network.

National Rural Telecommunications Cooperative CEO Tim Bryan during a recent press conference said, “I have no doubt that the Starlink constellation could be successful in some areas, particularly over things like the deep blue seas. I struggle to see how it’s going to reliably deliver 100 megabit service to the hundreds and thousands of customers in the census block groups it bid for.”

However, this won't be a problem with 5G cellular networks, as 5G is expected to support up to 1 million connected devices per 38 square miles, 5G will be able to carry a lot more data and transfer it much faster than Starlink's internet service.

What Regulatory Hurdle is Starlink Facing in India?

The government is currently assessing if Starlink beta service will violate any provision of the Indian Telegraph Act of 1885, the Indian Wireless Telegraphy Act of 1933, India’s satcom policy of 2000 and the Information Technology (IT) Act of 2000.

A senior government official told *The Economic Times* that Starlink does not “immediately appear” to violate the Section 4 of the Indian Telegraph Act as SpaceX is yet to establish, maintain or work a telegraph in Indian jurisdiction.

A 'telegraph' under the Act, is any instrument used for transmission or reception of signals, images, data, and sounds/intelligence by wire or other electro-magnetic emissions.

The Department of Telecommunications (DoT) is yet to firm up its final view regarding the Starlink offering.

Future Scope

Starlink says users can expect to see download speeds **between 100-to-200 Mbps**. As the company launches more satellites and installs more "ground stations" — which are needed to provide the internet service to users — Starlink promises speed and latency will improve

Pros of Starlink Internet.

Here are a few pros of the Starlink internet.

Faster internet.

Starlink internet is faster than traditional satellite internet. Starlink is so fast that comparing its speed with conventional satellite internet is absurd.

Why is Starlink faster than conventional satellite internet?

The answer lies in mathematics. Except for Starlink, other providers use Geostationary satellites to beam down the internet. Geostationary satellites have an operational altitude of 35,000 km. When a user sends a signal, the electromagnetic wave from the user terminal goes to the geostationary satellite. From there, the response comes back to the user receiver end. So, the total round trip for internet is 35,000 km + 35,000 km = 70,000 km.

An electromagnetic wave travels at the speed of light (about 3,00,000 km per second). So, total roundtrip time for satellite internet is 70,000 km / 3,00,000 km-per-sec = 233 ms. This time is called latency. The higher the latency, the slower the internet. Though the latency is theoretically 233 ms, in real life, due to various system delays, this latency

is well over 300 ms. Depending on where you live (for example – Guam), this latency could be as high as 1500 ms.

On the other hand, cable internet has latency between 20 ms to 40 ms. This comparison shows that typical satellite internet is at least 10 times slower than cable internet. There's nothing a Geostationary satellite can do to increase the internet speed.

Let's calculate the latency for Starlink satellite internet. Starlink has an operational altitude of only 550 km above the earth. So, a roundtrip for internet signal from Starlink dish to Starlink satellite to Starlink dish is 550 km + 550 km = 1,100 km. So, roundtrip time is 1,100 km / 3,00,000 km-per-sec = 3.67 ms. Though the latency is theoretically 3.67 ms, in real life, due to various system delays, this latency is around 20 to 30 ms. In conclusion, Starlink internet is faster than conventional satellite internet, and cable internet. Furthermore, Starlink's internet is fast enough for competitive gaming.

Cheap.

Starlink's internet price is competitive. It is cheaper than cable and satellite internet in rural and suburban areas. In many locations, suburban users pay the same amount as their city counterparts but receive far slower internet. For example, in cities, sometimes people pay $50-$60 for 100/10 internet (100 Mbps down, 10 Mbps up). But in rural areas, users pay more than $100 but receive only 10/1 internet (10 Mbps down, 1 Mbps up). Whereas, Starlink charges only $99 for unlimited speed.

Starlink is available everywhere.

It does not matter wherever you live, Starlink internet is available at your location. Starlink covers the whole world, from Antarctica to the middle of the ocean. Thousands

of low earth satellite orbiting above us. Its signal reaches every part of this world. Whether you are in a remote suburb, middle of the ocean, or the sky, Starlink internet is available.

On the contrary, cable internet (for example, Spectrum) is not available everywhere. Except for major cities, their service is limited. Rural cable internet speed is very disappointing and costly. It is also valid for cellular internet. Cellular internet is not that great for media consumption — such as YouTube, Netflix, Hulu.

Easy to install.

Starlink dish is easy to install. After order confirmation, SpaceX will ship Starlink package containing a dish, WiFi router, mounting brackets (according to your choice), and necessary cables. The dish installation does not require any specialized knowledge or skill. Just find a place where you have a clear view of the sky. Install the mounting bracket and fasten your Starlink dish, pointing towards the sky. After powering it up, the dish will reorient by itself for optimal signal. Installation can't get easier than this.

ADVERTISING

Faster disaster recovery.

Whenever disaster strikes a region, it takes days, if not weeks, to restore internet service. Storms, tornadoes, wildfires, or flood can severely damage internet cable. After a severe storm, fixing those cables not only expensive but also time-consuming.

But, Starlink internet does not suffer any internet outage due to earth disaster. As soon as the sky clears up, you can receive Starlink internet. It has thousands of base stations

throughout the world. Even if some base station goes down due to bad weather, other base stations will provide internet to Starlink satellites.

Reliable.

Starlink provides a reliable internet. Conventional satellite internet providers only operate a handful of geostationary satellites. Due to the high altitude of geosynchronous orbit, their internet is very unreliable and spotty.

Superior portability.

Starlink internet has better portability than cable internet. Though cellular is portable, it's service is not available everywhere. Traditional satellite internet is also as mobile as Starlink, but it provides inferior internet speed with high latency and poor service.

Cons of Starlink Internet.

There are several disadvantages to the Starlink internet. But none of these are severe enough to avoid this excellent service.

Slower internet in cities.

Starlink has one major disadvantage over cable internet. At any given time, Starlink has a fixed number of satellites over a specific location. All the users in that particular spot share the same bandwidth. So, in cities, there are more people to share the same bandwidth than in rural areas. Thus, Starlink's speed in cities will be slower compared to suburban areas.

Hardware installation.

Hardware installation could be an issue for many users. A typical cable company or satellite internet company offers a hardware installation service. But, Starlink does not have this hardware installation service. So, a user has to install the Starlink dish by themselves or hire someone to do it. Depending on places, it could be tough to get an installer.

Moreover, Starlink needs a clear view of the sky to receive uninterrupted internet. If you live in a condominium or high rise building, installing a Starlink dish could be challenging. Depending on places, you may need to install the hardware on top of your house roof. It could be impossible in cities if you are a renter, and your landlord does not allow you to install the dish.

Not portable.

Starlink is not portable compared to cellular internet. We can take our phone freely anywhere and receive the internet. But the Starlink dish is not portable at all. Though it is possible to install the dish over RV or Boat, it is not compact enough to carry freely.

Service disruption during lousy weather.

Satellite service disruption during rain, storm, or solar storm is ordinary. However, that's not a severe issue. This kind of disruption is also real for cable internet.

Conclusion:

Every technology has pros and cons. However, if the advantages of a technology outweigh the cons, we should embrace that tech. Starlink has more benefits than

conventional satellite, cellular and cable internet. That's why we should embrace this internet instead of shunning it.

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