Assignment 2 – The Need for IPv6

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1. IPv4 Exhaustion: A Growing Concern

When IPv4 was introduced in the 1980s, its **4.3 billion** unique IP addresses seemed more than enough. However, with the explosion of the internet, smartphones, smart appliances, and IoT devices, this supply quickly started running out.

Countries with large populations, such as **India and China**, and rapidly developing tech hubs in the **Middle East**, have been hit hardest by this shortage. To work around the issue, many networks rely on **Network Address Translation (NAT)**, which allows multiple devices to share a single IP address. While this extends IPv4's usability, it also adds complexity, reduces performance, and creates security vulnerabilities.

Simply put, **the modern internet has outgrown IPv4**, making the shift to IPv6 essential.

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2. Why IPv6 is the Solution

IPv6 was specifically designed to overcome IPv4's limitations. It uses a **128-bit address system**, which allows for **3.4×10^{38} unique IP addresses**—enough to assign a unique address to every device in existence, with plenty of room for future growth.

This vast capacity makes **IPv6 ideal** for handling the increasing number of connected devices, from **smart homes and wearable tech to autonomous vehicles and industrial IoT systems**. Unlike IPv4, IPv6 **removes the need for NAT**, making networks **simpler, faster, and more secure**.

IPv6 is **future-proof**, ensuring the internet continues to evolve and scale efficiently.

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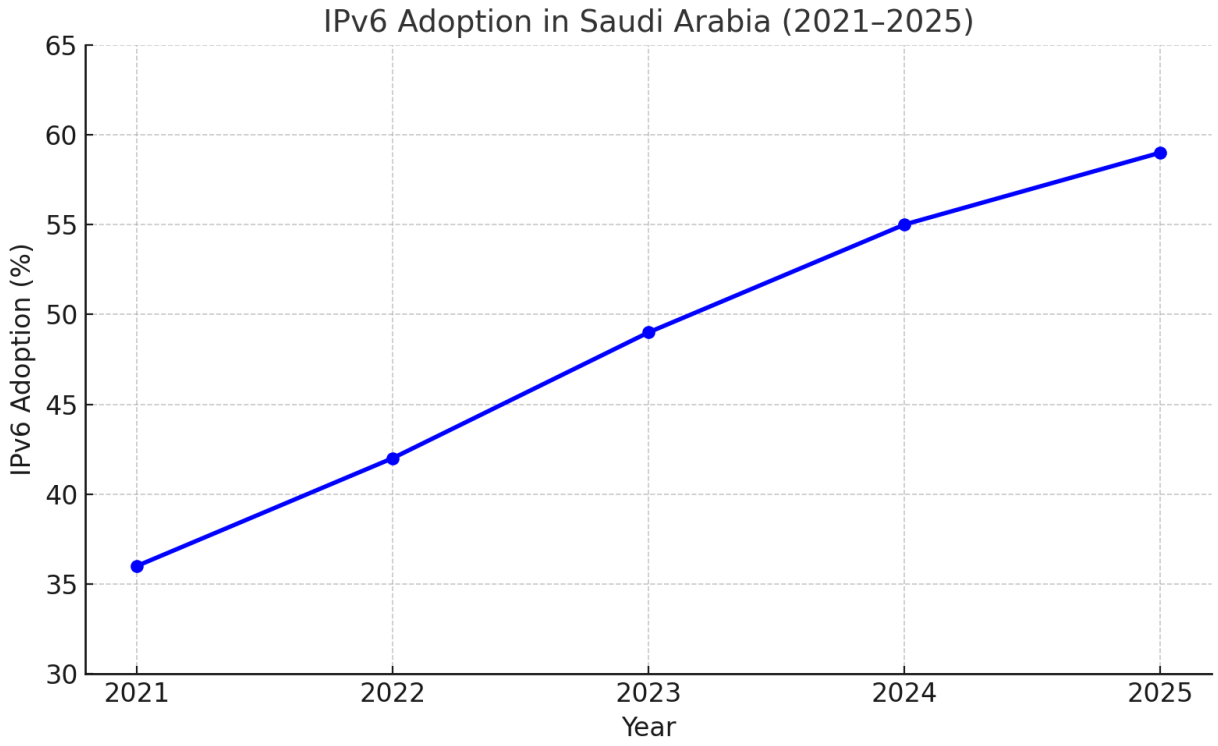
3. IPv6 Adoption in Saudi Arabia

As of **2025**, approximately **59%** of internet users in **Saudi Arabia** are using IPv6, according to data from the **Internet Society Pulse** and the **Communications, Space & Technology Commission (CST)**.

This represents a significant increase from **36% in 2021**, thanks to efforts by local **internet service providers (ISPs)** and **government initiatives** aimed at accelerating IPv6 deployment.

IPv6 Adoption in Saudi Arabia (2021–2025)



Year	IPv6 Adoption (%)
2021	36%
2022	42%
2023	49%
2024	55%
2025	59%

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4. Challenges & Solutions in IPv6 Adoption

Challenge 1: Outdated Systems

Many businesses and organizations still use **legacy hardware and software** that only support IPv4.

Solution: A **phased upgrade strategy** can help ease the transition. Companies can implement **dual-stack networks** (which support both IPv4 and IPv6) while gradually upgrading their infrastructure. Additionally, **training IT staff** on IPv6 deployment is crucial.

Challenge 2: Knowledge Gap Among IT Professionals

Many **network engineers and IT professionals** have limited experience with IPv6, which slows down adoption.

Solution: Investing in **certified IPv6 training programs** and integrating IPv6 education into **university IT and computer science courses** will equip professionals with the necessary skills to manage the transition effectively.

References

1. Internet Society Pulse. "Country Report: Saudi Arabia." https://pulse.internetsociety.org
2. CST. "Saudi Arabia among Top Ten Countries for IPv6 Adoption." https://www.cst.gov.sa
3. Google IPv6 Statistics. https://www.google.com/intl/en/ipv6/statistics.html