# Table of Contents

**TABLE OF CONTENTS** ................................................................................................................................................. 2

1. **EXECUTIVE SUMMARY** .............................................................................................................................................. 3

2. **INTRODUCTION** ................................................................................................................................................................. 5
   2.1. Project Background .......................................................................................................................................................... 5
   2.2. Structure of Document .................................................................................................................................................. 6
   2.3. Methodology .................................................................................................................................................................. 6

3. **IPV6 STRATEGY OBJECTIVES AND TRACKS** .................................................................................................................. 8
   3.1. Objectives .................................................................................................................................................................... 8
   3.2. Tracks ........................................................................................................................................................................ 8

4. **PREVIOUS FINDINGS** .......................................................................................................................................................... 9
   4.1. IPv6 Status Quo and Readiness Assessment ............................................................................................................. 9
   4.2. IPv4 Exhaustion Study ............................................................................................................................................... 11
   4.3. IPv6 Countries Benchmark Study ......................................................................................................................... 14
   4.4. IPv6 International Bodies & Organizations .......................................................................................................... 17

5. **IPV6 STRATEGY ACTION PLAN** ................................................................................................................................. 20
   5.1. The National IPv6 Task Force .................................................................................................................................. 20
       5.1.1. First Meeting (July 30, 2008) .............................................................................................................................. 22
       5.1.2. Second Meeting (September 21, 2008) .................................................................................................................. 22
       5.1.3. Third Meeting (November 18, 2008) .................................................................................................................... 23
       5.1.4. National IPv6 Event (Planned February 2009) .................................................................................................... 23
   5.2. Action Plan – Infrastructure Track Initiatives ..................................................................................................................... 24
       5.2.1. IPv6 Addressing ................................................................................................................................................ 24
       5.2.2. IPv6 Commercial Support for Nation Wide Infrastructure ..................................................................................... 25
       5.2.3. Make .sa ccTLD IPv6 Compliant .......................................................................................................................... 26
       5.2.4. IPv6 Compliant Internet Filtering ...................................................................................................................... 26
       5.2.5. Build an IPv6 Test Lab and Disseminate IPv6 Technical Experience .............................................................. 28
   5.3. Action Plan – Awareness Track Initiatives .......................................................................................................................... 29
       5.3.1. Establish a National IPv6 Task Force ................................................................................................................... 29
       5.3.2. Outreach Activities ............................................................................................................................................. 30
           5.3.2.1. Media ............................................................................................................................................................ 30
           5.3.2.2. IPv6 Task Force Website ................................................................................................................................ 31
           5.3.2.3. International Contacts .................................................................................................................................... 31
           5.3.2.4. Dissemination of Information .......................................................................................................................... 31
       5.3.3. International Cooperation .................................................................................................................................... 31
       5.3.4. IPv6 Training ....................................................................................................................................................... 33
       5.3.5. IPv6 Compliant Procurement ............................................................................................................................. 34

6. **MILESTONES TO VERIFY SUCCESS** .......................................................................................................................... 35
   6.1. Enable IPv6 connectivity at ONE Facilities Based Provider (FBP) ........................................................................... 35
   6.2. Establish a National IPv6 Task Force ............................................................................................................................ 36
   6.3. Establish and IPv6 Lab .................................................................................................................................................. 36
   6.4. National IPv6 Event ...................................................................................................................................................... 36
   6.5. Commercial IPv6 Services Available at Multiple FBPs ............................................................................................. 37
   6.6. IPv6 Compliant DNS for .SA Top-Level Domain Registry ........................................................................................ 37
   6.7. Commercial IPv6 Services available from Five (5) ISPs .......................................................................................... 38

7. **TIME LINE** .................................................................................................................................................................. 39
1. Executive Summary

The IPv6 Strategy for Saudi Arabia identifies a set of milestones to be achieved within a phased timeline via an action plan of initiatives categorized into two tracks: Infrastructure and Awareness. Meeting the milestones would facilitate the deployment and further penetration of IPv6 on a nationwide basis so as to eventually realize an IPv6 ready internet infrastructure in the Kingdom of Saudi Arabia.

The milestones and action plan initiatives were based on previous studies. The studies assessed the IPv6 status quo and readiness of local stakeholders, extracted lessons from a comprehensive IPv6 benchmark study of eleven (11) countries and stated the status of IPv6 in relevant international bodies and organizations.

The three (3) studies are:

- IPv6 Status Quo and Readiness Assessment
- IPv6 Countries Benchmark Study
- IPv6 International Bodies and Organizations

The IPv6 Strategy for Saudi Arabia objectives are a set of high level goals to be achieved for the purpose of setting up the right environment to promote the deployment of IPv6 nationwide.

The identified objectives are:

- Prepare for the IPv4 exhaustion by supporting IPv6 and ensure stability, business continuity and room for continued growth of the internet in Saudi Arabia
- Ensure a smooth adoption of IPv6 by stakeholders so as to minimize risks
- Raise overall IPv6 awareness nationwide by approaching stakeholders of both the public and private sectors highlighting the necessity to adopt IPv6

The IPv6 Strategy follows a two (2) track approach that addresses **Infrastructure and Awareness** aspects of IPv6 adoption. Within each track, a set of five (5) initiatives are to be taken as follows:

1. **Infrastructure Track:**
   1.1. IPv6 Addressing
   1.2. IPv6 Commercial Support for Nation Wide Infrastructure
   1.3. .sa ccTLD IPv6 Compliance
   1.4. IPv6 Compliant Internet Filtering
   1.5. IPv6 Lab

2. **Awareness Track:**
   2.1. IPv6 National Task Force
   2.2. Outreach Activities
   2.3. International Cooperation
   2.4. IPv6 Training
   2.5. IPv6 Compliant Procurement

The strategy was agreed upon and finalized by both the CITC and FBPs members of the IPv6 Task Force. The Strategy will be owned and implemented by members of the task force to achieve the set of milestones.
The set of milestones to be achieved via the strategy tracks and initiatives would serve as a measurement of success. The milestones are a set of seven (7) large goals some of which are of a general aspect such as IPv6 addressing, IPv6 compliant .sa ccTLD Registry. Other milestones are of specific importance and relevance to the ICT infrastructure in Saudi Arabia such as the establishment of IPv6 connectivity at FBPs and IPv6 compliant internet filtration. Figure 1 below details each of the seven (7) milestones and the expected date of realization.

**Figure 1 - IPv6 Strategy Milestones and Timeline**

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Why?</th>
<th>Suggested Date</th>
<th>Alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPv6 at ONE FBPs</td>
<td>Essential and Enough to start offering IPv6 to ISPs and End Users</td>
<td>Early 2009</td>
<td>Universal Service Provider Act — STC to offer IPv6 Connectivity by Mid-2009</td>
</tr>
<tr>
<td>IPv6 Task Force Saudi Arabia</td>
<td>Essential to raise awareness and encourage deployment</td>
<td>End of 2008</td>
<td>Already Established</td>
</tr>
<tr>
<td>Establish an IPv6 Lab</td>
<td>Establish and Disseminate practical IPv6 Experience</td>
<td>End of 2008</td>
<td>Installation on track</td>
</tr>
<tr>
<td>IPv6 National Event</td>
<td>Raise awareness and encourage the IPv6 deployment</td>
<td>Early 2009</td>
<td>Preliminary Agendas and tentative date (Feb 9, 2009)</td>
</tr>
<tr>
<td>IPv6 at Multiple FBPs</td>
<td>Important for ISPs and End Users to have more than one Choice</td>
<td>End of 2009</td>
<td>CITC Legislative Measure and/or Financial Incentives</td>
</tr>
<tr>
<td>IPv6 Compliant SA ccTLD Registry</td>
<td>Essential to run IPv6-only hosts or an IPv6-only infrastructure</td>
<td>End of 2009</td>
<td>Regulatory measures and/or &quot;Universal Services Fund&quot; to hire experts to implement DNSv6 (mid-2010)</td>
</tr>
<tr>
<td>Commercial IPv6 Services available from Five (5) ISPs</td>
<td>More choices to end users</td>
<td>End of 2010</td>
<td>Regulatory measures and/or &quot;Universal Services Fund&quot; to help ISPs adopt IPv6</td>
</tr>
</tbody>
</table>
2. Introduction

2.1. Project Background

The Communication and Information Technology Commission (CITC)\(^1\) was created in 5/3/1422H and changed its name to the current one on 21/5/1424H. Its vision is that Saudi Arabia should benefit from universally available, high quality and affordable communications and information technology services. Its mission is to provide a fair, clear and transparent regulatory environment to promote competition, to safeguard public interest and stakeholder rights, to enable universal availability of advanced ICT services and optimize utilization of scarce resources, to increase ICT awareness and usage to enhance national efficiency and productivity and to build a professional and motivated CITC team.

The Internet Services Department of CITC aims at creating the right environment for the development of Internet Services in Saudi Arabia. It has several responsibilities including but not limited to the Domain Name Management for .sa names, content filtering policy definition and implementation, internet exchange management and others.

Aiming at fulfilling its missions, CITC decided early 2008 to create the right environment for a migration to *Internet Protocol version 6 (IPv6)*, which appears now as a certain long term means to address the imminent exhaustion of IPv4. In order to facilitate the adoption efforts of IPv6 in Saudi Arabia, CITC has launched the *IPv6 Sub-project* as part of the *Internet Services Development Phase II (ISD Phase II)* initiative.

Establishing a strategy for the adoption of IPv6 in Saudi Arabia, along with the establishment of the National IPv6 Task Force are the main outcomes of the IPv6 Sub-project. The strategy identifies a set of milestones to be achieved within a phased time line through an action plan of initiatives to be further addressed in the document. Meeting the milestones would facilitate the deployment and further penetration of IPv6 on a nationwide basis so as to eventually realize an IPv6 ready internet infrastructure in the Kingdom of Saudi Arabia.

The milestones and action plan initiatives were based on previous studies. The studies assessed the IPv6 status quo and readiness of local stakeholders, extracted lessons from a comprehensive IPv6 benchmark study of eleven (11) countries and stated the status of IPv6 in relevant international bodies and organizations.

The three (3) studies are:

- IPv6 Status Quo and Readiness Assessment
- IPv6 Countries Benchmark Study
- IPv6 International Bodies and Organizations

\(^1\) [http://www.citc.gov.sa/](http://www.citc.gov.sa/)
2.2. Structure of Document

The document is divided into three main parts. The first part summarizes the relevant findings of the first three (3) studies of the IPv6 Project listed in the previous section.

The second part presents the proposed action plan and initiatives of the “IPv6 Strategy for the Kingdom of Saudi Arabia” along with a separate section for the National IPv6 Task Force and its recent activities. The action plan is of two (2) tracks addressing Infrastructure and Awareness aspects.

The Third part presents the set of Milestones to be met through the action plan.

The structure framework of the document follows the below list of sections:

- Executive Summary
- Introduction
- IPv6 Strategy Objectives and Tracks
- Previous Findings
- IPv6 Strategy Action Plan
  - The National IPv6 Task Force
  - Infrastructure Track Initiatives
  - Awareness Track Initiatives
- Milestones to Verify Success
- Timeline

2.3. Methodology

The methodology used to develop the “IPv6 Strategy for the Kingdom of Saudi Arabia” is the following:

1. Identifying the main findings of the first three (3) deliverables of the IPv6 Sub-project which are:
- **IPv6 Status Quo and Readiness Assessment**: the findings of this deliverable are important to evaluate the AS-IS situation of IPv6 in KSA. In order to establish milestones and recommendations for an IPv6 strategy, it is important to know the baseline first and consequently identify goals and milestones
- **IPv6 Countries Benchmark Study**: findings of this study would present the worldwide experience, best practices and initiatives followed to promote and deploy IPv6 and their applicability in KSA in order to achieve the goals/milestones
- **IPv6 International Bodies and Organizations**: establishing relations with IPv6 relevant organizations and bodies that manage IPv6 addresses allocation, IPv6 standardization, IPv6 deployment (IPv6 backbones and networks) and IPv6 promotion (international forums) is an important factor of the IPv6 strategy. The findings of the study presented the relevance of each body/organization to KSA and hence it was deduced which bodies/organizations to join or follow up as part of the overall IPv6 Strategy

2. **IPv6 Strategy Objectives**: The objectives were set to be of high level and setting the direction of the IPv6 Strategy for a nationwide scope of impact

3. **Action Plan**: the main part of the document and the strategy is focused around initiatives that need to be done to achieve a successful implementation of IPv6 in the Kingdom of Saudi Arabia. The initiatives are divided into two (2) tracks, one for the infrastructure and the other for awareness mainly owned by the National IPv6 Task Force

4. **IPv6 Task Force**: as part of the Action Plan, the design and requirements for a Saudi Arabian National IPv6 Task Forces are explained

5. **Milestones**: the last phase of the strategy presents a set of milestones that are regarded as a “criteria of success”. The criteria of success consisted of important elements such as the ability to offer IPv6 native connectivity on a commercial basis and ability to connect to the IPv6 based internet worldwide through at least one Facility Based Provider (FBPs) and later on through multiple FBPs

6. A timeline for each of the goals/milestones and recommendations are finally summarized and presented in a tabulated and graphical format

CITC’s role is to be technology neutral; this document does not suggest specific technical solutions on how to achieve the migration. **CITC’s role will generally be one of a “promoter” and not a stronger role of a “facilitator” or even an “enforcer”**.
3. IPv6 Strategy Objectives and Tracks

3.1. Objectives

The IPv6 Strategy for Saudi Arabia objectives are a set of high level goals to be achieved for the purpose of setting up the right environment to promote the deployment of IPv6 nationwide.

The identified objectives are:

- Prepare for the IPv4 exhaustion by supporting IPv6 and ensure stability, business continuity and room for continued growth of the internet in Saudi Arabia
- Ensure a smooth adoption of IPv6 by stakeholders so as to minimize risks
- Raise overall IPv6 awareness nationwide by approaching stakeholders of both the public and private sectors highlighting the necessity to adopt IPv6

3.2. Tracks

The IPv6 Strategy follows a two (2) track approach that addresses Infrastructure and Awareness aspects of IPv6 adoption. Within each track, a set of five (5) initiatives are to be taken as follows:

3. Infrastructure Track:
3.1. IPv6 Addressing
3.2. IPv6 Commercial Support for Nation Wide Infrastructure
3.3. .sa ccTLD IPv6 Compliance
3.4. IPv6 Compliant Internet Filtering
3.5. IPv6 Lab

4. Awareness Track:
4.1. IPv6 National Task Force
4.2. Outreach Activities
4.3. International Cooperation
4.4. IPv6 Training
4.5. IPv6 Compliant Procurement

Section 6 details each of the two track’s initiatives objectives along with proposed timelines for implementation. As a measure or criteria for success for the implementation of the strategy initiatives, a set of seven (7) milestones are to be met as will be detailed later in Section 7.
4. Previous Findings

As stated earlier, the “IPv6 Strategy for the Kingdom of Saudi Arabia” relies on findings and outcomes of the first three deliverables of the IPv6 Sub-project.

The following sections list the most important findings of these studies that are of relevance to the IPv6 Strategy.

4.1. IPv6 Status Quo and Readiness Assessment

- Facility Based Providers (FBPs): Five (5) out of nine (9) were assessed for their IPv6 status quo and readiness plans. The other four (4) FBPs did not answer the IPv6 questionnaire. The questionnaire addressed areas such as IPv6 knowledge and technical-howl, IPv6 access connectivity, peering, upstream connectivity, business and economic elements and involvement in any IPv6 working groups, forums or gatherings. Of those DSPs, all but one has done some consideration about IPv6 in some way. The detail level of IPv6 readiness and consideration varies between them though. Currently, there are two IPv6 address blocks allocated from RIPE to LIRs in Saudi Arabia. The first block is 2001:1490::/32, allocated in 06/2003 to LAB experiments at King Abdul-Aziz City for Science and Technology (KACST) and 2001:16a0::/32, allocated in 12/2003 to SaudiNet/Saudi Telecommunications Company (STC). The KACST prefix is visible in the global BGP routing since 15/11/2007, and is currently reachable via a tunnel from British Telecom (BT, AS 5400). The STC prefix has never been visible in the global BGP routing, and is hence not reachable. With the exception of KACST, no single “Service Provider with International Gateway” (FBPs) is IPv6 capable today, and KACST (as a research institution) does not provide commercial connectivity to non-academic/research end users. With FBPs not being IPv6 ready, regular ISPs cannot get IPv6 connectivity to the world as regular ISPs do not operate international gateways.

All FBPs identified the lack of market demand for IPv6 as the main obstacle towards IPv6 adoption. Figure 2 below summarizes the main findings of the questionnaire process that was sent to Facilities Based Providers (FBPs).

Figure 3- FBPs IPv6 Questionnaire Findings
- **Internet Service Providers (ISPs):** Three (3) out of 62 ISPs answered the questionnaire. Though a mature assessment of ISPs IPv6 readiness cannot be done with the minimal feedback received, the fact that only 3 out of 62 ISP licensees responded to the questionnaire, it can be assumed that there has not been any interest as of yet from ISPs in IPv6. This was also inferred from offline discussions between CITC personnel and ISPs. RIPE NCC data shows that no local ISPs have acquired any IPv6 address blocks. A fair assumption can be stated in that as soon as FBPss start their IPv6 service offerings, ISPs could find incentives in complying to IPv6 as FBPs constitute the international gateways for regular ISPs.

- **Domain Name System (DNS) for .sa:** there is currently no IPv6 transport available, so the web servers, mail servers and other servers for the .sa registry are not IPv6 capable yet. All DNS *.net.sa servers do not have IPv6 transport available yet, but the externally run secondary on rip.psg.com does have IPv4 and IPv6 transport. Additional secondary name servers are planned, to be run by RIPE and PCH, which will also have IPv6 transport. IPv6 glue records can also be entered in the .sa TLD zone, so IPv6-capable DNS servers hosted in .sa can be registered. When registering a domain, the name servers are tested for correctness of the setup. This process is currently not IPv6 capable, and needs enhancements. IPv6 connectivity to the .sa DNS servers hosted inside Saudi Arabia (*.net.sa) and to the WWW and e-mail servers needed to access the registry services is also still missing, so registering a .sa domain from an IPv6 only network is not yet possible.

- **Software and Hardware Vendors:** a group of major SW/HW vendors was selected to assess their IPv6 readiness. These have been Microsoft, IBM, HP, Dell, Cisco and Juniper. Data from their official online websites showed that they are ready to ship IPv6 with many of their SW/HW products. Most of these vendors regard IPv6 of strategic importance and have, in addition to supporting the technology in their products, participated in forming IPv6 Task Forces worldwide and played an important role in the development and standardization of IPv6.

![Figure 4- ISPs, Enterprise, cc .sa TLD Registry & Vendors Assessment Summary](image)

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Status</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISPs and Enterprise</td>
<td>No interest Only 3/62 ISPs answered Questionnaires No Consideration for IPv6 No Future Plans No IPv6 Addressing</td>
<td>Not ready</td>
</tr>
<tr>
<td>SaudiNIC cc .sa TLD Registry</td>
<td>No IPv6 Transport Support yet The necessary software and process changes to add IPv6 Glue Records into the DNS zone have been implemented in July/August 2008 already</td>
<td>Not Fully Compliant Work is Ongoing</td>
</tr>
<tr>
<td>SW/HW Vendors</td>
<td>Major vendors are already shipping IPv6 within their products</td>
<td>Major Vendors are ready</td>
</tr>
</tbody>
</table>

- **CITC and Facility Based Providers (FBPs):** can be considered as the most influential stakeholders in a future IPv6 awareness/deployment strategy and also in the establishment of the national IPv6 Task Force: CITC for its regulatory role and ability to raise the flag of leadership and Facility Based Providers (FBPs) for being the owners and operators of ICT infrastructure in Saudi Arabia. ISPs do play an important role in being able to add more penetration by offering IPv6 services to end users, however, their IPv6 offerings rely on FBPs.
offering IPv6 services and connectivity to the IPv6 Internet cloud. Software and Hardware vendors also play an important role though they usually follow demand or mandates for IPv6.

As part of the “IPv6 Status Quo and Readiness Assessment Study”, the IPv4 exhaustion case on a global scale was addressed in addition to the local status of IPv4 in Saudi Arabia. This is addressed in the following section 5.2.

4.2. IPv4 Exhaustion Study

One of the most significant sections of the “IPv6 Status Quo and Readiness Assessment Study” is the estimation of the impact of the IPv4 exhaustion on the Internet market in Saudi Arabia, so it's included in more detail here. The expected demand for IPv4 addresses in Saudi Arabia, the expected lifetime of the free IPv4 address pool, and the projected growth of the IPv4 Internet allocations to Saudi Arabia have been studied and put into relation.

To summarize the results:

- Saudi Arabia needs at least 10 Million IPv4 addresses to number the expected number of households and mobile telephone Internet users in the mid-term future (this number is based on the assumption that 50% of all households and 20% of all mobile users would eventually be connected to the Internet, and need only one IPv4 address each – numbers based on the Internet Service Development Project Phase I data).

- On a global scale, well-renowned experts (Geoff Huston et al) predict that the IPv4 address pool at the regional registries (RIRs) will run out at the end of 2011 as revealed by Figure 4.

Figure 5- IPv4 Exhaustion Graph for IANA and RIRs

![IPv4 Exhaustion Graph](http://www.potaroo.net/tools/ipv4/index.html)

Source: “The IPv4 Address Report, Geoff Huston”


Figure 4 above presents the exhaustion trends of unallocated IPv4 address blocks at both IANA and RIRs as of September 2008. It is expected that IANA (in red) to run out of IPv4 addresses by October of 2010 and RIRs (in green) in October of the following year of 2011.
Figure 5 below presents the expected timeline for critical IPv4 exhaustion dates for both IANA and RIRs in a clearer way.

RIPE NCC allocation/assignment data shows that as of July 2008, Saudi Arabian LIRs have been allocated/assigned a cumulative total of 2.17 million IPv4 addresses as shown in Figure 6 below.

Tables 1 and 2 as taken from Geoff Huston’s “IPv4 Resource Allocations” online report present the allocated and advertised IPv4 address space to Saudi LIRs. It is worth mentioning here that the advertisement of IPv4 address blocks does not indicate the level of actual usage/utilization by end users but rather the addresses that are deployed on production networks and ready to be used. A block could be advertised yet not utilized at all by end users.

Saudi Arabia currently holds 0.08% of the global allocated address space with a per capita index of 0.08 addresses.
Table 2 - Advertised IPv4 Address Space in Saudi Arabia (Source: Geoff Huston, IPv4 Resource Allocations)

<table>
<thead>
<tr>
<th>/8's advertised</th>
<th>Prefix</th>
<th>% of IPv4 space</th>
<th>% of RIR managed space</th>
<th>% of allocated space</th>
<th>% of advertised space</th>
<th>% advertised</th>
<th>per-capita index</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.09518</td>
<td>/11.4</td>
<td>0.04%</td>
<td>0.05%</td>
<td>0.06%</td>
<td>0.09%</td>
<td>73.36%</td>
<td>0.06</td>
</tr>
</tbody>
</table>

As Table 2 indicates, 73% of the allocated IPv4 address space to Saudi Arabia is being advertised, but as explained before, this does not tell in any way what the actual utilization by end users is but rather the IPv4 address space that is “ready” to be used in production networks. The per capita index of advertised address space is at 0.06 addresses. Saudi Arabia advertises 0.09% of the total global advertised IPv4 address space.

- Extrapolating Saudi Arabia's Internet growth until 2012 (red sketch)(Figure 7), using a linear regression based on previous data of cumulative allocated IPv4 addresses from 2004 until mid 2008 (black sketch), significantly less than half of the target IPv4 address amount of 10 million will be reached by the expected time IPv4 runs out. The expected number of allocations/assignments is expected to reach the vicinity of 3.5 million IP addresses by 2012 (red sketch)

Figure 7 also highlights the three (3) phases of pre-depletion (before Oct. 2010), depletion phase (Oct.2010 – Oct.2011) and post-depletion phases post Oct. 2011. The linear regression assumes that the same growth trend as the 2004-2008 period will be exhibited with no acceleration or deceleration of IPv4 address allocations/assignments

- From these numbers it is clearly visible that the desired level of Internet usage in Saudi Arabia cannot be reached in the remaining life span of IPv4. In 2012, about 3.5-4 million IPv4 addresses would have been allocated, 10 million IPv4 addresses are the expected goal for market saturation, and there will not be any reasonable way to acquire the missing 6 million addresses.

Figure 8 below shows the address allocation/assignment extrapolation forecast with the findings of Internet Services Development Phase I expected internet penetration growth percentages (Typical “S” curve trend)
It is important to point out that the IPv4 Internet will not be turned off in 2011 – it will continue to work, but sustainable and normal growth will not be possible when IANA and RIRs deplete their IPv4 address space. So IPv6 is required to ensure further growth and business continuity for all users of the Internet.

4.3. IPv6 Countries Benchmark Study

The study benchmarked IPv6 efforts and activities of eleven (11) countries. The eleven countries were selected from an overall group of seventeen countries. The seventeen countries were grouped by gathering the countries previously selected for the Internet Benchmark study of the previous Internet Services Development Phase I and other nations encountered during the data collection and research on IPv6 worldwide efforts and activities. The seventeen countries were first classified into three (3) categories as per the number of years IPv6 activities have been present: Established (more than 6 years), Recent (2003-4-5-6) and Just Started (2007-8).

A selection criteria was applied to each class separately, the selection criteria consisted of three (3) elements: Criticality of IPv4 Exhaustion to the Country, Governance and Maturity.

The selected countries from the established class were: Japan, Korea, Taiwan and China. From the recent class: USA, India and Malaysia. The Just Started class included: Australia, Thailand, Germany and Hong Kong.

The eleven (11) selected countries IPv6 strategies, promotion policies and overall activities were assessed according to the following assessment criteria:

- Background
- IPv6 Main Bodies
- Governmental Initiatives and Activities
- Promotional Activities
- Commercial Deployment and Offerings
- Research and Development and Technical Activities
Lessons Learned

Figure 9 below depicts the overall methodology and approach in developing the “IPv6 Countries Benchmark Study”.

### Figure 10- IPv6 Benchmark Study Development Approach

<table>
<thead>
<tr>
<th>Resources</th>
<th>Selection Criteria</th>
<th>Assessment Criteria</th>
<th>Categories of Lessons</th>
</tr>
</thead>
</table>
| - Global IPv6 Forum Contacts  
- National IPv6 Forum Chapters Worldwide  
- ICT Ministries and Regulators Official Websites  
- National Internet Registries  
- ICANN, IANA, ARIN  
- Worldwide IPv6 Summits, Conferences and Seminars  
- ITU, OECD  
- Geoff Huston Online IPv4/IPv6 Reports | - Criticality of IPv4 Exhaustion  
- Maturity  
- Governance  
- Three Classes of Countries  
- Established: Japan, Korea, Taiwan, China  
- Recent: USA, India, Malaysia  
- Just Started: Australia, Thailand, Hong Kong, Germany | - Governmental Initiatives  
- Commercial Offerings  
- Promotional and Awareness Activities  
- R&D and Technical Activities  
- Extract Lessons Learned | - Regulatory  
- Commercial  
- Promotional  
- R&D, Technical |

The countries assessment highlighted a set of IPv6 initiatives and activities that were undertaken by both the public and private sectors in order to promote the deployment and promotion of IPv6 and which can be summarized as:

- The inclusion of the IPv6 addressing technology as an integral part of national ICT strategies proved to be of essential importance in IPv6 deployment and promotion efforts. ICT initiatives that are launched by the local ICT regulators or Ministries of ICT for the aim of further promoting the penetration of data and/or telecommunications services are being the main implementer of IPv6 in data and telecommunications networks. These initiatives usually span several years thus keeping the IPv6 effort running for long periods of times. Examples of including IPv6 into national ICT strategies are those of the e-Japan, e-Taiwan, NGN and IT839 of Korea, MyICMS 886 of Malaysia and Digital 21 Strategy of Hong Kong. In addition to including IPv6 as an integral part of a bigger ICT strategy as highlighted above, several countries have launched specific IPv6 strategies that would specifically target the deployment and promotion of IPv6. Examples are Korea’s IPv6 Promotion Policies I&II, Taiwan’s National IPv6 Development and Deployment Program, Malaysia’s National IPv6 Council Timeline and Thailand’s National IPv6 Policy and Roadmap. These initiatives are usually launched by the local ministries of ICT (Korea, Malaysia, Thailand) or under the direct jurisdiction of the office of the cabinet itself (Taiwan). The promotion policies are usually phased on several years with each promotion policy or phase building on the successes of the previous one and addressing the weaknesses and problems that were encountered and identified. Promotion policies address issues related to IPv6 capable infrastructure and networks, IPv6 based applications, IPv6 pilot projects such as ubiquitous cities in Japan and Korea and IPv6 promotional and awareness activities.
The transition of e-government networks in several countries was in all cases being sponsored and facilitated by the government itself via technical guidance and recommendation of best practices. In the case of the US, the transition of its governmental sector was rather mandated by the central federal government. The transition of e-government networks is considered to be an important IPv6 promoter due to the influence governmental agencies would have on stakeholders that interoperate and closely correlate with the agencies (service providers, vendors, private and public stakeholders that internetwork with the governmental agencies).

The local regulatory and ICT governmental authorities are mostly playing the role of the sponsor, enabler or facilitator of IPv6 activities instead of the role of the enforcer, which is only seen in few cases, like the USA where the federal agencies were mandated by the Federal government to move into IPv6 by June 2008. The decision on IPv6 adoption for the private sector is left to the judgment of the service providers and other stakeholders of the private sector who are better positioned to align any IPv6 plans with their business requirements. Enforcements by the local regulator, other than being hard to follow up and audit could disrupt and complicate the business activities of the private sector thus defeating the purpose of improving the prospects of ICT sector by deploying IPv6.

The creation of a non-governmental non-profit promotional body or forum as a local chapter of the global IPv6 Forum is a practice that has proven its efficacy in the deployment, promotion and awareness IPv6 activities in each of the benchmarked countries. The local IPv6 Forums, Task Forces or Councils, though usually initially established and sponsored by the local ICT authorities, later on undertake their activities as independent entities whose policies and plans are agreed upon by its members. The members represent the government sector (ICT and regulatory authorities), ISPs, Telcos, Enterprise, Vendors, R&D institutes, academia and independent IPv6 experts and individuals. The activities of the local forums and task forces were most the times found to be categorized into technical activities and promotional-awareness activities. Activities under each category are undertaken via a framework of Working Groups that comprised of delegates from the different members of the forum. Technical working groups usually addressed issues related to standardization, security, network management systems, transition guidance and services ported on IPv6 such as VoIP, WiMAX, Mobile IPv6 and others. Promotional and awareness working groups dealt with issues related to seminars, IPv6 summits, workshops, training and human resources. IPv6 Summits were found to be the most prominent and beneficial promotional activities that would most of the times be organized by the local IPv6 forums/taskforces and would gather IPv6 experts and representatives from all over the globe who would represent their experiences for the benefit of the local stakeholders.

The establishment of a nationwide IPv6 test bed over an existing R&D or R&E network or public network that would allow its participants to use IPv6 connectivity gave stakeholders the needed pilot environment for testing and nurturing IPv6 expertise and knowledge base without running the risk of disrupting their production networks. IPv6 supportive IPv6 pilot and test beds also served as a testing environment for R&D IPv6 related activities.

The most important obstacle in transitioning to IPv6 was found to be the absence of a business case and the lack of demand from service providers' clients and end users. Despite of this, service providers in many countries have already established IPv6 services as it gives them a differentiator element over the competition. The anticipation of potential future IPv6 demand after the exhaustion of IPv4 has also played a role in service providers adopting IPv6 despite the lack of an immediate business necessity or incentive.

Procurement best practices now stipulate the importance of acquiring IPv6 capable HW/SW in future procurement and upgrade cycles. This practice also considerably reduces the prospective costs of any IPv6 adoption plans as it would make IPv6 a part of the normal and periodical ongoing IT process cycle instead of a sudden migration to IPv6 plan that would disrupt production networks operations and incur much higher costs.
IPv6 native connectivity is the aim of any IPv6 effort. In addition to IPv6 connectivity at the access, distribution and backbone networks, the establishment of IPv6 native connectivity at both international gateways and at the peering levels was found to be important. This translates into the necessity of local internet exchanges being IPv6 capable. The availability of IPv6 capable internet exchanges helps diffuse the deployment and promotion of IPv6 based internet.

IPv6 training and human expertise plays an important role in IPv6 deployment and promotion efforts. There is currently a lack of IPv6 expertise personnel at the technical level without which reliable and sustainable deployment and management of IPv6 internet would be a very hard task. IPv6 training and know-how knowledge base building served as a key success factor in most of the benchmarked countries. In Malaysia for example, the National Advanced IPv6 Center of Excellence has set up IPv6 training activities and IPv6 certification programs that would graduate the needed IPv6 expertise.

### 4.4. IPv6 International Bodies & Organizations

In this study, a number of international bodies relevant to the Internet and IPv6 in general, and that could be of relevance and importance to the IPv6 deployment in Saudi Arabia have been identified and classified as per their type of activities.

Figure 10 below depicts the overall methodology that was followed in developing the study. As the figure shows, the different organizations were identified and categorized into: Standardization, Address Management, Awareness/Promotional and finally R&D/Deployment Projects. The different bodies were assessed based on a criteria of elements such as IPv6 Role, Geographical Scope, Relevance to KSA and Membership Structure. The final stage was the issuance of a set of recommendations as detailed below.

As stated earlier, the different entities have been grouped into four categories:

1. **IPv6 Standardization Bodies and umbrella organizations**
   1.1. The Internet Society (ISOC)
1.2. Internet Engineering Task Force (IETF)
1.3. International Telecommunications Union (ITU)
1.4. European Standards Telecommunications Institute (ETSI)

2. IPv6 Address Management Bodies
2.1. Internet Corporation for Assigned Names and Numbers (ICANN)
2.2. Internet Assigned Numbers Authority (IANA)
2.3. Number Resource Organization (NRO)
2.4. RIPE Network Coordination Center (RIPE NCC)
2.5. Asia Pacific Network Information Center (APNIC)
2.6. American Registry for Internet Numbers (ARIN)
2.7. Latin American and Caribbean Internet Address Registry (LACNIC)
2.8. American Registry for Internet Numbers (ARIN)
2.9. African Network Information Centre (AfriNIC)

3. Awareness creation and community work
3.1. IPv6 Forum
3.2. IPv6 Portal
3.3. Middle East Network Operators Group (MENOG)
3.4. UAE IPv6 Task Force
3.5. Asia Pacific IPv6 Task Force

4. Others – research networks, sources of IPv6 documentation and recommendations, ...
4.1. 6NET
4.2. SixXS
4.3. Euro6IX
4.4. Eurov6 – European IPv6 Showcase
4.5. go6 portal
4.6. Japan Gigabit Network (JGN)
4.7. Widely Integrated Distributed Environment (WIDE) Japan
4.8. Korea Advanced Research Network 2 (KOREN2)

For all these organizations, a detailed assessment was made on each organization’s role regarding IPv6, on its membership structure and geographical scope, and of its relevance to the IPv6 development in Saudi Arabia. For example, ISOC or ICANN/IANA play a very important role for the Internet as a whole and IPv6 specifically, but direct interaction with either body will not be directly beneficial, as IETF and RIPE NCC play a more direct role regarding IPv6 technical standards and IPv6 addressing in KSA.

Based on this, the study resulted in the following list of recommendations to help move forward IPv6 deployment in Saudi Arabia. The list is included in this section as-is, without timelines or priorities. Specific recommendations as part of the overall IPv6 Strategy will be detailed in later sections.

- Subscribe to RIPE IPv6 and Address Policy mailing list and read RIPE the archives, to see what is being discussed
- Attend the next RIPE meeting (October 2008 in Dubai)
- Subscribe to IETF WG mailing list and read IETF work group mailing list archives, to see what work is currently done
- Attend IETF meetings, IETF meetings are held three times a year, they are a week-long, the goals of the meetings are to reinvigorate the WGs to get their tasks done and to promote a fair amount of mixing between the WGs and the areas
- Have a membership with IPv6 forum, it will be an asset and powerful to CITC to house a well-built knowledge and awareness to move forward, as the IPv6 forum workgroups are community groups and are available with no fees
- Establish contact with the IPv6 forum regarding a national KSA IPv6 task force creation
- Set collaborative linking environment with IPv6 Portal to be willing to analyze, develop and participate in IPv6 worldwide activities, and create an account to get access to extra documents, sections and features, and IPv6 national Forums
- Reading the lessons learned of Europe 6IX project implementation and take into consideration the overall outcome of the tested IPv6 Advanced services and applications
- Utilize 6NET organization resources such as books (6NET IPv6 Deployment Guide - October 2005), Press releases, Newsletters, Information, Public deliverables, and standards contributions.
- Subscribe to SixXS to be able to provide tunnel connectivity to the end users for testing a variety of services and applications. However we recommend connecting CITC to IPv6 cloud using router to the other end of the tunnel to build separate IPv6 environment (this setup is emulated by the proposed IPv6 LAB in the IPv6 project). CITC can utilize the benefits from SixXS services including tools for monitoring and debugging the IPv6 routing tables manipulated using the provided tunnels.
- CITC can employ the outcome and results of the Eurov6 distributed showcases including Services (IPv6 DHCP, flow control, IPv6 in IPv4 tunnel, etc) and Applications (apache, Bind 9, FTP, web, Mozilla, SSH, etc).
- Accelerate the rate of adoption of the new features and significant improvements offered by 6Go organization.
- Get a training provided by UAE taskforce on IPv6 Core Protocols, Implementation tools and procedures for IPv6 Network professionals.
- Join MENOG scheduled events and meetings listed in MENOG official website including presentations, tutorials and workshops.
- Build an IPv6 research and operation center for developing operation and management technologies of the IPv6-compatible network.
- Subscribe in Asia Pacific Task Force website, which provides a mailing list and information on deployment strategy status in, Australia, China, EU, India, Japan, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand, in addition to guidelines, promotion and data collection workgroups.
5. IPv6 Strategy Action Plan

Based on the findings detailed in the previous section, an overall action plan has been developed.

As stated earlier, the action plan contains initiatives that fall into two (2) categories:

- **Infrastructure**: Initiatives of this track target the deployment of IPv6 in particular infrastructure elements of the ICT network
- **Awareness**: this aims at raising the sense of urgency and awareness on IPv6 as a technology and its importance so as to drive and encourage the IPv6 deployment

![IPv6 Strategy Tracks and Initiatives](image)

Besides the above initiatives that are organized in two (2) parallel tracks, the Action Plan also encompasses a number of Milestones that serve as an intermediate checkpoint to verify whether sufficient achievements have been made, and to take corrective action at an early-enough point in time.

One central aspect is the foundation of a Saudi Arabian IPv6 Task Force as a focal point for all IPv6 activities. More details on the Task Force can be found in the next sub-section. The following subsections will detail the individual track initiatives, grouped into the respective track, and ordered by importance and timeline.

### 5.1. The National IPv6 Task Force

One essential element for success of the IPv6 strategy is to raise awareness in the general public.

Implementing IPv6 in the network backbone is not very difficult, but if there is absolutely no demand from the end customers, ISPs and FBPs are reluctant to invest into software upgrades, man power for implementation and training, and other costs attached to the IPv6 roll-out. From the questionnaire results in the “IPv6 Status Quo and Readiness Assessment” study, it was concluded that there has been very minimal consideration for IPv6 at the ISPs or the end users level. Questionnaires revealed “No Market Demand” as the major obstacle for IPv6 deployment.
So, it is important to inform the general public, especially the industries that have high demands regarding the quality and future stability of their Internet access (banking, oil), that there is a need to implement IPv6 in the near future, to ensure business continuity and stability in the years after the IPv4 exhaustion.

To achieve this, a new organization has been formed, the “Saudi Arabian IPv6 Task Force”.

The main functions of the IPv6 Task Force are:

- Raise awareness in Saudi Arabia about the IPv4 exhaustion and the national strategy to move towards IPv6, to ensure Internet stability, business continuity, and future growth
- International coordination with the IPv6 Forum and other national IPv6 Task Forces
- Organization of IPv6 awareness events and IPv6 summits inside Saudi Arabia
- Establish and maintain good working relationship to the local media (newspapers, radio, TV)
- Establish and maintain contacts with key players from all industry sections, ensure that the mission is not forgotten and that people will keep being aware of the IPv6 strategy
- Collect and disseminate technical and non-technical information about IPv6 on its web site
- Find incentives to motivate ISPs (and others) to move towards IPv6
- Be a focal point for all IPv6 activities in Saudi Arabia, to avoid duplication of effort and lack of communication between interested parties

The IPv6 Task Force should (at least) be comprised from:

- CITC personnel, to have a strong backing from the governmental / regulatory side
- FBP decision makers, to get proper priorities their activity plans for the next years
- Key personnel from the non-networking industry, like banking and oil, to ensure these stakeholders are addressed appropriately
- Interested parties from the research and education community (KACST etc) to get their views

Besides the volunteer work noted above, the IPv6 Task Force should also have a few paid-for staff members to fulfill functions like:

- Ensure timely reach-ability of an “Official IPv6 Task Force representative” (which will help to achieve the goal “be a focal point for all IPv6 activities”, and will also make working with the media easier)
- Work with the print media, and provide them with pre-written articles about IPv6, like reports from the workshops/summits, status updates, and such, so that the media can then take these and print them without the need to have their own journalists write text – so it's more likely to get material printed
- Work with the volunteer members of the IPv6 Task Force, to make sure that they keep up the important work they need to do together in the Task Force
- Coordinate the organization of the official events (workshops, summits, internal task force meetings, …)
- Maintain the IPv6 Task Force web site

The funds for these staff members are initially coming from CITC. In the long run, other funding models (use the “universal services funds”, use funding by the members, continue funding by CITC) needs to be considered and decided upon.

The individual activities expected from the IPv6 Task Force are explained in more detail in Section 6.3, “Action Plan - IPv6 Awareness Initiatives”.

The IPv6 Task Force will be dismantled when the mission has been fulfilled and when IPv6 in Saudi Arabia is a reality. The exact criteria to decide that is to be decided by the Task Force in the time to come.
The National IPv6 Task Force has already held three (3) meetings during which a various IPv6 related activities and discussions have been undertaken as follows:

### 5.1.1. First Meeting (July 30, 2008)

The National IPv6 Task Force held its first kick-off meeting on July 30, 2008. The meeting was attended by CITC and FBPs representatives and members. The meeting focused on the following key issues:

- **Presentation of the CITC IPv6 Project and its main aims:**
  - Establishment of the National IPv6 Task Force
  - Setting an Nation Wide IPv6 Strategy

- **Preliminary findings of the IPv6 Project:**
  - The IPv4 exhaustion and the predicted dates of exhaustion for both IANA and RIRs
  - Results of IPv6 Readiness questionnaires to FBPs and other local stakeholders

- It was stressed during the meeting that IPv6 is seen as the way forward, to ensure future growth of the internet and hence Business Continuity

- It was communicated and stressed to the present stakeholders (FBPs) their important role to achieve a successful migration (being the owners and operators of the local ICT infrastructure) and the expected proactive and committed involvement they must play in both the National IPv6 Forum activities and the implementation of the future IPv6 Strategy

- CITC collected feedback from the stakeholders on their IPv6 readiness, their projected timelines, and get them committed towards IPv6

### 5.1.2. Second Meeting (September 21, 2008)

The second of the IPv6 Task Force was also attended by FBPs during which the following was presented:

- **Findings from the IPv6 Project**
  - IPv6 Status Quo and Readiness Assessment
  - IPv6 International Countries Benchmark
  - IPv6 International Organizations and Bodies

- **IPv6 Strategy Development Methodology**

- **IPv6 Strategy**
  - Objectives
  - Tracks (Infrastructure and Awareness)
  - Milestones and Timeline

Several discussions surrounding both the outcomes of the IPv6 project findings and the proposed IPv6 Strategy were undertaken and it was once again stressed on the importance and central role of FBPs in deploying IPv6 in Saudi Arabia. CITC reiterated the high expectation and high level of expected commitment from FBPs which includes the following:

- Actively Participate in IPv6 Task Force Activities
- Support IPv6 in Infrastructure
- Support IPv6 in Internet Filtering
  - WWW Content
  - Access List Filtering
• Connect to future IPv6 Test Lab

It was also discussed during the meeting the importance of undertaking a nationwide IPv6 event later in the process which should be held and which will be open to the general public and which is widely announced to all stakeholders that play a role in the migration to IPv6: ISPs, FBPs, mobile and fixed line phone operators, key enterprises, governmental enterprises (planned for February 2009)

5.1.3. Third Meeting (November 18, 2008)

The third task force meeting was held on November 18th. In addition to representatives from FBPs, Cisco Systems was represented.

The meeting started by Cisco presenting on general IPv6 related issues as a technology and later on technical matters related to actual deployment of the protocol along with an action plan referring to RFC 5211.

Gert Doering from Devoteam presented a general overview on the IP management hierarchy, IPv4 address policies and latest changes, IPv6 policies, the current status of global IPv6 deployment and a case study of IPv6 deployment at an ISP.

CITC also presented and reiterated the overall IPv6 Strategy for Saudi Arabia. The strategy was discussed further. It was agreed to finalize and accept the strategy elements as is.

Further discussions were undertaken over the next task force meeting dare and agenda as well as the IPv6 National Event planned for February.

5.1.4. National IPv6 Event (Planned February 2009)

To make all of the Internet community in Saudi Arabia aware of the upcoming IPv4 exhaustion, of the move to IPv6, and of the technical requirements to achieve the IPv6 migration, it is suggested to have the IPv6 Task Force organize a larger IPv6 event.

One possible format would be a one (1) day conference with parallel tracks for technically talks and for higher-level overview talks about the benefits of IPv6 and the risks of sticking to IPv4.

Further contents could consist of successful case studies where experiences from successful IPv6 roll-outs in various places can be shared. This could be ISP case studies, but also content provider, e-mail services, or end-user experiences.

It is recommended to invite IPv6 experts from other countries to give talks. These could come from other countries’ IPv6 Task Forces, from RIPE NCC, or be more technically oriented to give in-depth IPv6 technical talks. As well, the summit should invite speakers from the national R&D and R&E sectors, to learn from their experiences.

It’s important to keep the media involved early on, so that people will notice well in advance that there is an important event coming up, and arrange their schedules to be able to take part. The event itself should also be very well covered – TV news, detailed articles in computer magazines, articles reminding everybody of the mission towards IPv6 in the mainstream newspapers.
The attendance fee to this IPv6 Summit should be considered well. It should not be too low (to avoid giving the impression of a “low quality” event) and not be too high (to avoid taking away the chance for people to attend).

## 5.2. Action Plan – Infrastructure Track Initiatives

The infrastructure track consists of five (5) initiatives aiming at deploying IPv6 in particular infrastructure elements of the local ICT networks. It contains the tasks that need to be done by the FBP operators and CITC to play their part in the introduction of IPv6 in Saudi Arabia. Most of it is standard technical work, but given the special nature of the ISP/FBP hierarchy in Saudi Arabia and the legal requirements for content filtering, there are tasks very specific to Saudi Arabia that need to be addressed.

### 5.2.1. IPv6 Addressing

The objective of this initiative is for Service Providers to acquire IPv6 Address Blocks.

All FBPs offering IP services and most ISPs in Saudi Arabia are members of the RIPE NCC (LIRs) to satisfy their IPv4 addressing demand (52 LIRs in total).

Except STC and KACST, none of the LIRs has requested IPv6 address space from RIPE yet.

The address space requested by STC is the standard size for all providers, a /32 allocation. This is enough for small to medium sized providers, but depending on the addressing scheme going to be used by STC, a larger allocation might be necessary, like a /28 to be able to assign 1 million end-user prefixes of size /48.

The recommendation to the FBPs and ISPs is to consider their addressing needs in IPv6, depending on the size of the addresses to be given to their end customers and the number of customers, and as soon as possible request IPv6 address space from the RIPE NCC.

For those ISPs that are not LIRs on their own, but are using IPv4 addresses from their upstream providers, they should ask their upstream provider for an IPv6 address block (a sub-allocation), thus creating a market demand for IPv6.

Along the same avenue, all ISPs should demand IPv6 connectivity from their current IPv4 upstream providers. If peerings exist, ISP or FBPs should cooperate to enable IPv6 connectivity on the peerings as well.

For the planned test lab, it is considered beneficial to have official IPv6 address space, to be able to connect the lab network to other networks, and to the global IPv6 Internet (via a Tunnel, initially).

CITC should therefore become a RIPE member (LIR) and should acquire an IPv6 address block (/32) from RIPE – initially, but not limited to, for addressing the test lab.

Becoming a LIR has the added benefit of being able to acquire IPv6 address space for the future Saudi Arabian Internet Exchange, NIXP. (A /48 of IPv6 address space would be acquired under the special policy “addresses for exchange points”).

In the RIPE region, there is currently no possibility to get provider independent IPv6 address space (IPv6 PI). So if CITC decides not to become a LIR, this will mean that they will need to use IPv6 address space from one of their providers, e.g. KACST for an initial setup. When they change...
providers, they will have to renumber all networks using space from the old provider to addresses from the new provider. Being a LIR, their own IPv6 address block is automatically independent from specific upstream connections.

5.2.2. IPv6 Commercial Support for Nation Wide Infrastructure

The objective of this initiative is for Service Providers to provide commercial IPv6 services through:

- FBP1s to implement IPv6 in their Networks
- FBP2s to acquire IPv6 Upstream Service
- FBP3s to Implement IPv6 in Future Peering
- FBP1s to implement IPv6 in their applications/services

Saudi Arabia has a fairly unique approach to international IP connectivity: all Internet service providers (ISPs) are required by law to use a fairly small number of Service Providers, called Facility Based Providers (FBPs), licensed to run an International Gateway for international IP connectivity. To achieve international IPv6 connectivity for any network user in Saudi Arabia, these central gateways and the FBP infrastructure needs to be IPv6 capable. So this is an essential blocking point.

The operators of the International Gateways have already been contacted with a direct letter to raise awareness regarding the IPv6 migration, and have taken part in the National IPv6 Task Force Meetings to start working on the IPv6 implementation (Section 6.1)

Nevertheless, special emphasis needs to be put on the goal that the FBP infrastructure and International Gateways are fully IPv6 capable, so that other organizations and ISPs can use it to connect to the IPv6 Internet. It is recommended that CITC frequently contacts the FBP1s to find out about the ongoing work in adding IPv6 services to their networks, and make sure that it's appropriately prioritized by management. Since CITC is assuming the role of a promoter for IPv6
and advisor for the migration, no more powerful measures (as, for example, making the implementation of IPv6 mandatory by regulation) will be done.

5.2.3. .sa ccTLD IPv6 Compliance

The objective of this initiative is for SaudiNIC to prepare the .sa cc TLD to be IPv6 ready.

For a full IPv6 migration, the following parts of the .SA TLD registry need to be enhanced to support IPv6 (see the “IPv6 Status Quo and Readiness Assessment" Study for details):

- IPv6 transport for all authoritative DNS servers
- IPv6 connectivity and service for the WWW and E-Mail servers
- Support of IPv6 Glue records in the DNS zone, DNS database, and DNS software
- Support of DNS server validity checks on IPv6-connected name servers

This is not as urgent as other items, but need to be done well in advance of the IPv4 exhaustion date, to be sure it works when needed. Implementation depends on the availability of production quality IPv6 transport from ISPs/FBPs.

Work on this is already ongoing - e.g. the necessary software and process changes to add IPv6 Glue Records into the DNS zone have been implemented in July/August 2008 already.

5.2.4. IPv6 Compliant Internet Filtering

The objective of this initiative is for Service Providers to implement IPv6 Internet Filtering by realizing both of an:

- IPv6 Ready WWW Content Filter
- IPv6 Ready Access Lists Filter
Saudi Arabia is using a system to filter unwanted and/or illegal content from the WWW by using web filtering software and hardware at the International Gateways, where Service Providers connect to the outside world.

The approach taken is this:

- Web requests are redirected from the IGW routers to load-balancing devices. This is done with “Foundry” and “Cisco CSM” load balancers.
- The load balancers direct the outgoing WWW requests to a set of servers that do the actual content filtering. This is done with “Sidewinder” devices from Secure Computing, and “ProxySG Appliances” from Blue Coat Systems.

It can be concluded from the IPv6 Questionnaires feedback that most FBPs have not done any work to make their network IPv6 compliant yet. So it is assumed that the filtering infrastructure is not IPv6 capable yet either, and urgently needs to be adapted.

It is recommended that CITC should amend the regulatory framework to mandate IPv6 support in the filtering setup at all International Gateways. CITC has no regulatory power over the vendors, but by this indirect approach, the operators of International Gateways will need to make sure their filtering setup is IPv6 capable and that the vendors deliver appropriate solutions.

This is prioritized “high”, because the implementation with the vendors will take some time, and for a production IPv6 service, to have these filters in place is required by law.

Besides using a web proxy system to filter access to inappropriate content based on URL address, the Saudi Arabian International Gateway system also uses router access list based filtering, to block access based on the IPv4 address of the destination host.

This needs to be extended to handle blocking of IPv6 addresses as well. To achieve this, the processes inside CITC need to be amended to permit adding of an IPv6 address, and to separate filtering entries for IPv4 and IPv6. Then, the procedures at the operators of International Gateways need to be extended to handle IPv4 and IPv6 address filtering, and to download the lists in an appropriate way into the filtering devices.

It might be needed to amend the regulatory framework to adapt to this as well.

This item is prioritized as “medium”, because initial IPv6 connectivity will be possible even if this is not implemented yet. It needs to be there for the production IPv6 Internet to meet the
requirements of the law, but since this only depends on CITC and the Operators, not on external vendors, this should be fairly easy to implement.

5.2.5. Build an IPv6 Test Lab and Disseminate IPv6 Technical Experience

The objective of this initiative is for Service Providers to connect to IPv6 Lab and build IPv6 Practical Experience.

Figure 16- The IPv6 Test Lab and General Features

Detailed requirements for the test lab are specified in the deliverable document IPv6:D6.

The test lab's purpose is twofold:

- Find answers to the questions “how to technically operate an IPv4/IPv6 network” - the focus here should be on the technologies used by the majority of the KSA Internet users
- Give stakeholders the chance to experiment with IPv6 without endangering their own network

Some requirements for maximum effectiveness of the lab setup are as follows:

- The lab is to use public IPv6 addresses, either provided by CITC or through another IPv6 provider
- The lab network should be connected to the global IPv6 Internet, initially using an IPv6-over-IPv4 tunnel, later on by using native IPv6 connectivity when available
- Access to the lab should be open, for all interested stakeholders
- If another IPv6 lab wants to connect to the CITC IPv6 lab, this can be done in one of two ways:
  - Using the public Internet, connecting with an IPv6-over-IPv4 tunnel
  - Using a direct leased line from the other IPv6 lab, using native IPv6
- Optionally, the Lab could host a SixXS tunnel broker (see http://www.sixxs.net/) to give interested end users in KSA an easy way to connect to the IPv6 internet. This depends on bandwidth and server hardware availability in the lab setup
The experience gained from the test lab should be made publicly available, either on CITC's web site, or on the website of the IPv6 Task Force. It is suggested to write technical in-depth documentation, and easy to follow step-by-step instructions for the affected stakeholders (ISPs, enterprises).

5.3. Action Plan – Awareness Track Initiatives

The Awareness track consists of five (5) initiatives aiming at deploying IPv6 in particular infrastructure elements of the local ICT networks.

5.3.1. Establish a National IPv6 Task Force

The objective of this initiative is to establish an IPv6 Task Force that will own and drive the National IPv6 Strategy.

As explained in section 6.1, one fundamental element of the IPv6 Strategy is working on the general lack of awareness regarding IPv6. To improve this situation, a national Saudi Arabian IPv6 Task Force has been founded. One of the results of the “IPv6 Status Quo and Readiness Assessment” Study is that the general level of awareness inside Saudi Arabia regarding IPv6 is very low, even inside the organizations of utmost strategic importance (Service Providers running the national backbone and/or the International Gateway Services (FBPs)).

There is only one organization that has IPv6 operational experience/connectivity, which is KACST. KACST is not providing commercial of services to non-university related end users.

The awareness effort of the IPv6 Task Force shall include activities targeting the decision making level management and these can be:

- Sending official letters, backed by the CITC governor, to the largest service providers (FBPs, mobile providers, ISPs) and to the largest enterprises (banking, oil), informing the stakeholders that IPv4 will run out in the foreseeable future, that IPv6 is the only scalable way forward, and
that they need to prepare themselves for the move to IPv6, to ensure future growth and business continuity beyond 2011.

- Specifically target all Facility Based Providers (FBPs) explaining that the whole success of moving the country towards IPv6 depends on the backbone networks and International Gateways being IPv6-ready in the near future
- Invite key persons from the management level of the largest service providers and largest enterprises to take part in the work of the Saudi Arabian IPv6 Task Force.
- Send the message to the media (newspapers, television) that the move to IPv6 is considered of strategic importance to Saudi Arabia, so that even smaller enterprises and end users can be aware that a change is coming.

At the IPv6 Workshop on 30/07/2008, the participants agreed to work together in the form of such a Task Force.

The specific details on the structure of the IPv6 Task Force will be established in the next months. These details will be part of the deliverable D9 of the CITC IPv6 Project.

### 5.3.2. Outreach Activities

The objective of this initiative is for raise awareness of all stakeholders to encourage the deployment of IPv6 nationwide.

**Figure 18- IPv6 National Task Force Scope of Outreach Activities**

![IPv6 National Task Force Scope of Outreach Activities](image)

#### 5.3.2.1. Media

To make sure that the IPv4 exhaustion problem is not being forgotten and that people stay aware that the network has to move to IPv6, the IPv6 Task Force should work with the local media and regularly recall the topic to the stakeholder's memories.

This could be, for example, by publishing technical articles about IPv6 in technical journals, or by having non-technical articles in the mainstream media about the status quo regarding IPv4 exhaustion and IPv6 migration in Saudi Arabia and other countries.
Ideally, the IPv6 Task Force should have a paid-for staff member with good writing skills, so that the newspapers can just take the provided material and print it.

5.3.2.2. IPv6 Task Force Website

The IPv6 Task force should have their own web site where basic information about the Task Force itself, technical information about IPv6, and recommendations for the stakeholders on how to implement IPv6 in their networks can be found.

This website should be established in the industry as a good source of all sort of information regarding IPv6. So it needs to be well-maintained and updated regularly.

To increase credibility, it is important that this website is reachable over IPv6 transport.

5.3.2.3. International Contacts

The IPv6 Task Force should maintain contacts with the global IPv6 Forum, and with the IPv6 Task Forces in the countries of the Middle East region, to coordinate outreach activities, development of technical documentation, and similar activities.

Interested parties from the region could be invited to the IPv6 Task Force events, leading to better technical cooperation, and exchange of knowledge and experience.

5.3.2.4. Dissemination of Information

The IPv6 Task Force should continue the work of collecting and maintaining documentation and how-to documents regarding IPv6, and publish them on their website.

This should be done in cooperation with the IPv6 forum, other national IPv6 task forces, and other sources of IPv6 material (e.g. 6NET/6diss, Euro6IX, SixXS, etc) to avoid duplication of effort that has already been done elsewhere.

It is also important that the IPv6 Task Force is also reachable by classical means, e.g. telephone, so interested persons, especially from the media, but also from enterprises and network operators, can find a point of contact where to ask about IPv6.

5.3.3. International Cooperation

The objective of this initiative is to share IPv6 experience with international IPv6 bodies and establish Saudi Arabia’s presence in relevant IPv6 international organizations.
The “IPv6 International Bodies and Organizations” Study identified the IETF, the RIPE NCC, and a few dedicated IPv6 communities as the key parties in the technical community regarding IPv6. The IPv6 Task Force should nominate IPv6 delegates that would join the following mailing lists, to keep in touch with the industry development and the IPv6 address policy development:

- RIPE Address Policy Mailing list: http://www.ripe.net/ripe/maillists/
- RIPE IPv6 WG mailing list: http://www.ripe.net/ripe/maillists/
- IPv6-Operators mailing list: http://lists.cluenet.de/mailman/listinfo/ipv6-ops
- MENOG mailing list: http://www.menog.net/mailing_lists.php
- APNIC and Apricot: http://www.apricot.net/

There are other IETF mailing lists, but some of them are very high-volume, and others are very specialized to individual technical details. So the recommendation is to get familiar with the overall workings of IETF and RIPE first, and then add more lists and forums later on.

Besides mailing lists, there are a number of web forums and online technical communities that should be followed on a regular basis:

- The Go6 community: http://go6.net/
- The SixXs community: http://www.sixxs.net/main/
- The IPv6 portal: http://www.ipv6portal.org/
- The 6NET deliverables web site: http://www.6net.org/

The second recommendation is to attend the RIPE meeting in Dubai in October 2008 (http://www.ripe.net/ripe/meetings/ripe-57/), because personal contacts to other experts working in this field cannot be valued high enough. Also, due to good experience at previous contacts between CITC and APNIC, it might be useful to attend the APRICOT meeting in Manila in February 2009.

Attendance of an IETF meeting is suggested for a later stage, when more technical expertise has been achieved. IETF meetings are very focused on technical details, and require in-depth
preparation for the topics discussed, so they are not very useful to establish first contacts and get an overview.

Besides technical contacts highlighted above, it is recommended to establish high-level non-technical contents to other countries' IPv6 Task Forces.

The umbrella organization where all these task forces can be reached is the global IPv6 forum, [http://www.ipv6forum.com](http://www.ipv6forum.com/). Key contact to the IPv6 Forum is Mr. Latif Ladid, Chairman of the IPv6 Forum, reachable via latif@ladid.hu.

CITC should nominate a contact person for non-technical coordination work regarding IPv6, and have that person establish contacts to the IPv6 forum as part of the work of the Saudi Arabian IPv6 Task Force. The costs for being a member of the IPv6 Forum are 2500 EUR (approximately 14000 SAR).per year.

Besides the IPv6 Forum, contact should also be established and maintained with other national IPv6 Task Forces from the Arabian region, the MENOG forum, and the Asia Pacific IPv6 Task Force.

5.3.4. IPv6 Training

The objective of this initiative is to enhance the internetworking training curricula and programs to cover IPv6 so as to produce the required IPv6 expertise.

*Figure 19- The National IPv6 Task Force Scope of Training Awareness*

![IPv6 Task Force Scope of Training Awareness](image)

The National IPv6 Task Force will work with Service Providers, universities, colleges and commercial training institutions to bring IPv6 to their curriculum and develop IPv6 Training Plan contents.

Raising the awareness in this regards is very important to make sure IPv6 skilled engineers are available in 2011 when IPv4 runs out and IPv6 will become unavoidable.

Academic bodies and entities such as universities and technical training institutions should be contacted via official IPv6 Task Force communications (backed by CITC and the governor, if possible) reminding them about the importance of including IPv6 know-how and material in their IT/Networking related curriculum.
The deliverable document “IPv6 Policies, Procedures and Guidelines” has more detailed plans how an IPv6 training course could be structured.

It would be beneficial to include members from the Educational sector into the IPv6 Task Force as well, for improved cooperation and communication.

5.3.5. **IPv6 Compliant Procurement**

The objective of this initiative is to highlight the importance that stakeholders include IPv6 compliance in SW/HW procurement policies. This measure would facilitate the gradual inclusion of IPv6 support in the ICT infrastructure of stakeholders, create a demand for IPv6 and send the message to vendors that IPv6 demand is on the rise involving them more in the process of awareness and deployment.

It is recommended that the National IPv6 Task Force highlight the importance of:

- Mandating in all procurements of all products having any relation to networking (either being a networked device itself, or storing, processing, or otherwise handling network data) the capability of operating in an IPv4-, IPv6-, or mixed IPv4+IPv6 environment. Both the Public and Private sectors shall be approached with awareness and suggestions of the importance of amending such procurement policies. The Task Force shall approach governmental agencies, ministries and the e-Government program that, based on the problems to be expected with IPv4-only products in the upcoming years, it is recommended for all future governmental procurements to include IPv6 compliance.

- Making it a requirement for stakeholders Internet links procurements (access, uplink, peering, international uplink and others) to be fully IPv6 capable

The IPv6 Task Force shall highlight that stakeholders entering into ICT procurement contracts not noticing IPv6 compliance would run the risk of incurring large costs in the future when no more IPv4 address space is available as they would resort to sudden and “last minute” measures/changes to adopt IPv6 for business continuity.
6. Milestones to Verify Success

As explained before, the main goal of the IPv6 Strategy and its Action Plan is to set up a framework on how to act in the next few years to achieve a smooth transition of the Internet usage in Saudi Arabia to a future Internet where free IPv4 addresses will not be available anymore, and IPv6 must be used.

The essential part of the strategy is to move the Internet networks in Saudi Arabia from “IPv4 only” networks to a parallel usage of IPv4 and IPv6, with enough room for further growth due to the usage of IPv6 for large numbers of users.

In later years, when IPv6 is deployed widely enough, IPv4 can be removed, but this is not part of this strategy document, because the appropriate time to do so is not yet known. It is expected this to be at least 10 years in the future.

Seven (7) specific “large” goals are being recommended, to be used as milestones to measure success.

The deadlines have been chosen as a reasonable compromise between

- Having enough time to reach the milestones, and
- Leaving enough time for the next goals to be implemented

The detailed actions required to achieve these goals, together with their respective owner and suggested timeline for implementation, have been explained in the previous sections.

Those detailed initiatives have priorities set, to be able to more easily decide on the course of actions to take, and what activities to postpone if not enough available resources can be found. The milestones do not explicitly list priorities, as all of them are considered essential and indispensable. Consequently, the milestones all have a recommendation for a fallback plan of what to do in case the milestone is not reached in time.

6.1. Enable IPv6 connectivity at ONE Facilities Based Provider (FBP)

The milestone is reached when at least one FBP offers IPv6 connectivity (transport) to his customers (ISPs or end users). It does not need to be commercial grade / production quality IPv6 yet, just basic IPv6 connectivity.

This is a necessary prerequisite to facilitate IPv6 access for Internet Service Providers and other end customers. One FBP is sufficient to give other players the option to connect their networks to the IPv6 Internet.

Although KACST was found to be IPv6 ready in terms of access networks, peering and upstream connectivity, KACST is not a typical commercial FBP that delivers commercial services but rather an independent scientific institution. So KACST is not considered regarding the achievement of this milestone.

Deadline: this goal must be met by early 2009
Alternative: if this goal is not met, use the “universal service provider” act to force Saudi Telecom (STC) to provide IPv6 by mid 2009
6.2. Establish a National IPv6 Task Force

This is necessary to have a driving force for continued awareness about IPv6 in Saudi Arabia. The Task Force will gather different stakeholders to share IPv6 deployment experiences. The Task Force will serve as a discussion forum for its members, and focal point for all IPv6 activities in Saudi Arabia. Members shall include participants from the different lines of stakeholders: CITC, FBPs, ISPs, Enterprise and Government.

More details about the proposed structure and the specific goals of the IPv6 Task Force can be found in section 6.1 of this document.

The National IPv6 Task Force has already been established and had its kick-off meeting on July 30, 2008.

6.3. Establish and IPv6 Lab

The IPv6 Test Lab for Service Providers to connect to IPv6 Lab and build IPv6 Practical Experience.

Detailed requirements for the test lab are specified in the deliverable document of the IPv6 Project.

The test lab's purpose is twofold:

- Find answers to the questions “how to technically operate an IPv4/IPv6 network” - the focus here should be on the technologies used by the majority of the KSA Internet users
- Give stakeholders the chance to experiment with IPv6 without endangering their own network

The experience gained from the test lab should be made publicly available, either on CITC’s web site, or on the website of the IPv6 Task Force. It is suggested to write technical in-depth documentation, and easy to follow step-by-step instructions for the affected stakeholders (ISPs, enterprises)

_Time frame: ongoing work, to be operational in Q4/2008_

6.4. National IPv6 Event

To make all of the Internet community in Saudi Arabia aware of the upcoming IPv4 exhaustion, of the move to IPv6, and of the technical requirements to achieve the IPv6 migration, it is suggested to have the IPv6 Task Force organize a larger IPv6 event.

It is recommended to invite IPv6 experts from other countries to give talks. These could come from other countries’ IPv6 Task Forces, from RIPE NCC, or be more technically oriented to give in-depth IPv6 technical talks. As well, the summit should invite speakers from the national R&D and R&E sectors, to learn from their experiences.
The attendance fee to this IPv6 Summit should be considered well. It should not be too low (to avoid giving the impression of a "low quality" event) and not be too high (to avoid taking away the chance for people to attend).

The IPv6 National event will be the first public event after the series of task force meeting events that did not include stakeholders outside the circle of CITC and FBP. It would constitute the first public nationwide level announcement on the issue of IPv4 exhaustion and importance of adopting IPv6.

Time frame: Tentative Q1/2009

6.5. Commercial IPv6 Services Available at Multiple FBPs

This milestone is reached when more than one FBP offer production quality IPv6 services to their customers. Necessary prerequisites for such services are:

- Properly monitored (as well, or better, as the IPv4 network)
- Service level agreements (at least for the FBP internal network)
- Fully supported by FBP support staff
- Not considered "experimental" anymore

This goal is important to enable ISPs to purchase properly monitored and commercially supported IPv6 service, and to be able to choose from different players on the market. If the ISPs cannot get proper IPv6 service, they cannot start implementing production quality IPv6 services in their own networks.

This step must also be accompanied with IPv6 Filtering (ACL and Proxy Filters) enablement.

Deadline: this goal must be met before the end of 2009
Alternative: if STC has no commercially supported IPv6 product, use the “universal services provider” act to force them. If STC does have IPv6, but no other provider has, consider legislative measures to force them or using the “universal services fund” to help them implement it.

6.6. IPv6 Compliant DNS for .SA Top-Level Domain Registry

To fully support future IPv6-only users on the Internet, the .SA TLD registry must make sure that both their DNS servers (for answering questions about DNS names) as well as their registration office infrastructure (e-mail servers, web servers, zone checks, …) can be accessed from an IPv6-only host, and that their internal processes can handle zones with IPv6 records.

This is a requirement to be able to run IPv6-only hosts or an IPv6-only infrastructure at some future date. Full compliance depends on the availability of IPv6 transport from a FBP.

Deadline: this goal should be met before the end of 2009
Alternative: check feasibility of applying regulatory measures to force the .SA TLD registry, or use the “universal services funds” to pay an expert to implement the necessary changes by mid 2010.
6.7. Commercial IPv6 Services available from Five (5) ISPs

This goal has been met when there are five (5) ISPs on the market that offer production quality IPv6 services, with full commercial support, not to be considered “experimental services” anymore.

This is a requirement to enable end users and enterprises to be able to have a choice in the market place on where to get production quality IPv6 connections.

This is necessary to have before the end of 2010, to give end users time enough to enable their networks to be ready for the IPv4 exhaustion in 2011.

The number of “5” ISPs is a compromise of “at the IPv4 exhaustion point in 2011/2012, all (operational) ISPs need to have IPv6 fully rolled out to all end users, so their networks should be ready earlier on” and “individual ISPs might have good reasons for postponing the implementation to a later date”. It is assumed that when 5 ISPs have production quality offerings, the resulting market forces will speed up IPv6 deployments at the other ISPs.

*Deadline: this goal must be met before the end of 2010.*

*Alternative: check feasibility of applying regulatory measures to force ISPs to adopt IPv6.*

---

### Figure 20 - IPv6 Strategy Milestones and Timeline

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Why?</th>
<th>Suggested Date</th>
<th>Alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPv6 at ONE FBPs</td>
<td>Essential and Enough to start offering IPv6 to ISPs and End Users</td>
<td>Early 2009</td>
<td>Universal Service Provider Act – STC to offer IPv6 Connectivity by Mid-2009</td>
</tr>
<tr>
<td>IPv6 Task Force Saudi Arabia</td>
<td>Essential to raise awareness and encourage deployment</td>
<td>End of 2008</td>
<td>Already Established</td>
</tr>
<tr>
<td>Establish an IPv6 Lab</td>
<td>Establish and Disseminate practical IPv6 Experience</td>
<td>End of 2008</td>
<td>Installation on track</td>
</tr>
<tr>
<td>IPv6 National Event</td>
<td>Raise awareness and encourage the IPv6 deployment</td>
<td>Early 2009</td>
<td>Preliminary Agendas and tentative date (Feb 9, 2009)</td>
</tr>
<tr>
<td>IPv6 at Multiple FBPs</td>
<td>Important for ISPs and End Users to have more than one choice</td>
<td>End of 2009</td>
<td>CITC Legislative Measure and/or Financial Incentives</td>
</tr>
<tr>
<td>IPv6 Compliant .SA ccTLD Registry</td>
<td>Essential to run IPv6-only hosts or an IPv6-only infrastructure</td>
<td>End of 2009</td>
<td>Regulatory measures and/or &quot;Universal Services Fund&quot; to hire experts to implement DNSv6 (mid-2010)</td>
</tr>
<tr>
<td>Commercial IPv6 Services available from Five (5) ISPs</td>
<td>More choices to end users</td>
<td>End of 2010</td>
<td>Regulatory measures and/or &quot;Universal Services Fund&quot; to help ISPs adopt IPv6</td>
</tr>
</tbody>
</table>
7. Time Line

[The time line section should detail the span of time each of the strategy’s track initiatives will occupy in time (start – end). CITC and FBPs input are required here. The below is the timeline after the last changes of strategy (2 instead of 3 tracks) and consolidation of initiatives]

Figure 21- Strategy Initiatives Timeline