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White paper

IPv6: How Soon is Now?
As a service provider and systems integrator Atos faces the limitations of IPv4 in its network operations every day. These challenges will increasingly be experienced by all users of the IPv4 address space, both inside the corporate network and over the Internet.

Whilst there are considerable hurdles, there is a pressing need to accelerate the adoption of the IPv6 protocol to provide, consume and develop new innovative services in an increasingly connected world. These services will help build the business case for the adoption of IPv6; which the industry has so far struggled to deliver.

In this white paper, intended for CIOs, CTOs and a technical audience, we outline the challenge and provide direction for the industry on what we must all do. Today.

A call to action: To the IT services industry and IT departments worldwide.

Given the dependency on the Internet and IP protocol for the majority of our services and future aspirations, the IT services industry together with our partners and customers need to urgently make the case and drive adoption of IPv6.
IPv6: How Soon is Now?

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About the Atos Scientific Community
The Atos Scientific Community is a network of some 100 top scientists, representing a mix of all skills and backgrounds, and coming from all geographies where Atos operates. Publicly launched by Thierry Breton, Chairman and CEO of Atos, the establishment of this community highlights the importance of innovation in the dynamic IT services market and the need for a proactive approach to identify and anticipate game changing technologies.
Executive Summary

IPv4 has been powering the Internet for more than 30 years, enabling communication between various parties for scientific, social and business purposes. At the time of its inception, nobody could have predicted that by 2011, there would be more than 2 billion Internet users and 6 billion mobile subscribers all competing for the same limited address pool which in theory can support a maximum of 4.3 billion addresses.

On February 3rd 2011, the Internet Assigned Numbers Authority (IANA) allocated the remaining last five available portions of IPv4 address space to the Regional Internet Registries (RIRs) signaling the expected and official depletion of IPv4 address space. While there are still some available addresses at the RIR level, the situation is worsening rapidly because of the relentless proliferation of broadband connectivity; IP-powered smart phones, the emergence of sensor networks and increased Machine to Machine communication all converging over the same IP-based infrastructure.

The vision of a ubiquitously connected society and subsequent social and economic benefits is seriously under threat unless a coordinated and sustainable IPv6 transition takes place. The threat was considered serious enough for some governments to issue IPv6 procurement mandates as early as 2003 together with tax incentives to encourage adoption. Unfortunately the rate of adoption continues to lag with only 15% of the Internet Autonomous System numbers currently supporting both IPv4 and IPv6.

Lack of a clear business case, incompatibility with IPv4, a steep learning curve and the absence of native IPv6 content are some of the key barriers leading many organizations to defer adoption. At the same time, a number of initiatives for extending the life of IPv4 have emerged including address conservation and reclamation as well as Carrier Grade Network Address Translation (CGN). There is a risk that initiatives will compound the issue by creating unfounded optimism regarding the longevity of IPv4 and slowing down the adoption of IPv6 further. IPv4 address space is now a valuable commodity, clearly illustrated by Microsoft’s $7.5 million acquisition of Nortel’s legacy IPv4 address pool.

To sustain the expected Internet growth, there is no adequate alternative to adopting IPv6. The advantages of the new protocol go beyond alleviating the IPv4 crisis by providing a significantly larger address space. From a technical perspective, IPv6 is a superior protocol that brings much needed simplicity, transparency and integrated security features leading directly to tangible operational cost savings. On the business front, the unconstrained address space, enhanced mobility and advanced networking features of IPv6 will underpin future sensor networks and Machine to Machine (M2M) communication triggering new product and service innovations across the board.

The IPv6 “Killer App” is likely to be the enablement of the Internet of Things (IoT); M2M interaction together with mobile connectivity. Whilst alternative low power protocols may still emerge, IPv6 is likely to be required to enable our network infrastructures to handle the scale of the IoT and M2M communications.
The IPv4 Problem: Panic

The landscape of IPv4 address space depletion and IPv6 adoption is constantly changing. This chapter provides a summary of the current status at the time of writing.

IPv4 exhaustion

IPv4 is the standard protocol used for Internet communication which relies on a 32-bit address in the IP header to deliver packets from source to destination. The binary 32-bit header yields a total of almost 4.3 billion possible addresses which in the eighties would have been considered almost infinite. However, the continuous and explosive growth of mobile broadband adoption1 consuming over a billion IP address, coupled with the fact that connectivity will increasingly be embedded in almost every human-made object, means that IPv4 is no longer a sustainable solution for powering the Internet.

Today we associate IP devices with laptops, tablets, smart phones, TVs and other personal devices, but in the future trains, planes, cars, trucks, ID Tags, fridges, pallets, smart meters and even human-embedded sensors will have not just one but several IP addresses.

In order to appreciate the status of IPv4 exhaustion, it helps to understand the current allocation mechanism. In summary the Internet Assigned Numbers Authority (IANA), responsible for the global coordination of the Internet Protocol addressing systems, allocates addresses in the form of /8 blocks2 to Regional Internet Registries (RIR) who in turn assign smaller blocks to Internet service providers who ultimately provide IPv addresses to end users.

On February 3rd 2011, the IANA assigned its last /8 block equally amongst the five RIRs which means the RIRs are no longer able to receive further IPv4 addresses ranges. Using the latest IPv4 address statistics from the various RIRs9 reveals the gravity of the issue as there are less than 190 million unassigned IP addresses available, with Asia/Pacific and Europe regions likely to run out first.

Once the above addresses are exhausted the Internet can be maintained, but entry into both existing and new innovative markets will be extremely difficult. This applies to simple requirements taken for granted today such as web presence and VPN access and equally to the more innovative and emerging services such as industrial and home automation as well as disaster prediction and early warning systems. The equitable nature of the Internet may also come under threat as the scarce IPv4 addresses left become even more valuable and sold to the highest bidder - putting new innovative start-ups at a huge disadvantage.

Managing IPv4 address exhaustion

A number of measures and proposals have been used or discussed to delay the IPv4 address exhaustion.

1. Network Address Translation (NAT) which allows a large number of hosts to share and communicate with the Internet using one or a limited number of public IP addresses. While this approach has already played an important role in extending the life of IPv4, it modifies the packet header before it reaches its destination which means there is a requirement for intelligence and processing power within the network rather than only at the end points. As a result, NAT increases the complexity and cost of networks because it creates asymmetry between clients and servers, complicates the provision of public services and interferes with peer-to-peer and security applications3.

2. Better allocation of IPv4 space - however given the number of IPv4 addresses left, this can no longer be considered an effective long term solution.

3. Reclaiming address space - however this is often too costly and disruptive to be worthwhile.

4. Recycling IPv4 address space by using previously reserved ranges such as the E-Class4. The challenge here is that many IP stacks and security devices are configured to ignore or deny traffic from and to these address ranges.

Whilst these measures help manage the current situation, they are not ultimate answers. Migration to IPv6 is considered the only solution, even though it will take significant time and effort.

What is an IPv6 address anyway?

IPv4 addresses are 32-bits in length (comprised of 1s and 0s) and we use a “dotted decimal” notation to express them in a human-readable format, like such as “176.67.8.217”. In IPv6 the addresses have 128 bits - 4 times longer, and in this case we use a “colon-hexadecimal” notation, each 16-block of the address is represented by a 4-digit hexadecimal number. They look like this: “1023:adb7:0000:12a3:0000:0000:00ad:6501”. These unique addresses are what enable users to connect to services, routing network traffic over the Internet to where it needs to be.

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1 In 2011, there were more than 1186 billion mobile broadband subscribers, according to ITU
2 A block of IP address space is denoted by a /prefix (for example /24 for a /24 block)
3 RIP statistics ARIN statistics APNIC statistics AFRINIC statistics
4 http://www.ripe.net/ripe/statistics/ripe-routes
5 E-Class addresses are of the format 240/0/0/0 to 255/255/255/255 (any address commencing 1111 in binary!) They were reserved when the class system was introduced and are not used on the Internet today.
IPv6 adoption so far

Despite the widely accepted and imminent exhaustion of IPv4 addresses with the crippling effect this could have on the Internet, IPv6 adoption is very much in its infancy. There are a number of ways to measure the degree of IPv6 adoption but they all lead to the same disappointing conclusion. Only 15% of autonomous systems (AS) in the Internet Border Gateway Protocol (BGP) routing table are currently advertising IPv6 prefixes\(^2\) while a mere 0.35% of ASes are advertising IPv6 only. In the Domain Name System (DNS), used for resolving names to IP addresses, 86% of the Top Level Domains (TLDs) have IPv6 name servers. However the picture is much bleaker below the TLDs as only 1.25% of dot com domains have IPv6 (AAAA) records defined\(^3\).

IPv6 Google search engine web hits are a good and realistic measure of the degree of adoption of IPv6. Unfortunately statistics from Google paint a similar picture with less than 1% of total users being IPv6 clients.

The industry as a whole remains in an early adoption phase whilst time is quickly running out. It also demonstrates the challenges of IPv6 migrations which tend to be complex and multiyear projects, requiring continuous commitment at all levels of our organizations.

IPv6 stakeholders

We have outlined in Figure 2 a number of key stakeholders whose competing needs and motivations will shape the future adoption of IPv6.

- **Governments:** IPv6 is seen an enabler for improving government operations by streamlining services for more citizens, improving the quality and delivery of education and healthcare, providing equal Internet access for all as well as fostering environmental and energy monitoring and control. IPv4 has reached its performance limitation and cannot provide enough addresses to power planned “e-citizen centric” services as part of smart cities and smart grid initiatives. Despite the early pro-IPv6 policies and mandates, progress has been slow because of the difficulty to achieve a quick ROI in IPv6 migration projects and the economic crisis we have seen in recent years.

- **Internet Users:** While the demand is coming from the end users, the main interest is “always on” and high speed connectivity regardless of location and at competitive prices. End users are unlikely to pay premium prices for the same services they have today based on IPv4 unless supplemented by more innovative IPv6 based services.

- **Hardware & Software Vendors:** The migration to IPv6 depends heavily on the availability of software and hardware products. Significant progress has been made over the last three years with the majority of hardware and software products being either fully IPv6 capable or IPv6 capable with some feature limitations\(^4\).

- **Telecom & Mobile Operators:** For the last decade, telecoms and mobile operators have been struggling with increased competition and commoditization of their market. Cloud computing in combination with IPv6 and IoT provides them with an opportunity to become service aggregators working with local authorities, cities and even at national level to provide consolidated services and billing for citizen services.

- **Managed Services (MS) and System Integrators (SI):** These provide “design-build-operate” IT capabilities to various sectors; IPv6 enablement and migration projects and ongoing management services will need to form part of the future landscape.

- **Enterprises:** Many see IPv6 as a cost item rather than having a potential to deliver direct or indirect business benefit, which hinders demand.

Figure 2: IPv6 Stakeholders

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\(^2\) IPv6 adoption in the BGP routing table

\(^3\) Statistics calculated based on the information available in the Global IPv6 deployment progress Report

\(^4\) IPv6 Ready certification, IBM IPv6 readiness, Oracle IPv6 readiness, Microsoft IPv6 readiness, SAP IPv6 readiness
IPv6 Scope and Benefits: What Difference Does It Make?

IPv6 scope
Every device and application running an IP stack or making a related API call will eventually be impacted by the migration to IPv6 (Figure 3).

Figure 3: IPv6 Scope

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The technical benefits of IPv6 are numerous with only a subset presented here for brevity:

**Unconstrained address space:** IPv6 quadruples the number of bits from 32 to 128 and thus enables global connectivity for significantly more devices ($3.4 \times 10^{38}$). To illustrate, if all of Earth’s 7 billion people received a /48 subnet allocation there would be enough for trillions of worlds.

**End-to-end transparency:** The transparency is the result of unconstrained address space which eliminates the need for complex and costly Network Address Translation (NAT) techniques.

**Configuration simplicity:** The simplicity comes from improved auto-configuration capabilities enabling devices to autonomously assign IP addresses paving the way for self-managed networks in the context of IoT. This in combination with NAT removal has the added benefit of much more simplified infrastructure ultimately leading to better availability.

**Mobility:** While the implementation shares many features with Mobile IPv4, it has a number of improvements that are natively integrated.

The wide scope means that careful planning will be required to break the transition into manageable chunks. Understanding the dependencies and order of deployment will enable phased IPv6 migration while maintaining the integrity and continuity of both internal and external services. It is also important to recognize that the coexistence of external services being accessible via both IPv4 and IPv6 is a requirement that is likely to last for another 20 to 30 years with increased operational costs being inevitable.

We mention the Atos Technology Framework (ATF) as the defined suite of tooling and technology that underpins the delivery of services managed by Atos, covering everything from ticketing systems, monitoring systems, asset and configuration management to interfaces and capacity management and more. All of these areas will be similarly impacted by the introduction of IPv6 connectivity.

### IPv6 benefits

IPv6 has significant technical and commercial benefits, and when combined with other technologies such as the Internet of Things will underpin a number of innovations and use cases captured in Figure 4.

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**Figure 4: IPv6 benefits**

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8 [http://www.iana.org/about/presentations/gerich-sanjose-ipaddr-2010913.pdf]

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resulting in better mobility experience and increased scalability\textsuperscript{16}. With IPv6, mobile devices will be able to communicate directly and more efficiently.

IPv6 extensible structure opens up the door for innovative IP-based services taking advantage of header extensions\textsuperscript{17} such as mobility and source routing. The net result is that significant operational efficiencies can be gained but only once the transition is completed with the entire network running IPv6.

**Applications.** A number of applications, such as Microsoft DirectAccess\textsuperscript{18}, are already built on IPv6 which means adoption will be required if end users are to benefit from improved features and functionality.

### IPv6: A platform for future innovation

The deployment of IPv6 is clearly essential for the continuity of connected services after the depletion of the IPv4 address space. IPv6 also has the potential to underpin a number of emerging and innovative services. As the IPv6 address space is significantly large (Stop Me If You’ve Heard This One Before: 2\textsuperscript{128}), it will be possible for each and every computer connected to the Internet to benefit from a publicly accessible IPv6 address (Figure 5).

“NAT is Good”. That Joke Isn’t Funny Anymore. We expect IPv6 to signal the end of the systematic use of NAT/PAT in enterprise and home networks. Removal of NAT will ease the use and operability of direct peer-to-peer, real-time communications. In IPv4, NAT traversal was a complex issue to tackle for such applications, requiring third party servers, bootstrapping mechanisms or costly tunneling to enable communication between hosts. Organizations that have gone through acquisitions fully understand the cost and consequences of using NAT. So in this regard, we expect that IPv6 will trigger a new wave of real-time collaboration and communication applications.

IPv6 is expected to have a broad impact on connected services innovation. We expect that auto-configuration capabilities will help bootstrapping the connectivity of multiple objects to the Internet. Auto-configuration is a stateless mechanism which allows objects to generate an IP address using local link information and subnet information advertised by routers. The combination forms an IPv6 address that the object can use to connect to the Internet. This mechanism competes with the evolution of DHCP, yet doesn't require any additional elements in the network, which eases its use and deployment. This simple connectivity configuration mechanism is expected to have a great impact for connected consumer electronics as well as for smart objects that don’t have a proper input interface\textsuperscript{20}.

Until now, IP has been considered too heavy and complex to be used in the context of resource-constrained and low power devices. However, researchers and IETF working groups such as 6LowPAN (IPv6 over low power WPAN), ROLL (Routing Over Low power and Lossy networks) or CORE (CONstrained RESTful Environments) have worked on compression of the protocol header and adaptation of the neighbor discovery mechanisms to reduce the footprint and power consumption associated with IPv6 protocol. The result is an adapted yet fully functional IPv6 stack that can be deployed using close to 128 kB ROM and 16 kB RAM. This means that IPv6 can now be used on virtually any communicating object, from servers to small sensors, regardless of the underlying Layer 2 network technology. This future and possible ubiquity of the IPv6 protocol will help in breaking the silos related to the use of industry-specific network technologies leveraging IP as the least common denominator. This has the potential to simplify object configuration, ease interoperability, reduce cost and encourage innovation.

IPv6 represents a trigger for all sorts of innovations in connected services ultimately making the vision of IoT a reality. The subject of IoT is outside the scope of this paper but it is highly recommended to refer to the Atos Scientific Community "Internet of Things" White Paper to understand both the link to IPv6 and associated opportunities, such as smart grids and smart cities. Future IPv6 deployments will however need to address several issues; with security being one of the main concerns. With IPv4 and M2M networking technologies, part of the security of connected platforms was provided by the use of private IP addressing or by isolation provided by the use of proprietary protocols. As IPv6 devices become publicly reachable, appropriate measures need to be put in place to avoid security breaches, be it specific firewalling or connection throttling to avoid denial of service attacks on smart objects.

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\textsuperscript{19}http://www.ietf.org/rfc/rfc3775.txt

\textsuperscript{16}IPv6 header extensions

\textsuperscript{17}Microsoft DirectAccess

\textsuperscript{18}http://gigaom.com/cloud/internet-of-things-will-have-24-billion-devices-by-2020/

\textsuperscript{20}For example, a Graphical User Interface or command line.
As with the implementation of any new technology, successful adoption requires careful planning and proper education. IPv6 is a new protocol which, although drawing on some concepts from IPv4, brings an array of new features. Although many people think that a migration to IPv6 is primarily a networking issue, the truth is that all IT organizations across server, network, storage and application domains must be equally trained to contribute to both the planning and execution. The most complex and time consuming areas are the definition of policies and the validation of IPv6 readiness of all applications and therefore should be started as early as possible in the process. The actual changes to the network components, compute platforms, applications and the matching management processes can be done in parallel.

Technical challenges
There are a number of technical challenges associated with IPv6. This is due to the new and abundant IP address space, the need for IPv4 and IPv6 co-existence and the novelty of a number of integrated features.

1. IP Space Management
A central authority for governing the allocation of IPv6 as well as IPv4 addresses is required. IPv6 address management policy must be in place, communicated and enforced in order to ensure interoperability, end to end connectivity and to reduce long term operational costs.

2. IP Address Provisioning
Unlike IPv4 hosts which typically use a single IP address per interface, IPv6 can have multiple IP addresses per interface. Not only will IT staff need to get used to this feature, they will also need to understand the various methods of provisioning and the process used for selecting which source and destination addresses should be used for a particular session. Without this knowledge, interoperability issues as well as difficulty troubleshooting incidents can be expected. During the transition phase from IPv4 to IPv6, the complexity will only increase with the coexistence of IPv4.

3. IPv6 to IPv4 interoperability
To ease the transition from IPv4 to IPv6 a number of new tunnel protocols were developed. A tunnel protocol is a mechanism which enables software to wrap IPv6 in IPv4 or vice versa. Some tunnel techniques are implemented by network devices and others implemented by operating systems. The uncoordinated use of the various tunneling techniques by system administrators will increase the risks of interoperability problems and the complexity of incident handling. Both network and server support staff must have a thorough understanding of these protocols at a technical level and coordinate the implementation of tunnels at an organizational level.

4. Application IPv6 readiness
Industry testing has revealed that a number of applications fail to work correctly with IPv6 despite the fact that they run normally with IPv4 under the same conditions. So an important aspect of successful IPv6 migration is the compatibility of installed applications with the new protocol. For the majority of COTS applications, this will be automatically taken care of as part of new versions of products or updates to existing ones. For in-house applications, special attention needs to be paid to a number of challenges highlighted in RFC4038. However the following policies should be considered immediately:
   1. IPv6 support should become mandatory for all application procurement exercises
   2. For all future “in-house” application development projects, developers must be aware of and use IPv6 independent API calls.

5. Security Challenges
Although IPv6 has been around for well over a decade and until recently there have been a relatively small number of implementations within the enterprise. IPv6 is expected to become more widespread, therefore unknown vulnerabilities will be rapidly discovered. Although many of the same IPv4 security threats are also applicable to IPv6, there are additional and specific IPv6 features that require further protection. The tunneling mechanisms used to enable interoperability between IPv4 and IPv6 constitute an additional threat that must be understood and mitigated. Finally IPv6 is activated by default on many client and server operating systems which unknowingly may expose corporate devices to unnecessary security risks unless IPv6 networks are secured accordingly.

Business challenges
There are multiple hurdles to overcome, not least of which is the business case justification for IPv6 implementations as they are seen as cost activities rather than revenue generating. The move to IPv6 requires initial investments in planning, education and testing. Investments in hardware and software are less material as most equipment is already IPv6 capable or can be combined with investments in new technology as part of standard refresh cycles. Operational costs are also likely to go up during the transition period due to the coexistence of IPv4 and IPv6. The following highlights some of the top business challenges we will face:

Coordination: IPv6 migration is a complex, multi-faceted and multi-year project which requires coordination across the various business units and sub-units. Successful IPv6 adoption requires close coordination and commitment at all levels of the organization which means the elevation of IPv6 adoption subject to a strategic level is necessary.

Timing: Regardless of the timing organizations may decide to adopt IPv6, it is important to understand that the transition can only be postponed but not avoided. However, delaying the adoption of IPv6 does have some advantages; deferring investments and being able to leverage the experiences and best practices developed by the early adopters.

IPv6: Ignore at your peril. From an industry perspective, failure to act will have profound impact on the user experience. An Internet where carrier grade NAT in both directions (6to4 and 4to6) is prevalent will lead to poor user experience as service providers and their customers will have little control over the performance and availability of services being accessed by both IPv4 and IPv6 protocols. Even worse, end-to-end responsibility for Internet based services including operations become far more complex than today.
I Know It’s Over: How do we get there?

The IPv6 taskforce
Organizations must first and foremost address the IPv6 challenge and opportunity head-on. Our recommendation, and indeed our own approach, is to establish an IPv6 taskforce. The primary objective is to lay a solid foundation for the rollout of IPv6. Each taskforce should be made up of both business and technical representatives, and be supported by strategic vendors to accelerate the learning curve and benefit from lessons learned elsewhere. The vendors will also provide collaborative input into the process and ensure that the final outcome is supported, interoperable and achievable. The expected deliverables resulting from these taskforces should be:
- An IPv6 corporate policy which states IPv6 vision and strategy and outlines the governance structure surrounding the definition of IPv6 policies.
- Technical policies governing IPv6 addressing and transition technologies.
- An education and training plan.
- Selected technology partners.
- A communications plan.
- An “as-is” analysis of infrastructure.
- A proposed IPv6 adoption roadmap.

Creating the Business Case for IPv6
We have emphasized the risks and threats, but there is also real opportunity to differentiate services through IPv6 infrastructure. In time the IPv4 user base will become an increasing limitation for the services we all provide and consume. We predict a tipping point when there will be more IPv6-connected users and devices, and therefore opportunity, than the IPv4 landscape provides today.

Innovative services that make use of the increased connectivity IPv6 provides will form the basis of value propositions that our IT industry clients will themselves be able to take to market - Moving beyond the Atos Connected Car and Connected Train concepts, to the connected human, Smart Cities and the connected world. Simplifying connectivity to every device in the home through smart grids will again bring value to everyone’s lives and those businesses that serve us. The concept of multi-sided markets, where additional value is derived from the use of customer data, will also help fund and establish the IPv6 infrastructure that enables these new services.

Organizations can adopt different strategies for their external presence and their internal networks. It is therefore possible to break the IPv6 challenge down into manageable chunks and address each at an appropriate rate, with the appropriate business case.

Don’t leave it too late, the longer one waits, the higher the risks of problems with the legacy infrastructure and the more missed opportunities there will be.

Practical steps to take in your plan
We summarize below some activities that, from our experience, should be undertaken with IPv6 migration projects. This is just a brief list to set you on your way:
- Ensure IPv6 functionality is supported by all future hardware, software and services. Pay particular attention to network service providers, MPLS (Multiprotocol Label Switching network services), and the requirements of protocols such as SIP (Session Initiation Protocol), which is used for controlling communications channels.
- Ready the technical teams and service desks, with training and practical experience.
- Obtain an IPv6 address block, create an addressing strategy and set up processes for managing IPv6 address allocations.
- IPv6-aware core network services, core infrastructure, routing, DNS, DHCP, NTP and edge services (firewalls, IPS).
  - Firewalls require particular attention; some older solutions do not deal with IPv6 – either dropping all packets or letting everything through (a significant security risk!)
  - Set up system and security monitoring for IPv6, and ensure it is performed with the same diligence as existing IPv4 services.
  - Introduce IPv6 for application services.

The servers hosting the applications and applications themselves on a case-by-case basis:
- Add an IPv6 readiness phase to all internal software development programs.
- Some older packaged applications do not support IPv6 and a migration plan may be required.
- Add service addresses to DNS using AAAA records.
- Introduce IPv6 in the user environment (PCs, Laptops, Tablets, WiFi & Printers).
- For service providers ourselves, build and take to market a portfolio of IPv6-based services that enable us to deliver more value to our clients and the IT industry.

If some of these activities are too daunting for you in your organization, then perhaps Atos can help with Consulting, Systems Integration and Managed Services experience during each phase of the migration program.

For large multi-national organizations a migration strategy will need to take into account the global footprint of the business and consider how to address on country-by-county, departmental or service basis.

Conclusion
To be successful as an industry, we all need to make IPv6 part of our DNA. It starts with a vision, but we need to turn this into practical actions that we and our clients can jointly undertake. Whilst the topic is a technical one, the business case needs to be made on the business value and the opportunities IPv6 will underpin.

Please, Please, Please, Let Me Get What I Want: IPv6-based infrastructure, services and innovation.
About Atos

Atos SE (Societas europaea) is an international information technology services company with annual 2012 revenue of EUR 8.8 billion and 77,000 employees in 47 countries. Serving a global client base, it delivers IT services in 3 domains, Consulting & Technology Services, Systems Integration and Managed Services & BPO, and transactional services through Worldline. With its deep technology expertise and industry knowledge, it works with clients across the following market sectors: Manufacturing, Retail & Services, Public sector, Healthcare & Transports, Financial Services, Telecoms, Media & Technology, Energy & Utilities.

Atos is focused on business technology that powers progress and helps organizations to create their firm of the future. It is the Worldwide Information Technology Partner for the Olympic and Paralympic Games and is quoted on the NYSE Euronext Paris market. Atos operates under the brands Atos, Atos Consulting & Technology Services, Worldline and Atos Worldgrid.