NATIONAL COMMUNICATIONS AUTHORITY

National IPv6 Transition Strategy for

Federal Republic of Somalia

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NATIONAL COMMUNICATIONS AUTHORITY

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Foreword by The Minister

I applaud the National Communications Authority, the ITU, and all stakeholders for their dedication to developing Somalia's IPv6 transition strategy. Through strong partnerships, commitment, and strategic execution, this initiative will significantly improve Somalia's digital capabilities, promote innovation, and accelerate economic growth.

Somalia's digital transformation is at a crucial juncture, fueled by the increasing demand for internet connectivity and digital services that are shaping the country's ICT development agenda. Somalia must adopt proactive policies and strategies to keep up with advancing technology that ensures internet sustainability, security, and scalability. A critical step in this process is the transition from IPv4 to IPv6. This shift is essential to address the exhaustion of IP addresses, enhance network performance, and support emerging technologies like 5G and the Internet of Things (IoT).

The National IPv6 Transition Strategy represents a significant milestone in Somalia's digital journey. Developed by the National Communications Authority (NCA) in collaboration with the International Telecommunication Union (ITU) and various stakeholders, this strategy provides a structured approach to transitioning to IPv6. It aligns with the National ICT Policy and Strategy (2019–2024) and emphasizes Somalia's commitment to leveraging technology for socioeconomic development.

The transition to IPv6 is not just a technical requirement but a strategic catalyst for national development. The limitations of IPv4 create significant barriers to expanding internet services in Somalia, where digital connectivity is increasingly vital for education, business, governance, and public services. IPv6 provides a long-term solution by offering a vastly expanded address space, improved security features, and enhanced efficiency in internet operations. This strategy is essential for Somalia to achieve its national goal of 25% internet penetration by 2030.

Recognizing the importance of capacity building, this strategy prioritizes training, awareness campaigns, and stakeholder engagement to equip local institutions with the necessary skills for IPv6 deployment. Additionally, the Somali government is dedicated to developing suitable regulatory frameworks and technical standards to facilitate a smooth and coordinated transition. Establishing an IPv6 Task Force, collaborating with regional organizations like AFRINIC, and participating in international IPv6 initiatives will be vital for the success of this strategy.

The success of this transition relies on collaboration among all stakeholders, including government institutions, internet service providers (ISPs), academic institutions, and the private sector. I encourage all partners to actively engage in this transformative process to ensure that Somalia's internet infrastructure remains resilient, secure, and able to support future innovations.

H.E. Mohamed Adam Moalim Ali

Minister of Communications and Technology
Federal Republic of Somalia

Preface By Director General

FOREWARD BY DIRECTOR GENERAL

In the face of the exponential growth in demand for internet access and digital services across both the public and private sectors, the National Communications Authority (NCA) of Somalia is dedicated to fostering the advancement of the ICT sector within the nation. This commitment includes formulating regulations, strategies, and guidelines to support this crucial sector's development. In alignment with the Federal Government of Somalia's strategic vision to position Somalia as a regional frontrunner in the digital economy, the NCA, in partnership with the International Telecommunication Union (ITU), has meticulously crafted the National IPv6 Transition Strategy. This strategy is meticulously designed to navigate the complexities associated with the transition to IPv6, to champion the widespread adoption of IPv6, and to expedite the transition process.

The formulation of the National IPv6 Transition Strategy is a testament to our commitment to aligning with the National ICT Policy and Strategy 2019–2024. This policy is the culmination of extensive consultations and a rigorous adherence to international best practices. It aims to foster enhanced cooperation and cohesion between the public and private sectors while bolstering centralized ICT coordination. By providing a robust framework, this policy endeavors to leverage ICT as a pivotal tool for social and economic enhancement for the Somali population. It aims to propel Somalia towards accelerated socioeconomic advancement and attaining the Sustainable Development Goals by facilitating its digital evolution into a knowledge-based and inclusive society.

Developing and implementing a national IPv6 Transition Strategy is pivotal to reinforcing Somalia's digital transformation. The NCA is confident that the execution of this IPv6 strategy will offer clear and actionable guidance for local stakeholders on the transition towards IPv6, thereby ensuring that we meet our national objective of achieving a 25% internet penetration by the year 2030.

Mustafa Yasin Sheikh

Director General

National Communications Authority

Federal Republic of Somalia

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LIST OF ABBREVIATIONS

AFRINIC	African Network Information Centre
APNIC	Asia-Pacific Network Information Centre
BDT	Telecommunication Development Bureau
ccTLD	Country Code Top Level Domain
CITC	Communications and Information Technology Commission
CNE6	Certified Network Engineer for IPv6
CNP6	Certified Network Programmer for IPv6
CSA6	Certified System Administrator IPv6
CSE6	Certified Security Engineer for IPv6
CWG	Council Working Group
DHCP	Dynamic Host Configuration Protocol for IPv6
DNS	Domain Name Service
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
H/W	Hardware
IANA	Internet Assigned Numbers Authority
ICANN	Internet Corporation for Assigned Names and Numbers
ICT	Information Communication Technology
IETF	Internet Engineering Task Force

IoT	Internet of Things
IOS	Input Output System
IP	Internet Protocol
IPSec	Internet Protocol Security
IPv4	Internet Protocol Version Four
IPv6	Internet Protocol Version Six
ISP	Internet Service Provider
IT	Information Technology
ITU	International Telecommunication Union
KPI	Key Performance Index
LACNIC	Latin American and Caribbean Internet Address Registry
MCIT	Ministry of Communications and Information Technology
NCA	National Communication Authority
R&D	Research and Development
RIR	Regional Internet Registries
SA	Saudi Arabia
SLA	Service Level Agreements
SO	Somalia
Sov6TF	Somalia IPv6 Task Force
SomaliREN	Somali Research Education Network
STC	Saudi Telecom Company
S/W	Software
SWOT	Strength, Weakness, Opportunity and Threat
TTT	Train The Trainer
TSB	Telecommunication Standardisation Bureau
UN	United Nation
USA/US	United States of America
USD	United States Dollar

1. Introduction

The “IPv6 Strategy For Somalia Report” represents a significant milestone in Somalia’s technological advancement and internet infrastructure development. This comprehensive document, prepared by the National Communications Authority of Somalia in partnership with the International Telecommunication Union, provides a strategic framework for transitioning to the IPv6 internet protocol. This transition is crucial for overcoming the limitations imposed by IPv4 exhaustion, ensuring the scalability of internet services, and facilitating the country’s readiness for future technological evolutions.

The report explores an in-depth analysis of Somalia’s current internet landscape, highlighting the pressing need to adopt IPv6 to accommodate the growing demand for internet services and enhance the quality and reliability of these services nationwide. It sets forth a national internet penetration target of 25% by 2030, showcasing the government’s commitment to leveraging technology for economic and social development. The strategic outline includes critical milestones and initiatives, such as establishing an IPv6 task force to steer the country towards achieving this ambitious goal.

Furthermore, the strategy emphasizes the development of comprehensive regulatory guidelines and policies to facilitate the smooth transition to IPv6. It outlines a phased implementation approach, prioritizing establishing the necessary infrastructure, capacity building, and public awareness campaigns. This multifaceted strategy ensures that all stakeholders, including government agencies, internet service providers, and end-users, are well-informed and prepared for the transition, thereby minimizing potential disruptions to internet services.

In essence, the “IPv6 Strategy document” is not just a blueprint for technological migration but a visionary document that anticipates the future needs of Somalia’s digital landscape. It underscores the critical role of collaborative efforts between the government, private sector, and international partners in achieving a successful transition to IPv6. This strategic initiative marks a pivotal step towards enhancing Somalia’s internet connectivity, supporting digital inclusion, and fostering economic growth through technology-driven solutions.

2. Assess the current situation in the direction of the transition to IPv6

2.1 The need to move to IPv6

The Internet plays a vital role in the growth of ICT. The Internet is, without a doubt, the quickest and most effective means of communication, allowing individuals worldwide to communicate with each other.

IPv4 is an abbreviation for Internet Protocol version 4. The fourth version of the Internet protocol (IP) is a popular protocol for Internet communication. An IPv4 address is a 32-bit identifier that identifies a network device. As of February 2011, IANA reported APNIC was the first RIR runout of the IPv4 address and will followed by other RI₹ Internet Service Providers (ISPs) and Telecom Operators will encounter significant challenges in getting IPv4 addresses as the number of Internet users grows, as will their expectations for increased capacity and cyber services. It should be noted that some devices, such as (Network Address Translator (NAT), Dynamic Allocation, and Classless Inter-Domain Routing (CIDR)), were used to extend the life of the fourth version, but using these solutions is not good in the long run because it affects the quality of services and the level of security in the network, in addition to increasing operational burdens and thus increasing service costs.

The Internet Engineering Task Force (IETF) created IPv6 to address the issue of IPv4 exhaustion. IPv6 is a 128-bit address with a 2128-bit address space, which is significantly larger than IPv4. There are 340,282,366,920,938,463,4 63,374,607,431,768,211,456 (340 undecillionths) unique IPv6 addresses. Although the limited space of the IPv4 addresses is the primary reason for the construction of the new version, it is not the only reason for the transition towards implementing IPv6. The new protocol's designer drew on years of experience using IPv4 to address the Internet, so they preserved all of IPv4's strengths while adding numerous features that assist the ongoing development of cyber services. The most important of which is the self-configuration feature, which allows companies to deploy a large group of devices in one network and manage an effective connection in terms of performance and optimal utilization of resources, thus lowering costs. Including security features, i.e., Internet Protocol Security (IPSec), within the protocol and the new design of the protocol header ensure better routing that provides a higher quality of services in information networks.

So, to keep up with the global trend, the Federal Republic of Somalia must embrace IPv6 technology to ensure the continuity of Internet services in the country.

2.2 Classification and designation of stakeholders in the Federal Republic of Somalia

The transition to IPv6 required the collaborative efforts of all stakeholders and those with a direct or indirect relationship with the Information Communication Technology (ICT)

sector. As a result, the players in the transition process must be recognized and classified, as well as their role in the country's successful transition of infrastructure and services in the ICT sector.

It was agreed to classify all the stakeholders in the ICT technology sector into the following eight categories:

1. Policymakers and Regulators
2. Hardware (H/W) providers and software (S/W) developers (H/W and S/W vendors)
3. Telecom Operators
4. Internet Service Providers
5. e-Services Providers
6. Academic and Research Organizations
7. Civil Society Organizations
8. Users

As part of the exercise to prepare for the above IPv6 strategy, some of the above stakeholders have been contacted to assist in preparing the strategy by attending a national consultation meeting and an online public awareness workshop. All the stakeholders have been requested to fill out the IPv6 readiness assessment checklist and form to assist in assessing the current state of their IPv6 readiness for their network and plans.

2.3 National Level Consultation Meeting

On March 20th, 2023, a national-level consultation meeting was conducted with key NCA personnel to review and develop an action plan for the Federal Republic of Somalia's IPv6 strategy.

The following topics were presented and discussed during the meeting:

1. Work Plan for IPv6 Strategy Development for the Federal Republic of Somalia.
2. IPv6 Overview.
3. IPv6 Transition Issues.
4. IPv6 Readiness Assessment.
5. IPv6 Transition Strategy Plan.
6. Discussion and moving forward.

During the meeting, all the members agreed that the Internet penetration rate in the Federal Republic of Somalia is 13.7% (https://datareportal.com/reports/digital-2022-somalia) and that IPv6 adoption is very low in the Federal Republic of Somalia, at about 0.16% (https://stats.labs.apnic.net/ipv6/so). It was agreed that the Federal Republic of Somalia should target 25% Internet penetration by 2030, in line with Somalia's ICT Policy and Strategy for 2019–2024.

2.4 Online Public Awareness Workshop for Local ICT Stakeholders for the Federal Republic of Somalia

From April 2nd to 3rd, 2023, an online public awareness workshop was conducted for all the local ICT stakeholders regarding the IPv6 strategy development for the Federal Republic of Somalia.

The following topics were covered during the workshop:

1. **IPv6 Overview**
2. **IPv6 Transition**
3. **IPv6 Readiness Assessment**
4. **IPv6 Transition Strategy Plan**

During the workshop, all the members understood the purpose of this project. They agreed to cooperate with the ITU Expert to do an IPv6 Readiness Assessment exercise to assess the current IPv6 Readiness of their networks.

2.5 Summary of the analysis of the outcome of the workshop

In general, all stakeholders have agreed that the Federal Republic of Somalia must move to

IPv6 because the IPv4 addresses are near to exhaust with AFRINIC, and the demand for the Internet is growing exponentially locally. Furthermore, the Federal Republic of Somalia aims to achieve 25% Internet penetration by 2030 since the Internet is seen as an enabler for new industries and would contribute to significant GDP growth in the Federal Republic of Somalia.

During the workshop, all stakeholders agreed to work with the NCA and the ITU Expert to develop the National IPv6 Transition Plan. Therefore, they supported the establishment of the Somalia IPv6 Task Force (Sov6TF) to accelerate IPv6 adoption in the Federal Republic of Somalia. They strongly support forming a Somalia IPv6 Task Force to assist the Somali national-level agenda in achieving national adoption.

2.6 Strength, Weakness, Opportunity, and Threat (SWOT) Analysis

This SWOT analysis provides a general overview and should be adapted to the specific context and conditions in the Federal Republic of Somalia. It can serve as a starting point to identify strengths, weaknesses, opportunities, and threats related to implementing an IPv6 strategy in the country.

Table 2.1 IPv6 Strategy SWOT Analysis for the Federal Republic of Somalia

Strength	Weakness
1. All the stakeholders understood that there was a real need to move to IPv6 because the current IPv4 will soon run out in Federal Republic of Somalia. 2. NCA is very proactive in developing regulations, guidelines, and strategies to increase IPv6 adoption in Federal Republic of Somalia since the future growth of the national Gross Domestic Product (GDP) depends on the continuity of the Internet. 3. IPv6 provides a significantly larger address space, addressing the limitations of IPv4 address exhaustion and allowing for the growth of connected devices and networks in the Federal Republic of Somalia. This provides continuous internet connectivity in the Federal Republic of Somalia. 4. The enhanced security of IPv6 includes built-in security features that can strengthen network security in the Federal Republic of Somalia, protect against threats, and build confidence to attract all-level foreign organisations to operate from the Federal Republic of Somalia, which directly brings foreign direct investment (FDI) for the country's economic growth.	1. The availability of skilled professionals with expertise in IPv6 deployment may be limited, requiring investment in training and capacity-building initiatives. 2. Legacy System Compatibility: Ensuring compatibility with legacy systems and applications that predominantly use IPv4 might pose challenges during the transition to IPv6. 3. Lack of legal framework and policies to promote IPv6 so that reliable Internet services can be provided in Somalia.
Opportunities	**Threats**

1. ITU and other global Internet organisations are willing to help the Federal Republic of Somalia in terms of IPv6 strategy and capacity building without additional cost to increase IPv6 adoption in the Federal Republic of Somalia. 2. AFRINIC offers IPv6 addresses and IPv4 addresses without any additional charges. 3. Available assistance in terms of material and resources from other countries in the region can help the Federal Republic of Somalia implement the IPv6 strategy with reduced risk and avoid unnecessary mistakes through learning from these countries for a successful IPv6 transition. 4. Implementing IPv6 aligns with the Federal Republic of Somalia's digital transformation goals, enabling the growth of IoT devices, cloud computing, and other emerging technologies and indirectly contribute to GDP growth of Somalia.	1. AFRINIC still has a significant IPv4 address that enables the continuity of Internet connectivity in Federal Republic of Somalia. This might slow down IPv6 adoption in Somalia because the stakeholder feels that they still operate the Internet using IPv4 technology. 2. Cost and Budget Constraints: Upgrading network infrastructure and deploying IPv6 may require significant investment, posing financial challenges for organizations and ISPs in the Federal Republic of Somalia. 3. Limited Awareness and Adoption: 4. Lack of awareness about the benefits and importance of IPv6 among stakeholders and the general public could hinder the adoption and progress of IPv6 deployment in the Federal Republic of Somalia. 5. Connectivity Disparities: 6. Ensuring equitable access to IPv6 across different regions of the Federal Republic of Somalia, including rural areas, may be a challenge due to connectivity disparities.

Based on the above SWOT analyses, the weaknesses represent a significant challenge for the Federal Republic of Somalia in achieving a smooth and rapid IPv6 transition process. So, greater effort is required to overcome this weakness. On the other hand, several good opportunities must be capitalized to increase the national Internet penetration rate by 25% by 2030.

2.7. Internet Penetration in the Federal Republic of Somalia

The Federal Republic of Somalia's total population was 16.60 million in January 2022. There were 2.27 million internet users in the Federal Republic of Somalia in January 2022. The Federal Republic of Somalia's internet penetration rate stood at 13.7 percent of the total population at the start of 2022. (source: https://datareportal.com/reports/digital-2022-somalia).

Somalia is in 178th place globally in IPv4 public address statistics with 50,688 IPv4s (0.001% of world IPv4 addresses, i.e., 3,686,470,600) as of July 24, 2023. Concerning the above statistics, Somalia needs more public IPv4 addresses to achieve an additional 25% penetration rate by 2030, in line with the national target. Since IPv4 is already exhausted globally, AFRINIC is unable to allocate any more IPv4 addresses, and the alternative solution is to deploy IPv6 addresses.

2.8 Current IPv6 Deployment Status in the Federal Republic of Somalia

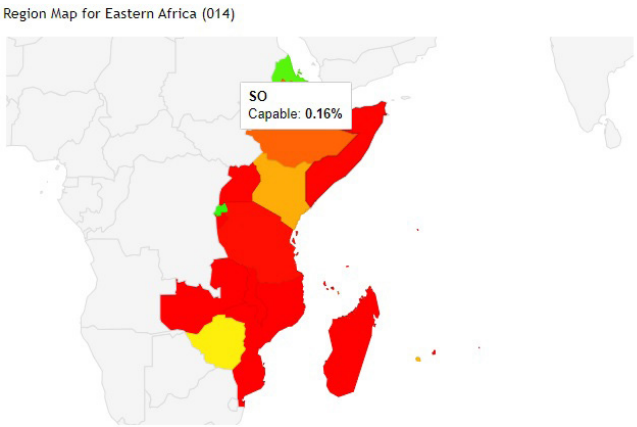

Figure 2.1 IPv6 Adoption in the Federal Republic of Somalia

(https://stats.labs.apnic.net/ipv6/so)

Figure 2.3 shows that the IPv6 adoption rate in the Federal Republic of Somalia is currently about 0.16%.

The Federal Republic of Somalia is in 160th place in global IPv6 global unicast address statistics with 655 364 IPv6 (0.003% of world IPv6 addresses, i.e. 24,656 573,543) as of 24 July 2023. Concerning the above statistics, the Federal Republic of Somalia needs more IPv6 global unicast addresses to achieve an additional 21.3% penetration rate by 2030, in line with the national target.

2.9 Benchmarking IPv6 implementation with other countries

One of the main drivers of Internet growth in Africa has been the rapid expansion of mobile telecommunications. Mobile devices, particularly smartphones, have become more affordable and accessible to a larger population. This has allowed more people to connect to the Internet, even in areas with limited fixed-line infrastructure. Mobile network operators have invested in expanding their networks and improving coverage, enabling users to access the Internet through mobile data services.

However, challenges still exist in ensuring widespread Internet access and narrowing the digital divide in Africa. Infrastructure in remote areas, affordability barriers, and socio-economic disparities still need to be addressed. Efforts are underway to address these challenges through initiatives like rural connectivity projects, community networks, and digital skills training programs.

In summary, the growth of the Internet in Africa has been driven by factors such as the expansion of mobile telecommunications, the development of undersea fiber optic cables, supportive initiatives and policies, and the popularity of social media and online services. While progress has been made, there is still work to ensure that all Africans can benefit from the opportunities provided by the Internet.

2.9.1 Saudi Arabia

Saudi Arabia has been a hotspot for IPv6 deployment. Still, the focus on deployment began over 16 years ago when the local regulatory authority, the Communications and Information Technology Commission (CITC), and the Saudi Ministry of Communications and Information Technology (MCIT) formed an IPv6 Taskforce. This group, which comprised all local service providers and other relevant institutions, started working on an IPv6

adoption strategy. Initially, they concentrated on raising awareness of the significance of IPv6, the core network and supporting services' capability, and the required technical capacity.

Saudi Arabia's total population was 35.59 million in January 2022. There were 34.84 million internet users in Saudi Arabia in January 2022. Saudi Arabia's Internet penetration rate stood at 97.9 percent of the total population at the start of 2022. (source:https://datareportal.com/reports/digital-2022-saudi-arabia? rq=saudi%20). Saudi Arabia is 38th in global IPv4 public address statistics, with 10 631 424 IPv4 (0.288% of world IPv4 addresses, i.e., 3,686,470,600) as of July 24, 2023 (source: https://www-public.imtbs-tsp.eu/~maigron/rir-stats/rir-delegations/world/world-ipv4-by-country.html#menu-sorttype).

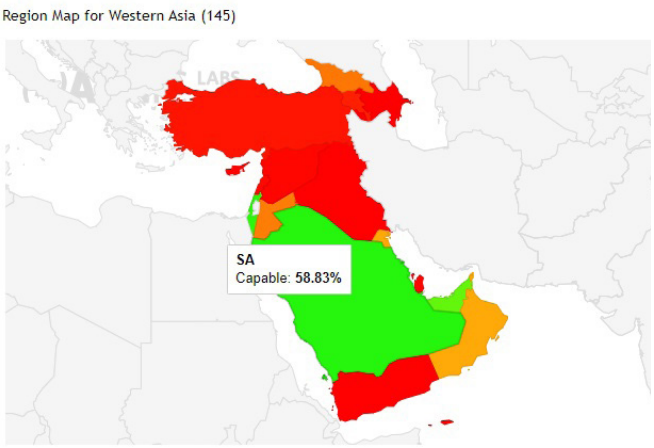

Figure 2.2 IPv6 Adoption in Saudi Arabia

(https://stats.labs.apnic.net/ipv6/sa)

Figure 2.2 shows Saudi Arabia's IPv6 adoption rate is 58.83%. Saudi Arabia has the most extensive IPv6 adoption in the Middle East. Saudi Arabia ranked 55th globally with 30,146,578 IPv6 addresses (0.122 % of the total IPv6 addresses allocated globally, i.e., 24,656,573,543) as of July 24th, 2023.

2.9.2 Arab Republic of Egypt

Egypt's total population was 111.8 million in January 2023. There were 80.75 million internet users in Egypt by January 2023. Egypt's Internet penetration rate stood at 72.2 percent of the total population at the start of 2023. (source: https://datareportal.com/reports/digital-2023-egypt?rq=egypt). Egypt is on 22nd in global IPv4 public address statistics with 24,155,904 IPv4 (0.655% of world IPv4 addresses, i.e 3,686,470,600) s 24th July 2023 (source: https://www-public.imtbs-tsp.eu/~maigron/rir-stats/rir-delegations/world/world-ipv4-by-country.html#menu-sorttype).

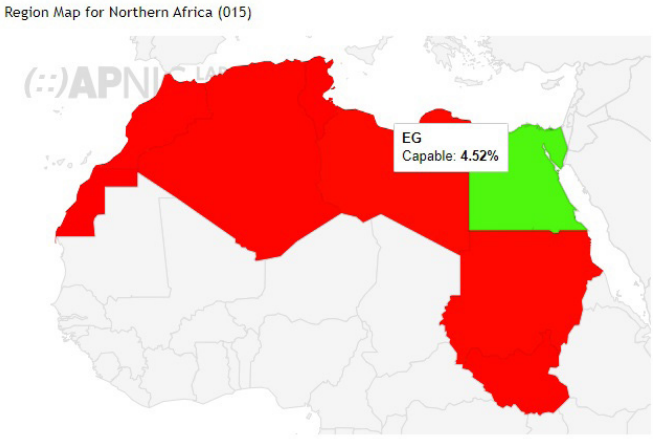

Figure 2.3 IPv6 Adoption in Egypt

(https://stats.labs.apnic.net/ipv6/eg)

Figure 2.3 shows the Arab Republic of Egypt's IPv6 adoption rate of 4.52%. Egypt has the second-largest IPv6 adoption in the Middle East region. As of July 24th, 2023, Egypt ranked 19th globally with 270,204,932 IPv6 addresses (1.096% of total IPv6 addresses allocated globally, i.e., 24,656,573,543).

2.9.3 Benchmark Comparison

The following section discusses comparisons between Somalia, Saudi Arabia, and Egypt for rolling out IPv6.

Table 2.2 Countries Benchmark Comparison

Somalia, Saudi Arabia, and Egypt have recognized the importance of IPv6 deployment and have taken steps to promote its adoption. But Saudi Arabia and Egypt started very early, established task forces, conducted awareness campaigns, and invested in training and capacity building.

Matrix	Somalia	Saudi Arabia	Egypt
IPv6 Adoption Percentage	0.16%	58.83%	4.52%
Country's Population	16.60 million in January 2022	35.59 million in January 2022	111.8 million in January 2023.

Internet Users	2.27 million in January 2022	34.84 million in January 2022	80.75 million in January 2023.
Internet Penetration Rate	13.7 % in January 2022	97.9 % in January 2022	72.2 % in January 2023.
Allocated IPv4 Address	50,688 Ranked 178th globally as of 24th July 2023	10,631,424 Ranked 38th globally as of 24th July 2023	24,155,904 Ranked 22nd globally as of 24th July 2023
Allocated IPv6 Address	655 364 Ranked 160th globally as of 22 May 2023	30,146,578 Ranked 55th globally as of 24th July 2023	270,204,932 Ranked 19th globally as of 24th July 2023
Total IP Address (IPv6 + IPv4)	706,052	40,778,002	294,360,836
Users per IP Address	**24 users per IP Adresss**	**0.87 users per IP Address**	**0.38 users per IP Address**
IPv6 Task Force	IPv6 Task Force To be established in 2024	Established IPv6 Task Force in July 2008	Established National IPv6 Task Force in September 2004
Established an IPv6 Test Lab	Started in 2021	Started in 2008	Started in 2005
IPv6 Compliant ccTLD Registry	Yes	Yes. Since 2009	Yes. Since 2009
Capacity Building	Yes. Started 2021.	Started since 2009	Started since 2006
Commercial IPv6 Services	Yes. Started in 2021	Started since 2010	Started since 2008
IPv6 Procurement Policy	Officially not yet	Yes. Since 2004	Yes. Since 2010

3. National Strategy for the IPv6 Transition in the Federal Republic of Somalia

3.1 Vision

Implement IPv6 to ensure the continuity of the Internet and support the latest technology, such as 5G and IoT, in the Federal Republic of Somalia.

3.2 Mission

To achieve a 2**5%** Internet penetration rate in the Federal Republic of Somalia by 2030.

3.3 Objectives:

This section discusses the objectives of the IPv6 strategy.

- Provide information regarding the required awareness and outreach program to promote IPv6 in the Federal Republic of Somalia.
- Provide clear guidelines on how to assess the IPv6 Readiness of critical stakeholders such as Internet Service Providers (ISPs), country code top-level domains (ccTLDs), Internet Exchange Points, Web Hosting Providers (Data Centres), and other relevant stakeholders to be ready for the core networks.
- Provide transparent, high-level national implementation guidelines on successfully migrating to the IPv6 platform with minimum hiccups.
- Provide a training plan to train all the local ICT talents with the latest IPv6 knowledge so that they are equipped with the latest IPv6 knowledge to assist the local stakeholders in migrating to IPv6.
- Provide clear cost guidelines so local stakeholders can prepare the necessary budget to migrate to IPv6.
- Provide relevant information for local stakeholders to seek assistance from international organizations regarding support for knowledge transfer to local talents and funding assistance for migration to IPv6.

3.4 Formation of an IPv6 Task Force to guide the implementation and monitoring of the IPv6 strategy in the Federal Republic of Somalia

In this section, we will discuss how the IPv6 Task Force can guide implementing and monitoring the IPv6 strategy in the Federal Republic of Somalia. This could increase Internet resources to ensure the continuity of the Internet at the country level and cater to the future needs of IoT and 5G technology.

a) Follow up with all the local ISPs to request additional IP addresses, especially IPv6 addresses, from AFRINIC with justification to support the latest technology, such as IoT and 5G. Since additional IPv6 addresses are crucial to achieving the national Internet penetration rate of 25%

by 2030, ISPs must ask for them. AFRINIC will allocate IPv6 addresses without extra cost. Only ISPs need to justify why they need additional IPv6 addresses.

b) b. Advise and work with government and private institutions (such as universities, banks, security agencies, etc.) with relatively large IT networks to request addresses directly from the AFRINIC. This is another smart move to increase the country's IPv6 resources. AFRINIC would easily approve this type of request compared to an ISP request.

c) For training and testing purposes, we recommend setting up specialized centers for training and an IPv6 Lab to test the equipment and software compatibility with the IPv6 protocol.

d) Organize more IPv6 awareness workshops and certified IPv6 training to increase local stakeholders' awareness of IPv6 technology in the country.

e) Propose introducing IPv6 topics in school-level IT subjects so students are exposed very early to IPv6 addressing. This would allow future school leavers to understand IP addresses better and learn to reserve these resources efficiently. Also, propose to include IPv6 topics at the polytechnic, technical institute, and university levels so that the country's future workforce has a deeper understanding of IPv6 and how to manage this resource effectively.

3.5 Develop regulations, guidelines, and technical specifications to support the IPv6 transition in the Federal Republic of Somalia.

I propose establishing a specialized department within NCA to develop new regulations, guidelines, and technical specifications supporting the IPv6 transition.

- Responsible for planning, monitoring, and measuring the IPv6 transition in the Federal Republic of Somalia.
- Responsible for monitoring and engaging global organizations in international engagement for regulations, guidelines, and technical specification development.
- Responsible for developing regulations, guidelines, and technical specifications related to IPv6 Research and Development (R&D) to support the ecosystem in developing local products and services with IPv6 capability.
- Responsible for monitoring IPv6 address resource management.

3.6 IPv6 Transition KPI Monitoring

To achieve the national target of 25% Internet penetration by 2030, constant monitoring and measuring key performance indicators (KPIs) are essential. This would allow corrections to be made to the policies, planning, and implementation so that Somalia could achieve the proposed target. For each criterion, the nature of the standard, the method, and the unit of measurement are determined, as are measurements of the current situation based on which key performance indicators (KPIs) will be determined, and the national administration will set future targets.

3.7 Participation in Regional and International Events

International Telecommunication Union (ITU): ITU organizes workshops and regional and global forums under the standardization and development sectors (Telecommunication Standardisation Bureau

(TSB), Telecommunication Development Bureau (BDT)) in which best practices in the field are presented to keep pace with global technologies, and it also allows for the benefit of ITU experts participating in these events. On the transition to IPv6, a group affiliated with the Union Council concerned with Internet issues (ITU – Council Working Group (CWG) - Internet) was created in Union member states.

Internet Corporation for Assigned Names and Numbers (ICANN - https://www.icann.org): The Authority holds three annual meetings in different regions of the world, and due to the importance of the outcomes of these meetings, participation must be carried out periodically and regularly by a team from the Ministry and the regulator (NCA), especially in participating in the work of the Consultative Committee for Government Representatives (ICANN GAC) along with other technical committees.

Regional Internet Registry (AFRINIC—https://afrinic.net): The RIR holds meetings annually to discuss policies for distributing and allocating Internet resources in the region. Accordingly, periodic and effective participation enables the Federal Republic of Somalia to follow up on the proposed policies and discuss their impact on the ICT sector.

IPv6 Global Forum (IPv6 Forum—https://www.ipv6forum.com): The IPv6 Forum also organizes various conferences, workshops, and training in collaboration with local chapters and other partners to share IPv6 knowledge globally.

3.8 Proposed Stages of Implementing the IPv6 Transition Strategy for the Federal Republic of Somalia.

It was agreed during the discussion with NCA and local stakeholders that this IPv6 transition strategy will be implemented for three years and in three phases as follows:

3.8.1 Phase I: Preparing for the IPv6 Transition (12 months from April 2025 to March 2026)

In this phase, the key aim is to prepare the local ecosystem to adopt IPv6 and achieve the following objectives:

a) Establishing a specialised training centre to prepare the local workforce with IPv6 knowledge.

b) Request additional IP address allocations for IPv4 and IPv6 to support current and future needs.

c) Conduct workshops and an IPv6 summit locally to promote IPv6 technology.

d) Ensure adequate participation in the local, regional, and global IPv6 workshop, conference, and IPv6 summit-related activities.

e) Establish pilot test labs to test the hardware and software before entering a natural production environment.

f) Establish an IPv6 Conformance policy locally in line with international standards. Establish the Conformance Test Lab locally to do the IPv6 Conformance test before allowing the products and services to be distributed locally.

The above activities can be carried out simultaneously to save time. Success in this phase would allow the country to move on to the next phase, Phase II.

3.8.2 Phase II: Implementation of Dual Stack Operation (6 months from April 2026 to September 2026)

The key aim of this phase is to enable Dual Stack (IPv4 and IPv6) operation in the local stakeholder's networks:

a) Analyse and approve the appropriate dual-

stack strategy for each stakeholder before implementing the dual-stack infrastructure.

i. Enable dual-stack operation in the infrastructure networks of the ISP, Exchange Point, ccTLD, and all the relevant stakeholders.

ii. Preparing Dynamic Host Configuration Protocol (DHCP) Server, Domain Name Service (DNS), and Web to support Dual-Stack operation.

b) Enable commercial IPv6 Internet service for customers.

3.8.3 Phase III: Monitor and Make Changes to IPv6 Strategy (12 months from October 2026 to September 2027)

The key aim of this phase is to monitor the dual-stack IPv6 implementation and make changes to policy, strategy, and timeline so that the national Internet penetration target of 25% can be achieved.

a) Ensure the Federal Republic of Somalia has achieved the target number of network IP address resources, i.e., active ASNs and IPv6 addresses, required to support local stakeholder requirements to support the latest technology, such as 5G and IoT.

b) Ensure the Federal Republic of Somalia has achieved the targeted network services and applications supporting IPv6.

c) Ensure that the targeted Internet penetration rate of 25% in Somalia is achieved by 2030.

d) Make changes to the implementation strategy if the above target has yet to be achieved.

4. Cost Estimation for the IPv6 Transition

The cost also depends on the transition strategy recommended by experts for the IPv6 transition. This section will discuss in detail what the cost estimation methodology consists of:

4.1 Factors that will affect the cost of moving to IPv6

Below is a list of factors affecting moving to IPv6 technology costs.

a) The type of applications used for the production network

- Web-based services using traditional networks may be more expensive than cloud-based services.

- client-server might also incur additional costs.

b) The proposed transition mechanism, i.e., dual stacking, tunneling, or translation, used to support the production network

c) Specifications of hardware and software used, whether high-end or lower-end.

d) Level of technical expertise in networking and familiarity with the IPv6 protocol.

e) The level of network security required during and after the transition period.

f) Choose between fast or smooth transition priorities.

Dual stack has been a natural selection for most enterprises compared to tunneling or translation. Tunneling or translation is recommended when the underlying networks are IPv4 and the end nodes are IPv6 capable. Additional costs will be incurred if operators wish to deploy tunneling or translation transition technology.

4.2 Device upgrade costs

The IPv6 Readiness Assessment exercise would provide clear guidance on whether devices need to be upgraded or replaced when stakeholders decide to migrate to an IPv6 network. Some devices only require an upgrade of their IOS to support IPv6. Some devices may have already reached the end of their useful life. So, these device manufacturers are unable to upgrade them. So, the operators have to choose between replacing these devices with new ones.

So, upgrading the Input Output System (IOS) would be cheaper than buying new ones. Most of the latest devices automatically support IPv6.

4.3 Application Upgrade Cost

The applications used by any stakeholders in the network could be divided into two (2) main categories, as below:

a) On-the-shelf application

b) Customise application

(a) **On-the-shelf applications**

For off-the-shelf applications, most application vendors have already supported IPv6 for the last 15 to 20 years. Many developers provide upgrades to the latest version of these applications either free of charge or at minimal cost, depending on the service level agreements (SLA) that stakeholders signed with these application vendors.

(b) **Customise Applications**

For customized applications, operators usually have the choice of upgrading the application immediately when they decide to move to IPv6 or waiting for the upgrade life cycle of the applications. Based on their experience in implementing IPv6 networks, most government and corporate clients follow an upgrade cycle that usually lasts a minimum of 5 years before they upgrade the applications. So, the cost could vary between an immediate upgrade and waiting for the life cycle. Naturally, an immediate upgrade is more costly than a life cycle upgrade.

Anyway, the decision to upgrade immediately or wait for a lifecycle depends on each stakeholder's business model. If the application is not hosted on the Internet, operators do not have the urgency to migrate to IPv6. They continue to use the application within the intranet. If the application is hosted on the Internet, the operators naturally have to make the necessary effort to migrate to IPv6. In some countries, like China and India, their users only have native IPv6 connectivity. The US government will, by 2025, only provide native IPv6 networks. So, if the users are from these countries, they cannot access these applications remotely because the application only supports IPv4.

4.4 Costs of Building IPv6 Capacity

Capacity building in IPv6 would be one of the core steps towards implementing IPv6 networks in Somalia. The local workforce needs to be equipped with proper IPv6 knowledge for a smooth transition and the maintenance of IPv6 networks in the future. Depending on foreign experts would increase the cost of IPv6 implementation. Based on the above case study, workforce training costs about 24.4% of total migration costs. A similar assumption can be made for Somalia as well.

5. IPv6 Addressing Strategy

A proper addressing strategy for IPv6 would solve previous setbacks created using public IPv4 addresses. The problem of the depletion of IPv4 addresses was due to mismanagement of IPv4 addresses in the past. In the early days of the Internet, IP addresses were distributed freely in big blocks. Some organizations in the USA and Europe were given Class A and B addresses. So when the IPv4 Internet became more commercial and expanded exponentially globally, the new countries that joined these networks only got Class C addresses. Later in the 1990s, the IPv4 Internet faced a shortage of IPv4 addresses, forcing industries to move to network address translator (NAT)-based networks to continue the life of the Internet. IPv6 was introduced as a new version of IP protocols near the end of the 1990s. The IPv6 networks allow continuity on the Internet. So, to avoid a mistake similar to IPv4, IPv6 technologies advocate proper IP address distribution to expand the lifetime of the IPv6-based Internet.

6. Capacity building in IPv6

Before implementing any technology, training the workforce on that subject matter is essential for the successful implementation of the technology. From the above case study in Section 4.3, 24.4% of the overall budget is allocated to capacity building. This is the most significant portion of the overall cost. The allocation of the most significant portion of the budget to the overall implementation cost shows capacity building is crucial for the success of the IPv6 transition.

This section discusses in detail what appropriate capacity-building programs the Federal Republic of Somalia workforce requires to fulfill the nation's vision of achieving a 25% Internet penetration rate.

6.1 Capacity Building Strategy

The training strategy is divided into three levels, depending on the expertise required by the local workforce. The following section discusses these levels in detail.

6.1.1 Awareness Programmes

It is a set of workshops and seminars that do not exceed 2 to 4 hours in one day and discuss issues with IPv4 and the importance of moving to IPv6. The key target audience for these workshops and seminars would be anyone keen to know the basics of non-technical IPv6 knowledge. The management level of stakeholders, i.e., directors and managers, would be suitable participants in these workshops and seminars. Organizers can engage a professional trainer or university professor as a trainer for these workshops and seminars.

6.1.2 Basics of IPv6

This technical training program enables the participants to understand IPv6 in terms of address allocation and the configuration of network devices with basic settings. We recommend the IPv6 Forum-Certified Network Engineer for IPv6 (CNE6) curriculum that the ITU offered through the ITU Academy, which is an IPv6 Network Engineering training program designed to provide in-depth knowledge of how to design, implement, and operate IPv6 networks. Globally, the industry recognizes the IPv6 Forum as the appropriate non-vendor-based program that fits well with industry requirements.

This training program is designed for IT and network engineers, academics, students, and communications and information technology researchers.

6.1.3 Advanced Topics in IPv6

This is an advanced technical training program to manage systems and services such as DHCP, DNS, Mobility, Applications and Programming, Security, advanced Routing, etc. The training can either be conducted at specialized external centers or in the local specialized center with

the help of external training experts. These programs are offered to managers of information networks who have demonstrated advanced capabilities in dealing with networks. Their entities must nominate them, and then the list of participants must be carefully selected to benefit from this program.

6.1.4 Establishing a specialized local training center for IPv6

ITU has had numerous projects and initiatives to train local trainers so that local trainers can train their local workforce. The ITU has successfully implemented this strategy globally to assist its members. This effort helped governments worldwide build their own in-house specialized training centers in their countries and continuously assist the local workforce. One of the successful establishments would be the ITU Regional IPv6 and IoT Expertise Centre for the Arab Region in the Republic of Sudan. Somalia could work with this expertise center to establish a local specialized training center in the Federal Republic of Somalia.

6.2 Sources of funding for the IPv6 training programmes

The Somali government will partner with several international organizations, such as the ITU, RIR, and IPv6 Forum.

7. Milestones and Timelines

Milestones	Justification	Target Date	Remarks
Establish Somalia IPv6 Task Force (SolPv6)	To enhance awareness and accelerate IPv6 adoption	May 2025	All stakeholders encouraged to actively engage
Host IPv6 Awareness Workshop	To increase awareness and support for IPv6 deployment	December 2025	Aim for 250 attendees by October 2025
Deliver Introductory IPv6 Certification Courses (CNE6 Silver & Gold)	To equip engineers with the necessary skills for IPv6 support	December 2025	Goal of 140 attendees by December 2025, endorsed by IPv6 Forum
Conduct Advanced IPv6 Certification Training (CSE6, CNP6, CSA Silver & Gold)	To prepare engineers for comprehensive IPv6 deployment	March 2026	Target of 40 attendees by May 2026, with IPv6 Forum endorsement
Create IPv6 Test Lab Facilities	To establish practical IPv6 experience and knowledge dissemination	February, 2026	Plan for a minimum of 2 Test Labs by February 2026
Acquire Additional IPv4 & IPv6 Addresses and Optimize Subnetting	To achieve a 25% Internet penetration rate by 2030	December 2025	13 stakeholders have registered for IPv6 addresses with AFRINIC, 7 pending
Achieve Full IPv6 Compliance for .SO ccTLD	To facilitate IPv6 services for domestic digital content	July 2025	Encourage domestic content providers to adopt IPv6 Stack
Implement Full-Scale Commercial IPv6 Services	To ensure dual-stack functionality across ISP infrastructure	September 2026	Urge all ISPs to provide commercial IPv6 services

Figure 10.1 milestones and timeline

Figure 10.1 shows the recommended milestones and timeline for implementing the proposed IPv6 strategy effectively so that the Federal Republic of Somalia could achieve a 25% penetration rate target by 2030. Change is the only word that does not change over time; the rest always experience changes. Changes are necessary for a progressive lifestyle. So, this strategy could include essential changes over time to fulfill future needs. Change management is vital among local ICT stakeholders so that they will be supportive of the government's vision and mission over time. The introduction of new technology could change the strategy over time. So, the local stakeholders should be prepared to accept this change so the Federal Republic of Somalia can progress in implementing the IPv6 strategy in the country.

With the exponential growth of Internet users

8. Conclusion

in the Federal Republic of Somalia, IPv4 cannot support this growth because of the limited IPv4 addresses within AFRINIC. Therefore, immediate actions are required to implement IPv6 to support this demand. This IPv6 transition strategy document would assist the Federal Republic of Somalia in implementing IPv6 in stages so that the Federal Republic of Somalia can achieve the Internet penetration target of 25% by 2030.

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