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Responsible and Editor/Author:	Organization:	Contributing WP:
Arjen Holtzer	TNO	WP5

Authors (organisations):

Annelieke van der Giessen, Silvain de Munck, Martijn Poel, Rob Smets (TNO).

Abstract:

This deliverable describes the monitoring framework that will be used to monitor and evaluate the GEN6 project and its nine pilots. The main topics are IPv6 uptake and governance, as described by the EC. Monitoring and evaluation will be done during the course of the project. This report describes the monitoring framework, the monitoring indicators and parameters and the data collection tools and procedure.

Keywords:

IPv6, Governments, monitoring, framework, evaluation, impact, policy, governance, uptake, indicators, parameters, methods, CIP, ICT PSP.

Revision History

The following table describes the main changes done in this document since its creation.

Revision	Date	Description	Author (Organization)
v0.1	21/02/2012	Document creation	Arjen Holtzer (TNO)
v0.2-v0.7	21/02/2012 until 12/03/2012	TNO internal additions	Annelieke van der Giessen, Arjen Holtzer, Silvain de Munck, Martijn Poel, Rob Smets (TNO)
v1.0	12/03/2012	Version for internal GEN6 review and external review	Arjen Holtzer (TNO)
v2.0	26/03/2012	Incorporated review comments by Michael Dinges (Joanneum), Uwe Holzmann-Kaiser (Fraunhofer FOKUS) and Onur Bektaş (Tübitak Ulakbim) Pre-final version shared among all GEN6 consortium partners	Arjen Holtzer, Silvain de Munck, Martijn Poel (TNO)
v2.1	26/03/2012	Template adjustment changes, final review	Jordi Palet (Consulintel)
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v2.4	02/04/2012	Typos corrected	Jordi Palet (Consulintel)
v2.5	30/11/2012	Explained the new deliverable structure from DoW2.0 in Section 4.1 and the resulting new planning in Chapter 6	Arjen Holtzer (TNO)

Disclaimer

Executive Summary

This deliverable D5.1 is part of the CIP ICT PSP project *Governments ENabled with IPv6 (GEN6)*, in which 7 national and 2 cross-border IPv6 pilots are executed. The pilots focus on different types of eGovernment services in Europe, e.g. portal websites and emergency services. The participating organizations are from Cyprus, Czech, Germany, Greece, Luxemburg, Netherlands, Slovenia, Spain and Turkey.

D5.1 belongs to "Activity A5.1 Monitoring of the experiments", as part of "WP5 Evaluation", and describes the monitoring framework and indicators that will be used to monitor the progress, results and effects of the national and cross-border IPv6 pilots. It includes the monitoring part for "Activity A5.2 Governance". The monitoring activity will focus on the progress and the results of the pilots and will take place *during the course* of the project. The emphasis is on learning and collaboration, instead of accountability and an ex post analysis by a third party evaluator. Central to this are the project goals set by the EC in the CIP ICT PSP 2011 work plan:

- Stimulating IPv6 upgrades of public networks and eGovernment services.
- Stimulating the development of new innovative IPv6 enabled content and services benefitting from new functionalities.
- Contributing to the prevention of a secondary IPv4 market and a quality drop in online public services caused by a depletion of the IPv4 address space.

The monitoring framework brings together the high-level EC goals defined in CIP and the goals for IPv6 from individual organization participating in IPv6 pilots. It does so by determining the impact of the pilots on four different levels: input, output, outcome and impact.

The way input leads to output, outcome or impact of the pilots follow certain impact channels, of which six will be used for GEN6: technical implementation, knowledge, awareness, human capital, costs & benefits and social networks. These impact channels relate to the EC and project goals. The monitoring framework will focus on the following stakeholder groups: pilot leaders, consortium partners and external pilot partners. Through these three groups the impact on two other stakeholder groups will be monitored: the external stakeholders, and those who could benefit from IPv6 and/or the GEN6 project but are currently unaware of this.

Data will be collected mainly via surveys to the consortium and pilot partners. Partners themselves may have to perform actual measurements in their networks and services, or collect data from other stakeholders they are in contact with. In addition to surveys, WP5 will carry out interviews with key stakeholders to learn about the project and organization context, needed for a good analysis of the collected monitoring data.

Two measurements will be done in the project. On measurement will be done in the second part of 2012, around M8, which will provide the base-line monitor. Its results will be published in M12. A second measurement will be done when the pilots are finalized (M24/M30). The results of the second measurement will be published in M30.

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1. PURPOSE OF THE MONITORING SYSTEM

This deliverable D5.1 is part of the CIP ICT PSP project *Governments ENabled with IPv6 (GEN6)*, in which 7 national and 2 cross-border IPv6 pilots are executed. The pilots focus on different types of eGovernment services in Europe, e.g. portal websites and emergency services. The participating organizations are from Cyprus, Czech Republic, Germany, Greece, Luxemburg, Netherlands, Slovenia, Spain and Turkey.

D5.1 belongs to "Activity A5.1 Monitoring of the experiments", as part of "WP5 Evaluation", and describes the monitoring framework and indicators that will be used to monitor the progress, results and effects at the level of the national and cross-border IPv6 pilots. To some extent, the data about individual pilots can be aggregated to the level of the GEN6 project.

The main purpose of the monitoring activity is to support learning (i.e. lessons about the costs and benefits of IPv6 implementation), collaboration (e.g. exchanging information) and improving the relevance and effectiveness of IPv6 pilots (e.g. the number of users involved).

The data about individual pilots - the evidence base - will be used for preparing guidelines, showcases and lessons learned, that will be part of project deliverables such as the project book, events, workshops and presentations. In addition, there are deliverables that focus on the immediate results of the monitoring activity. Both types of deliverables will contribute to the impact of the project, as defined by the goals of the CIP ICT PSP program and the goals of the individual pilots.

Most central are the project goals set by the EC in the CIP ICT PSP 2011 work plan:

- Stimulating IPv6 upgrades of public networks and eGovernment services.
- Stimulating the development of new innovative IPv6 enabled content and services benefitting from new functionalities.
- Contributing to the prevention of a secondary IPv4 market and a quality drop in online public services caused by a depletion of the IPv4 address space.

A second activity of WP5 (A5.2 Governance) will focus on the motivation of different stakeholders for introducing IPv6 and the effects of public incentive measures on decision-making. The monitoring framework and indicators described in this report will already cover some indicators targeting IPv6 governance measures supporting an efficient data collection.

The monitoring of the progress and results of the pilots as well as the motivations and effects of incentive measures on decision making in the individual pilots will feed the assessment of the success factors and bottlenecks for IPv6 implementation in general. This is part of activity A5.3 (Evaluation and validation) and will support defining the relevant lessons for the best practices

and handbook for IPv6 implementation.

The monitoring framework and related indicators as presented in this report will enable collecting data and revealing lessons that are relevant for key audiences, e.g. public organisations and others that are planning or managing IPv6 implementations. The monitoring framework will be consistent with EC approaches and terminology on monitoring and evaluation of support programmes, but will be customised for IPv6 and the main rationales for establishing IPv6 pilots.

Chapter 2 of this report will explain the monitoring framework for the GEN6 project and its nine pilots. Then, in Chapter 3, the indicators will be presented. Chapter 4 will describe the monitoring methods and tools that will be used to obtain the relevant information for the monitoring. Chapter 5 will discuss the approach to validating the logic of the monitoring framework and methods as well as the results of the monitor. Chapter 6 will present some conclusions and next steps.

2. MONITORING FRAMEWORK

This chapter describes the monitoring framework for monitoring and evaluation of the IPv6 pilots. In Section 2.1 the methodology that is used is described and will be applied to IPv6 and the GEN6 project. In Section 2.2 the reach of the monitoring with regard to the stakeholder groups that are targeted will be discussed.

2.1 Methodology Description

This Section describes the analytical framework for monitoring and evaluation of IPv6 pilots. First, in Section 2.1.1 it introduces the concept of intervention logic, also referred to as rationale or theory of change. Why intervene? Section 2.1.2, describes the levels of input, output, outcomes and impact. Third, in Section 2.1.3 it will be explained how these four levels are linked via so called impact channels. The importance of addressing technological as well economic and social aspects of pilots is stressed. Fourth, the intervention logic for conducting and co-financing IPv6 pilots will be derived. This will be based on the official documentation of the CIP ICT PSP programme (top down) and the challenges related to IPv6 (bottom up). It will include the specifics of pilots - as opposed to research projects - and the impact channels via which IPv6 pilots are expected to create outcomes and impact. In Section 2.1.5 the impact channels will be explained in greater detail. Then, governance will be addressed in Section 2.1.6. The focus is on decisions about the timing of IPv6 implementation by organisations and on the influence of public policies.

2.1.1 Intervention logic

The concept of intervention logic is developed in the context of public management and policy analysis[1] [2]. It is often applied in monitoring, evaluation and impact assessment studies on R&D and Innovation policy[3] [4] [5]. Its main purpose is to be explicit about the logic – the rationale, the theory - of an intervention by policy makers and other stakeholders. Being explicit on the logic

[1] *Pawson, R. and N. Tilley; Realistic Evaluation (1997)*

[2] *C. Weiss,"Evaluation methods for Studying Programs and Policies, 1998*

[3] *Ruegg R. and I. Feller, "A Toolkit for Evaluating Public R&D Investment: Models, Methods and Findings from ATP's First Decade," 2003*

[4] *Marc van Lieshout with cooperation of Annelieke van der Giessen (TNO); Renald Buter and Ed Noyons (CWTS); Christien Enzing and Jasper Deuten with cooperation of Bastian Mostert (Technopolis); Dirk Holtmannspötter, and Leif Brand and Günter Reuscher (VDI-TZ), 2011, Impact of FET Research Initiative - IFETRI Final Report, 16 February 2011*

[5] *Dinges, M, Poel, M. and N.S. Laugesen (2010). Beyond patents and Publications. Performance Monitoring Indicators for ICT Research in the EU-funded RTD. Study for the European Commission*

answers questions like: What is the challenge or opportunity of the intervention? What are the public interests? Who are the stakeholders? What are the market failures or system failures? Why intervene? As policy interventions are often based on past experiences, imperfect information, assumptions, expectations, consultations and compromises, the intervention logic can be unclear or implicit in policy documents. Explicit intervention logic provides clear orientation for the mechanisms, actors and activities to monitor. It also helps focusing an evaluation or impact assessment on crucial elements. For instance, if an R&D programme is 100% funded, aimed at academic excellence to bridge the gap with leading regions, a monitor could focus on patents and (academic) publications, using a benchmark of leading regions. For instance, if an R&D programme is 50% funded with the goal to increase business R&D, commercialisation and start-ups, a monitor could focus on business investments in R&D- such as matching and follow-up investments -, new products and services launched, and the number of start-ups. An extensive overview of various sets of indicators for monitoring FP7 and CIP ICT PSP projects is presented in a recent study[6].

2.1.2 Input, output, outcomes, impact

Differentiation between the levels of input, output, outcome and impact is essential in clearly describing the intervention logic and developing indicators for monitoring of research projects and pilots. Key inputs are money, time, facilities, devices, etc., by a range of actors involved in the project. Note that this is a mix of technological and social inputs. Via a series of activities, inputs are translated into output. Examples of outputs are patents, publications, events, demonstrators and new services. Both input and output are to a large extent planned and controlled by the project leader and other participants. This is less so for outcomes and impact.

As opposed to input and outputs, outcomes do not only concern the short term and the main participants, but also the medium term and other stakeholders. For instance, new services can be launched by participants of the project or pilot, in collaboration with other stakeholders, and leading to new business practices. In this process, patents may be licensed and the organisations involved are recognised as having state-of-the-art knowledge. New social networks are created. These are all outcomes that are not under the control of the project leader and the project/pilot participants. This also applies to impact.

Impact is the most important yet most difficult to predict or steer. The organisations involved, their suppliers, clients or entire sectors and regions may structurally increase their R&D activities, revenues and productivity, partly as a result of the project or pilot. Alternatively, the project or pilot may be recognised as effectively addressing societal challenges such as energy

[6] *Dinges, M. and C. Reiner (2011) CIP ICT-PSP Final (Second Interim) Evaluation Support Study - SMART 2010/0027 Case Study: Pilot Bs*

efficiency. Again, note that this often is a mix of technical, economic and social indicators. Impact is difficult to assess, due to timing and attribution issues. Often, impact is only realised after a longer period of time, long after the effects of a support programme have been assessed. Moreover, it is often unclear to what extent effects can be attributed to a particular policy intervention; how to isolate the contribution of a policy measure from other factors? Nevertheless, at the level of outcomes and impact, it is possible to recognise the original rationale for the policy intervention, e.g. economic growth and energy efficiency. Did an intervention address the challenges (needs, problems, issues) and achieve the policy objectives? Figure 2-1 illustrates the relation between input, output, outcome and impact, the policy objectives and the issues that need to be addressed, which together shape the intervention logic.

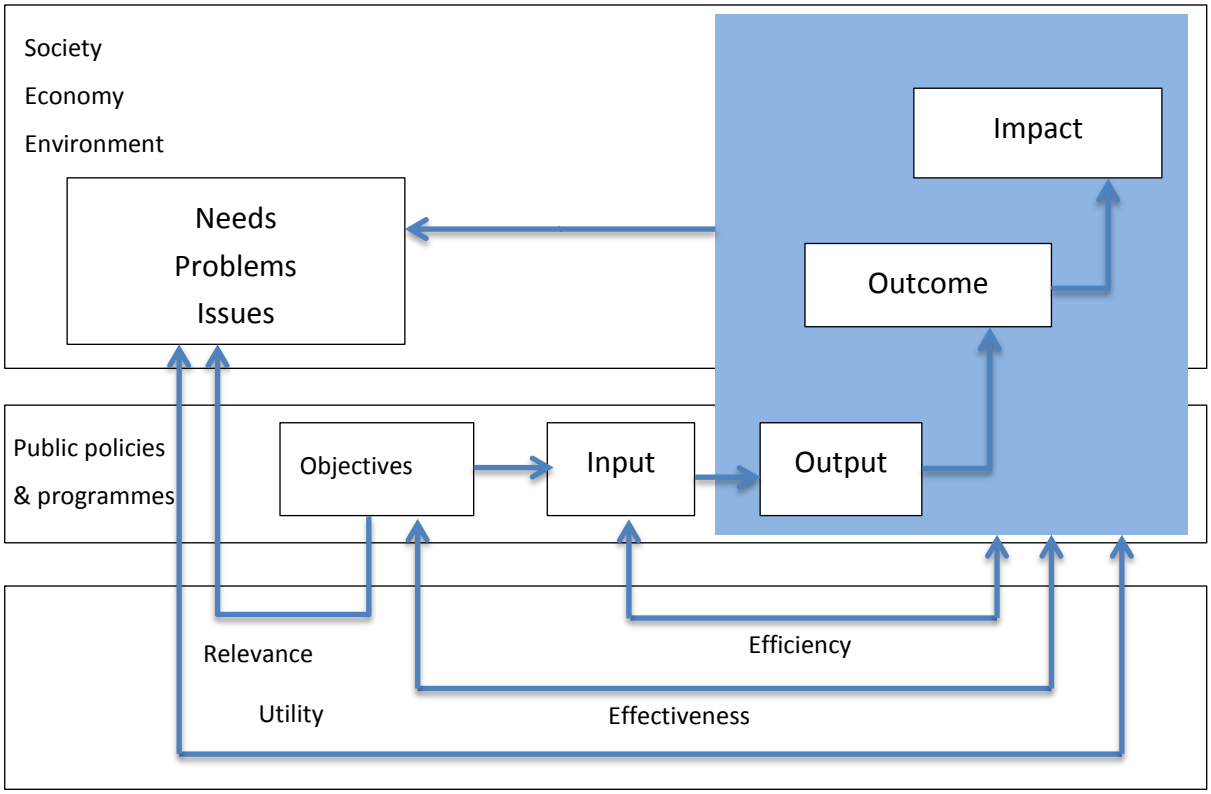

Figure 2-1: Intervention logic

2.1.3 Impact channels

Crucial elements of the intervention logic are the flows or mechanisms between the levels of input, output, outcomes and impact. How do specific types of input lead to output, outcomes and impact? Such flows or mechanisms are also known as *impact channels*. Academic literature and recent policy studies have defined a short list of impact channels that can be relevant for

policy interventions in the context of R&D and Innovation[7] [8]. For example, the main problem and policy objective can be related to social networks, e.g. between regions, between countries, or between universities and SMEs. For research projects that are addressing this problem, there should be network-related indicators at the level of input (e.g. existing ties between the actors involved), output (ties created by the project), outcomes (e.g. new ties to stakeholders outside the project, as a result of the project) and impact (e.g. sustainable ties in the network of the relevant regions and sectors). A similar set of indicators can be developed for impact channels such as knowledge and human capital, e.g. how a research project leads to new knowledge and better skilled researchers and users. The relevance of specific impact channels will depend on the needs/problems/issues and the objectives that underlie a policy intervention. The impact channels for the GEN6 project will be identified based on the intervention logic for the IPv6. The intervention logic for the IPv6 Pilots will be described in the next section.

2.1.4 Intervention logic of IPv6 pilots

The IPv6 pilots are supported by the CIP ICT PSP programme. The GEN6 project brings together nine pilots and is considered - by reviewers and the European Commission – to address the main challenges of the CIP ICT PSP programme (and its so-called Type B pilots). This implies that the intervention logic of CIP ICT PSP provides valuable information for making explicit the intervention logic of IPv6 pilots. This top-down analysis - use official CIP goals as input to GEN6 intervention logic - will be combined with a bottom-up analysis - use IPv6 specific goals and issues as input to GEN6 intervention logic.

Figure 2-2 summarises the intervention logic of the CIP ICT PSP. The intervention logic is made explicit in a study by Joanneum, TNO and DTI for the European Commission[8].

The strategic and operational objectives of CIP have been formulated as a response to the contemporary needs, problems and issues in Europe, such as the fragmentation of Europe's markets. Subsequently, the CIP instruments were designed, and budget was allocated to these instruments (e.g. type B pilots such as the GEN6 project). Also, a number of inputs and outcomes are defined within the programme. The policy objectives can be recognised in the outcomes and - especially - in the intended impact of the programme, for instance, an integrated EU digital market instead of fragmented markets. This coherence is shown in Figure

[7] *Marc van Lieshout with cooperation of Annelieke van der Giessen (TNO); Renald Buter and Ed Noyons (CWTS); Christien Enzing and Jasper Deuten with cooperation of Bastian Mostert (Technopolis); Dirk Holtmannspötter, and Leif Brand and Günter Reuscher (VDI-TZ), 2011, Impact of FET Research Initiative - IFETRI Final Report, 16 February 2011*

[8] *Dinges, M, Poel, M. and N.S. Laugesen (2010). Beyond patents and Publications. Performance Monitoring Indicators for ICT Research in the EU-funded RTD. Study for the European Commission*

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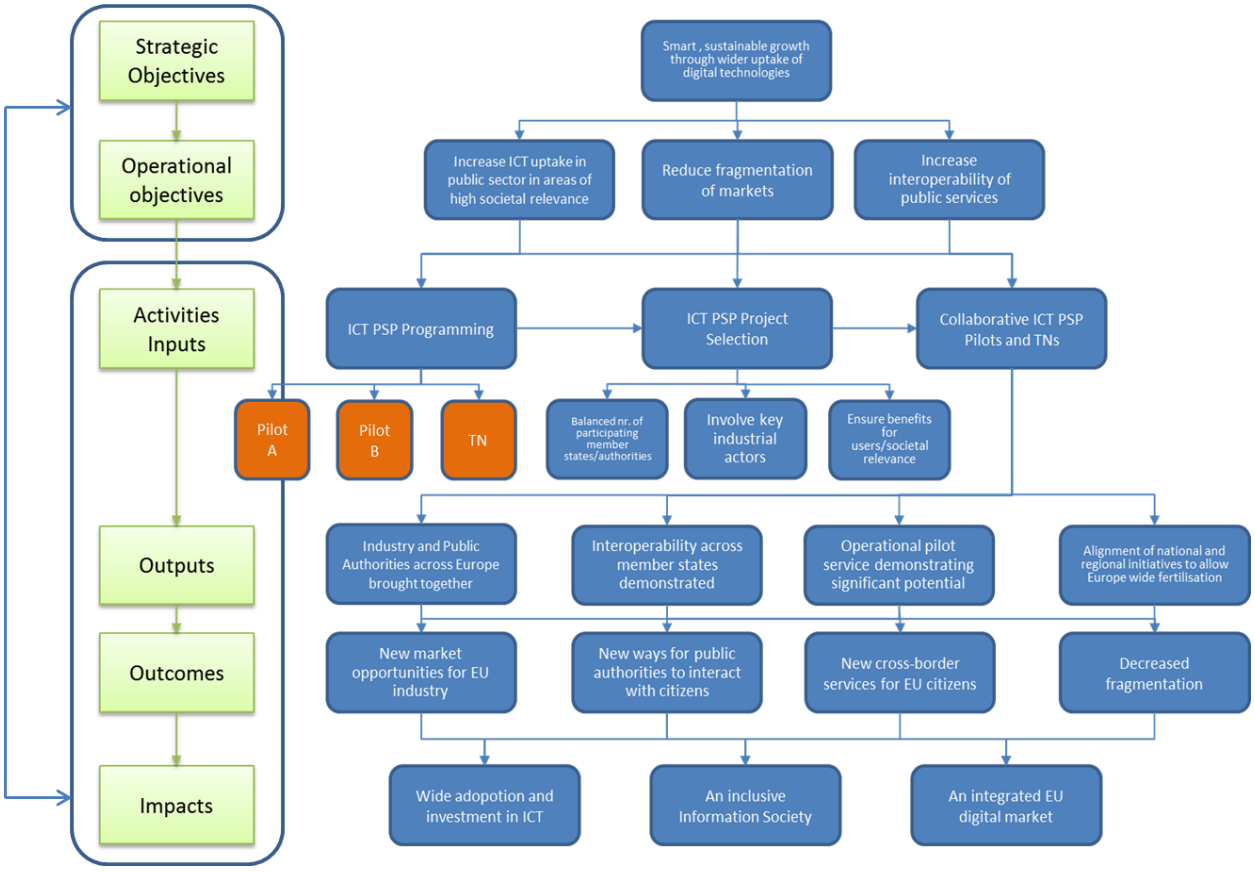

Figure 2-2: EC intervention logic at the level of CIP ICT PSP

Although Figure 2-2 presents the intervention logic at the abstract, aggregated level of the CIP ICT PSP programme, the main elements can be applied to IPv6. IPv6 pilots should contribute to wide adoption and investment in IPv6, not just by market leaders, large private organisations and early adopters, but also by public organisations and late adopters (inclusion). IPv6 pilots should contribute to an integrated European market in terms of suppliers, users, services, products, interoperability, etc. This reveals that IPv6 pilots are not just about creating new knowledge, but also about stimulating awareness and social networks, e.g. across Member States. The phrasing of the CIP ICT PSP intervention logic – and the application to IPv6 – reflects that the CIP programme is different from a (fundamental) research project. This has clear implications for a monitoring framework. For example, publications can be relevant output for pilots, but the emphasis may not be on academic publications but on leaflets/flyers and articles in popular press.

To complement the top down analysis of the CIP ICT PSP programme, for this report, studies and policy documents have been analysed on the needs, problems and issues related to IPv6,

e.g. the studies by TNO on IPv6 Monitoring in Europe[9] and The Netherlands[10]. Also the official documents of the IPv6 pilots in the GEN6 project have been analysed. Again, purpose of this analysis is about determining the suitable rationales and about impact channels for the monitoring framework. Why should organisations implement IPv6 and – especially – why should governments organise and/or co-finance IPv6 pilots?

Through this analysis, eight needs/problems/issues have been identified. Although these eight needs/problems/issues are not independent, they are often mentioned separately in literature. This allows for a clear link to the possible contribution of pilots, and the impact channels via which pilots stimulate the uptake of IPv6. This is shown in Table 2-1.

The relevance of three impact channels - knowledge, awareness, and social networks - was already revealed by the analysis of the CIP ICT PSP intervention. Based on the WP5 analysis of IPv6 documents, three impact channels have been added: technical implementation, costs and benefits and too some extent human capital (the latter as it can be important to some countries or pilots). To some extent, this concerns knowledge, e.g. about technical implementation and costs. However, because there are different types of issues in the technical implementation of IPv6, - e.g. availability of equipment, legacy infrastructures, standards, interoperability and knowledge-, and because this is crucial to a pilot, technical implementation is defined as a separate impact channel. The reasons for treating costs and benefits as a separate impact channel is the mere variety of costs and benefits that can be revealed by pilots (e.g. one-time and recurring costs, for suppliers and users) and the importance of allocating costs and benefits to actors. IPv6 implementation will be in the benefit of all actors (scarcity of IPv4 addresses; the macro level) yet with uncertainty about the costs and benefits for individual organisations (the micro level).

There is an additional reason for highlighting technical implementation and costs and benefits. The GEN6 project is invited by the European Commission to identify IPv6 success factors and bottlenecks, and monitor the impact of the GEN6 pilots with respect to these. The identification of success factors and bottlenecks will benefit from a detailed analysis of technical implementation, with a coherent set of indicators. The observations about the uptake and impact of IPv6 will benefit from a detailed analysis of costs and benefits.

[9] *Ahmed, K., Botterman M., Hartog, F. den, Hartog, T., Holtzer, A.C.G., Mayer, M., Olk, E., Prins, M., Smets, R., Tijmes, M., Venemans, P., Willemsen, M., Wu, K.W., Lihsuan, L., Ming, L.Y. and K. Huang, "IPv6 Deployment Monitoring in Europe, Study Report," TNO & GNKS, European Commission, Brussels, 2010*

[10] *Boen, M., Holtzer A.C.G., Schotanus, H., Smets R. and M. Tijmes, "IPv6 Monitoring in NL: eerste, tweede, derde en vierde meting", TNO, Delft, 2010-2011*

Need/problem/issues	Possible contribution of pilots	Impact channels
A pending shortage of IPv4 addresses	Pilots can contribute to tackling this (macro) problem, by addressing several technical and economic issues of IPv6 implementation	Awareness, knowledge, technical implementation, costs and benefits
Continuity issues resulting from a shortage of IPv4 addresses or from delayed introduction of IPv6	Continuity issues can be both prevented and addressed by pilots, e.g. by reducing the number of late adopters, and by creating information about technologies and processes to manage continuity	Awareness, knowledge, technical implementation,
High costs resulting from a scarcity of IPv4 addresses or late implementation of IPv6 (e.g. costs of technical consulting)	Pilots can reduce the costs – for individual organisations and society at large – by stimulating a variety of organisations to adopt IPv6 early; i.e. to prevent the risks and high costs of last minute implementation	Awareness, costs and benefits
More effective and/or efficient network management, e.g. address configuration, zoning and using the opportunity to 'clean up' legacy and piecemeal network management systems	Pilots can provide concrete examples and best practices of how IPv6 implementation can lead to more effective and efficient network management. The implications will be different for different (legacy) network management systems, for different types of IT departments, users, applications, etc.	Technical implementation, costs and benefits, knowledge, human capital
Better network performance, e.g. improved QoS implementation and security via IPv6 instead of applications	Pilots can reveal the types and magnitude of improvements in network performance. Improved QoS at the level of networks can have implications for QoS at the level of applications	Technical implementation, knowledge
Demand for IPv6 by customers	Pilots can lead to information about the different reasons that customers may have for (early) adopting IPv6. This information can be used to further stimulate demand for IPv6, and to estimate demand by types of users, over a period of time. This information is valuable for suppliers of IPv6 hardware, software and services	Awareness, social networks, knowledge
New services or features	Pilots can lead to information about how IPv6 implementation triggers (or is complemented by) innovation in services and features, e.g. related to quality, security and privacy	Knowledge, costs and benefits
Action plans and regulations on IPv6 adoption	National, European and other governments have communicated their ambitions or even obligations related to IPv6. Pilots can amplify these signals, provide inspiring signals, link relevant actors, and lead to relevant information	Awareness, social networks, knowledge

Table 2-1: IPv6 needs/problems/issues and how pilots can contribute to them

2.1.5 Elaboration of the impact channels

The impact channels used in GEN6 to link the levels of input, output, outcome and impact are depicted in Figure 2-3.

The set of impact channels is based on the needs/problems/issues that provide a rationale for organising and co-funding IPv6 pilots. In a specific country and pilot, one rationale may be more important than others. For instance, the available knowledge and human capital may be sufficient, while organisations are dragging their feet because awareness and urgency are lacking, or social networks between suppliers and users are insufficient. Here, a brief reflection is given on the six impact channels and the indicators at the level of input, output, outcomes and impact.

The first impact channel concerns the **technical implementation** of IPv6 and focuses on the effective technical implementation of IPv6, by organisations that use IPv6 and by suppliers of IPv6. One of the prime drivers for organisations to engage in IPv6 activities (and one of the main concerns) is the impact of the introduction of IPv6 on processes in the organization. For example, organisations are concerned with the reliability and availability of a service or application. At the level of input, indicators address the current stock of systems, standards and services. The output level concerns any changes and new elements. Outcomes can be related to network efficiency, performance levels, etc. Impact can be on – for instance – the overall quality of networks and applications, and on energy consumption.

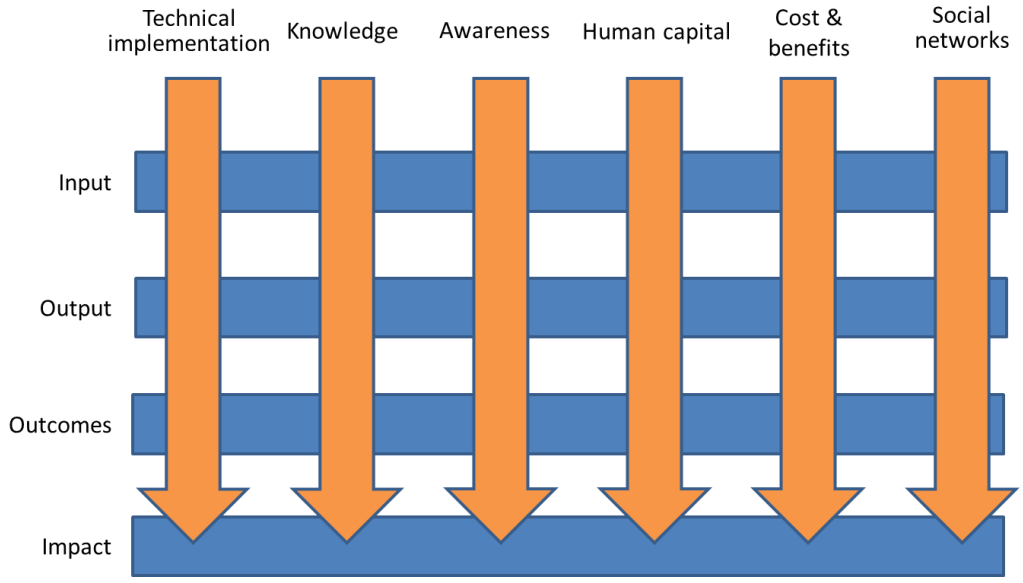

Figure 2-3: Intervention logic: the impact channels

The second impact channel takes into account the expected increase in **knowledge** within the organisations participating directly and indirectly in the pilots. This refers to knowledge of effective and cost efficient implementation of IPv6, but also to knowledge of individual

providers of IPv6 hardware, software and services, with respect to the demand for IPv6. Again, the indicators need to reveal how the pilot uses input (existing knowledge), creates output (e.g. publications), outcomes and impact.

A third impact channel focuses on the expected increase in **awareness** of IPv6 inside and outside the pilots, including organisations that do not yet have implementation plans. An example at the input level is the awareness of the participants in the pilot; they participate, so a basic awareness is present. Subsequently, the question is how their awareness increases and – more importantly – how the pilots increase awareness across a larger group of stakeholders.

The fourth impact channel concerns the expected increase in IPv6-related **human capital** within organisations that are closely involved in the pilots. Human capital refers to the set of skills people gather and develop during the course of the pilot.

The fifth impact channel focuses on the societal, technical, security and economic **costs and benefits** of implementing IPv6. Only to some extent, they are known at the start of the pilot. An understanding of the main costs and benefits - for different types of actors - can be an explicit objective of the pilot (e.g. an output or outcome). It can also be implicit. When the costs and benefits are known in more detail, and are shared with more stakeholders, the pilot can increase its impact.

The sixth impact channel is **social networks**. Strengthening of existing and the formation of new social networks between different stakeholders (within and outside the pilot) can support other mechanisms, e.g. increasing awareness. The emphasis can also be on - for instance - collaboration and trade across Europe's Member States, and between different types of actors in the innovation process, such as users, suppliers, consultants and policy makers.

2.1.6 Governance

To conclude this Section, the concept of governance will be included in the monitoring framework. In the context of IPv6 pilots, most relevant are decisions about the timing of IPv6 implementation. A number of factors can be relevant in making this decision (human capital, costs, benefits, risks, public policies, etc.). The monitoring framework will include a number of questions and indicators on the decision making process (who, why, when?), and the influence of public policy on decisions about the timing of IPv6 implementation (e.g. subsidies, regulations and campaigns). Given the emphasis on decisions about the timing of IPv6 implementation, the set of indicators is structured around potential factors that influence these decisions. The potential influence of public policies is addressed explicitly, to increase the relevance of the results for policy debates about IPv6. This allows commenting on the relevance of national IPv6 awareness campaigns, support schemes and regulations, as perceived by the participants in the GEN6 pilots, in the various EU Member States.

2.2 Impact & Project Stakeholders

The input, outputs, outcomes and impacts of the project will target different groups of stakeholders. The stakeholder groups are visualized in the stakeholder web of Figure 2-4. The monitoring framework aims to cover as much of the stakeholder groups with regard to outcomes and impacts as possible. Of course, because of the project structure the most information will be available on the impact on the parties within the two or three inner circles. Circle four and in particular circle five are outside the direct control of the project. Information on these outer rings will be collected though the contacts of the consortium partners that exist with organizations in the outer circles. The different stakeholder groups are described below. More details on the procedure and methods for information collection are described in Chapter 4.

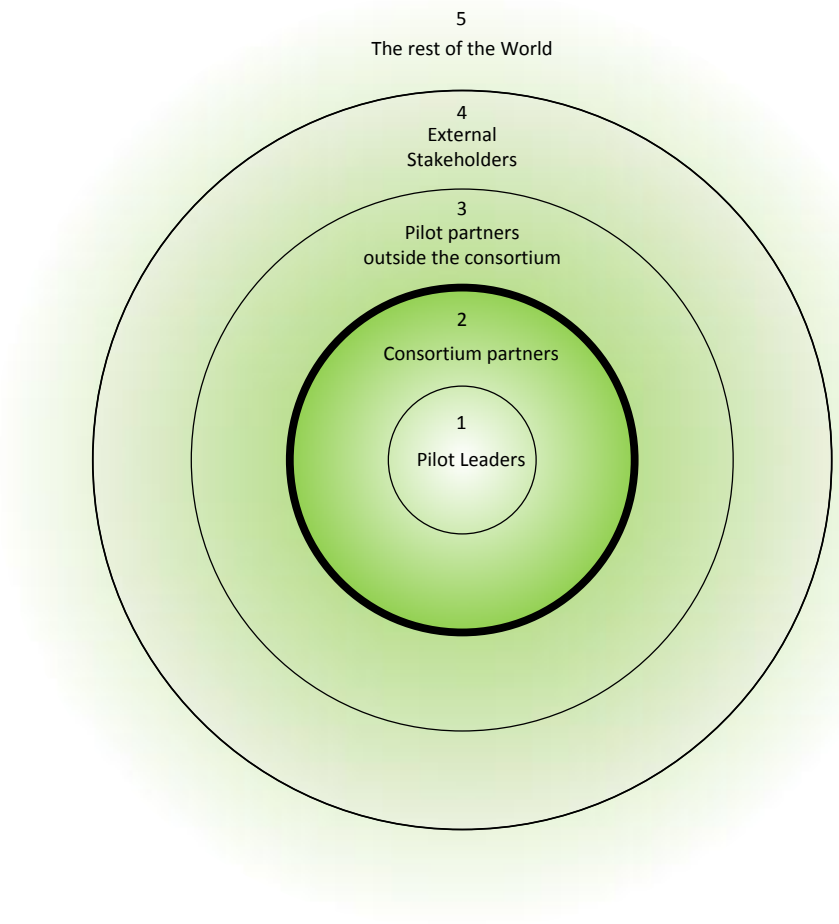

Figure 2-4: Stakeholder web in the GEN6 project as used in the Monitoring Framework

Circle 1: Pilot leaders

Every pilot has a pilot leader. The pilot leader is the main point of contact for the pilot. All information needed for the monitoring framework indicators regarding the pilot will in principle be collected via the pilot leader. The pilot leader will be responsible for obtaining the information from other people and organizations in the other 'rings' that are necessary to

obtain the relevant parameters. The pilot leader will also provide the stakeholder web for his pilot, prior to the first measurement. The pilot leaders are presented in Table 2-2.

#	Pilot Leader	Pilot
2	Consulintel	Spain
3	TUBITAK	Turkey
4	UMU	Cross-Border Pilot eGovernment Services
5	UL	Luxembourg
5	UL	Cross-Border Public Safety
7	ULFE	Slovenia
9	Citkomm	Germany
14	CTI	Greece
16	Alkmaar	The Netherlands

Table 2-2: Pilot leaders in GEN6

Circle 2: Consortium partners

All GEN6 consortium partners, except for the project manager Devoteam, take part in WP5. The consortium partners provide their parameters to the WP5 leader (TNO, coordinating the monitoring). The consortium partners are responsible for obtaining information from the stakeholders from ring 3, 4 and 5 that are relevant to the indicators. Of course, the pilot leaders are also consortium partners. The consortium partners are listed in Table 2-3.

Circle 3: Pilot partners outside the consortium

In several pilots, organizations participate that are not part of the GEN6 project consortium. They are “partners of partners” with respect to the pilot. Note that these partners are actively involved in executing the pilot. Examples are suppliers of equipment, service providers and consultants that continue to be actively involved during the course of the pilot. Since these organizations are part of the pilot, they can provide valuable information. Furthermore, input from these organizations is relatively independent, since the organizations are not part of the GEN6 consortium. Information from the organizations in the third circle will be obtained through the pilot leader.

Circle 4: External stakeholders

There are different stakeholders, which are not involved in the pilot execution, but are influenced by or have interest in the pilot execution and/or results. Examples of such external stakeholders can be public administrations that would like to use the lessons learned from the pilot in their country, users of a service that is piloted and vendors whose equipment is used in the pilots. Obtaining information from these external stakeholders as input to the monitoring framework will be performed through the pilot leader.

Consortium partners	
Devoteam Danet GmbH Germany	1
CONSULTORES INTEGRALES EN TELECOMUNICACIONE "CONSULINTEL", S.L. Spain	2
TUBITAK ULUSAL AKADEMIK AG VE BILGI MERKEZI Turkey	3
UNIVERSIDAD DE MURCIA Spain	4
UNIVERSITE DU LUXEMBOURG Luxembourg	5
MINISTERIA DE POLITICA TERRITORIAL Y ADMINISTRACION PUBLICA Spain	6
UNIVERZA V LJUBLJANI Slovenia	7
NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK – TNO Netherlands	8
KDVZ Citkomm Germany	9
FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V Germany	10
MINISTERIO DE INDUSTRIA, TURISMO Y COMERCIO Spain	11
TURKSAT UYDU HABERLESME VE KABLO TV ISLETME AS Turkey	12
GREEK RESEARCH AND TECHNOLOGY NETWORK S.A. Greece	13
COMPUTER TECHNOLOGY INSTITUTE & PRESS DIOPHANTUS Greece	14
INTELEN SERVICES UNLIMITED Cyprus/Greece	15
GEMEENTE ALKMAAR	16
MINISTERSTVO VNITRA Czech Republic	17
MINISTRY OF INDUSTRY AND TRADE Czech Republic	18
CZ.NIC Czech Republic	19

Table 2-3: Consortium Partners of the GEN6 project

Circle 5: "The rest of the world"

Apart from the organizations in the inner four circles there are many potential users of the results of the GEN6 project and its nine pilots. These organizations and people are not involved in the GEN6 project. This group will be reached mainly through the dissemination campaigns.

Note that organizations can move from one ring to another during the course of the project. For example, organizations not aware of the pilots may become very interested as an external stakeholder or maybe even pilot or consortium partners.

3. DESCRIPTION OF INDICATORS

This chapter presents an overview of the indicators that will be used for the monitoring of the activities and results of the GEN6 pilots. The indicators are structured along two dimensions, namely the impact channels (technical implementation, knowledge, awareness, human capital, costs & benefits, social networks) and per impact channel according to the impact levels (input, output, outcome and impact). This is done in Sections 0 through 3.6. Indicators related to governance are presented as well in Section 0. The overview of indicators are presented in Table 3-1 to Table 3-8, which include the related metrics, the data collection method, the relevance for specific pilots as well as the related stakeholder web impact circles. In the tables, L1 to L5 indicate the stakeholder levels (L1 for the pilot leader and L5 for the 'rest of the world').

Relevance of the indicators

In principle, the indicators have been defined such that they are relevant for all pilots. However, some indicators may not be relevant to a pilot, for example the comparison of IPv6 performance to IPv4 performance for a service only makes sense when there actually is both an IPv4 and IPv6 equivalent to the piloted network or service. An investigation among the partners has indicated that these are exceptions and therefore these will not be mentioned explicitly in the indicator tables. This means that for each indicator, a sufficient number of parameters for a sufficient number of pilots can be obtained.

Participants	Partner/s
Jordi Palet Martínez	Consulintel
Emre Yüce	ULAKBIM
Antonio F. Gómez Skármeta	UMU
Carlos Gómez Muñoz	MINHAP
Mojca Volk Janez Sterle	ULFE
Martin Krengel	Citkomm
Dorota Witaszek Uwe Holzmann-Kaiser	Fraunhofer FOKUS
Juan Jose Rodriguez Moreno	MINETUR
Kamil Seyhan	Turksat
Athanassios Liakopoulos	GRNET
Manos Varvarigos Michalis Oikonomakos Koumoutsos Konstantinos	CTI
Eirini Gkioxi	Intelen
Michiel Ettema	Gemeente Alkmaar
Denis Gibadulin	MoIT, MVCR and CZ.NIC

Table 3-1: Participants that responded to the indicator table investigation

Table 3-1 contains the names and affiliations of the participants that have responded to the indicator table investigation.

Note that since all indicators are relevant to all pilots, this does not mean they all have to be relevant to each partner. For example, a technical measurement can only be performed by the partner actually carrying out these measurements. This will be taken into account when collecting the monitoring data. The monitoring approach is explained in more detail in Chapter 4.

Definition of users

Several indicators focus on the effects on users of the pilot. Several categories of users can be distinguished. The first category concerns end users of the service or the network realised and implemented by the pilot, for example citizens that use a government service enabled by IPv6. A second category of users includes users of semi-finished products resulting from the pilot, for example developers of applications and services that will use the IPv6 network. A third category of users concerns users of other pilot results such as standards, tools, best practices, hand books, etc.

3.1 Technical Implementation

The indicators listed in this section provide information on the needs/problems/issues that are influenced by the way the technical implementation is executed. There are indicators that focus on the input of the pilot such as the start architecture of the current network in terms of complexity and performance. Amongst the output indicators are performance related indicators, such as achieved bandwidth and round-trip times, and indicators related to the flexibility of the implementation, a qualifier that is important for a future proof and secure network. Outcome indicators aim to chart the impact on the organization that undergoes IPv6 transformation. The impact of the transition to IPv6 on processes in the organization is an important aspect because it has impact on the way the organization operates its services. The pilot will also influence external entities. Questions such as: “What are the consequences for the reliability and availability of a service or application?” are touched upon using the indicators under “impact”. In this respect the environment is also considered external to the pilot and the influence of a transition to IPv6 on the environment is therefore relevant.

Technical Implementation				
#	**Indicator**	**Parameter**	**Methodology**	**Impact circle**
Input				
1	Complexity of current architecture compared to main competitor or peer and compared to target or visionary network (IPv4 and IPv6 and IPv6 compared to IPv4) based on personal	1..5 (1=less complex, 3=same complexity, 5= more complex)	Survey with motivation questions	L1, L2, L3

	experience.			
2	Level of state-of-the art of current architecture and implementation compared to main competitor or peer, or target or visionary network.	1..5 (1=legacy architecture and technology, 3=proven architecture and technology 5=first adopting architecture and technology)	Survey with motivation questions	L1, L2, L3
3	Current network architecture, design and high-level information on implementation.	Drawing / Schematic	An overview of the design is to be provided using a limited set of symbols and annotations	L1, L2, L3
Output				
4	Complexity of new (foreseen to be realized by the end of the pilot) architecture compared to main competitor or peer and compared to target or visionary network (IPv4 and IPv6 and IPv6 compared to IPv4) based on personal experience.	1..5 (1=less complex, 3=same complexity, 5= more complex)	Survey with motivation questions	L1, L2, L3
5	Level of state-of-the art of new (foreseen to be realized by the end of the pilot) architecture compared to: main competitor or peer, or target or visionary network.	1..5 (1=legacy architecture and technology, 3=proven architecture and technology 5=first adopting architecture and technology)	Survey with motivation questions	L1, L2, L3
6	New (foreseen to be realized by the end of the pilot) network architecture, design and high-level information on implementation.	Drawing / Schematic	An overview of the design is to be provided using a limited set of symbols and annotations	L1, L2, L3
7	IPv6 performance >= IPv4 performance for DNS	Yes or No statements based on supplied information on underlying qualifiers and quantifiers such as response time, success rate	Survey	L1, L2, L3
8	IPv6 performance >= IPv4 performance for DHCP(v6) or for SLAAC (v6-case only) and if applicable.	Yes or No statements based on supplied information on underlying qualifiers and quantifiers such as success rate	Survey	L1, L2, L3
9	IPv6 performance >= IPv4 performance for SIP and if applicable	Yes or No statement based on supplied information on underlying qualifiers and quantifiers such as success interoperability and session setup time and success rate	Survey	L1, L2, L3
10	IPv6 performance >= IPv4 performance for otherservices/components relevant to the pilot as mentioned in the WP3 pilot requirements documentation	Yes or No statement	Survey	L1, L2, L3
11	Percentage of the pilot requirements met in the implementation (functional)	% of total	Survey	L1, L2, L3
12	Percentage of the pilot requirements met in the implementation (security)	% of total	Survey	L1, L2, L3
13	Percentage of the pilot requirements	% of total	Survey	L1, L2, L3

	met in the implementation (performance)			
14	Percentage of the pilot requirements is met in the implementation (management)	% of total	Survey	L1, L2, L3
15	Percentage of the pilot requirements is met in the implementation (other)	% of total	Survey	L1, L2, L3
16	Percentage of implemented (IPv6) features operational?	% of total	Survey	L1, L2, L3
17	Percentage of implemented (IPv6) requirements operational?	% of total	Survey	L1, L2, L3
18	Percentage of already owned equipment that is reused without any update	% of total	Survey	L1, L2, L3
19	Percentage of already owned equipment that is reused with software update only	% of total	Survey	L1, L2, L3
20	Percentage of already owned equipment that is reused with hardware and software update	% of total	Survey	L1, L2, L3
21	New equipment purchased as percentage of total installed base	% of total	Survey	L1, L2, L3
22	Percentage of software that is reused without any update	% of total	Survey	L1, L2, L3
23	Percentage of software that is reused after update	% of total	Survey	L1, L2, L3
24	Percentage of new software that is introduced	% of total	Survey	L1, L2, L3
25	X to Y bidirectional bandwidth available for services on IPv6 and IPv4, X = user terminal, Y= application server	bps and fps	Measurement Sheet (xls). With X and Y to specify and typical values (mean, min., max.) observed in the network.	L1, L2, L3
26	X to Y bidirectional bandwidth available for services on IPv6 and IPv4, X = application server, Y= application server	bps and fps	Measurement Sheet (xls). With X and Y to specify and typical values (mean, min., max.) observed in the network.	L1, L2, L3
27	X to Y bidirectional bandwidth available for services on IPv6 and IPv4, X = network element, Y = network element	bps and fps	Measurement Sheet (xls). With X and Y to specify and typical values (mean, min., max.) observed in the network.	L1, L2, L3
28	X to Y bidirectional bandwidth available for services on IPv6 and IPv4, X = ..., Y = … (miscellaneous connections in the implementation relevant for service/network performance)	bps and fps	Measurement Sheet (xls). With X and Y to specify and typical values (mean, min., max.) observed in the network.	L1, L2, L3
29	X to Y round trip times and delays	s	Measurement	L1, L2, L3

	experienced by services on IPv6 and IPv4, X = user terminal, Y= application server		Sheet (xls). With X and Y to specify and typical values (mean, min., max.) observed in the network.	
30	X to Y round trip times and delays experienced by services on IPv6 and IPv4, X = application server, Y= application server	s	Measurement Sheet (xls). With X and Y to specify and typical values (mean, min., max.) observed in the network.	L1, L2, L3
31	X to Y round trip times and delays experienced by services on IPv6 and IPv4, X = network element, Y = network element	s	Measurement Sheet (xls). With X and Y to specify and typical values (mean, min., max.) observed in the network.	L1, L2, L3
32	X to Y round trip times and delays experienced by services on IPv6 and IPv4, X = ..., Y = … (other connections in the implementation relevant for service/network performance)	s	Measurement Sheet (xls). With X and Y to specify and typical values (mean, min., max.) observed in the network.	L1, L2, L3
33	X to & from Y packet loss on IPv6 and IPv4, X = user terminal, Y= application server	%	Measurement Sheet (xls). With X and Y to specify and typical values (mean, min., max.) observed in the network.	L1, L2, L3
34	X to & from Y packet loss on IPv6 and IPv4, X = application server, Y= application server	%	Measurement Sheet (xls). With X and Y to specify and typical values (mean, min., max.) observed in the network.	L1, L2, L3
35	X to & from Y packet loss on IPv6 and IPv4, X = network element, Y = network element	%	Measurement Sheet (xls). With X and Y to specify and typical values (mean, min., max.) observed in the network.	L1, L2, L3
36	X to & from Y packet loss on IPv6 and IPv4, X = ..., Y = … (other connections in the implementation relevant for service/network performance)	%	Measurement Sheet (xls). With X and Y to specify and typical values (mean, min., max.) observed in the network.	L1, L2, L3
37	Improvements in network management	1..5 (1=management has become more difficult,	Survey	L1, L2, L3

		3=management has not changed, 5=management has become easier)		
38	Improvements in service management	1..5 (1=management has become more difficult, 3=management has not changed, 5=management has become easier)	Survey	L1, L2, L3
39	Security measures meet certain flexibility for IPv6, without the need for updates, changes or replacements. Flexibility means there is a future proof security framework adaptable to new security issues that may arise in IPv6, such as new ICMP message formats, new IPv6 extension headers, …	1..5 (1=future changes are surely needed, 3=possibly needed, 5=not expected to need any future changes) Possible future changes are: firmware / software upgrade, replacement of equipment, nothing, …	Survey	L1, L2, L3
40	Amount of received IPv6 related helpdesk calls	% of total received calls	Survey on the mean, min., and max. values per day and the trend observed over a larger period of time.	L1, L2, L3
41	Change in time it takes to solve IPv6 related problems at the end of pilot implementation, compared to beginning of the pilot	%	Survey on the mean, min., and max. values.	L1, L2, L3
42	Did it take more time or less time to solve IPv6 related problems, than similar IPv4 related problems. If possible provide % of time gained or lost on IPv6 compared to IPv4.	Less / More and %	Survey	L1, L2, L3
43	Amount of content that is available via IPv6 compared to total.	Numbers and %	Survey	L1, L2, L3
44	Amount of content that is consumed via IPv6 compared to total.	Numbers and %	Survey	L1, L2, L3
45	Amount of services that is available via IPv6 compared to total.	Numbers and %	Survey	L1, L2, L3
46	Amount of services that is consumed via IPv6 compared to total.	Numbers and %	Survey	L1, L2, L3
47	Requirements for existing (IPv4-only) applications become less complex or voluminous with IPv6 enabled	1..5 (1 = increase in complexity and number of requirements 3 = no change in complexity and number of requirements 5 = decrease of complexity and number of requirements	Survey	L1, L2,L3
48	Did the pilot require changes in services such as changes in not-network related processes (related to IPv6 enabled services).	1..5 + examples (1 = always 3 = some cases, 5 = not at all)	Survey	L1, L2, L3
	The pilot has enabled the following services that are not possible using	List of services	Survey	L1, L2, L3

	IPv4-(only)			
50	The pilot has disabled the following services because of the transition to IPv6-(only):	List of services	Survey	L1, L2, L3
51	Percentage of units/departments and/or employees within the organisations that can use the services over IPv6	%	Survey	L1, L2, L3
52	Improvements in business continuity due to IPv6 implementation	1..5 (1= no improvement, 5=substantial improvement	Survey	L1
Impact				
53	The pilot has resulted in a higher/lower availability of the services in the pilot	1=no, disagree, poor 5 = yes, agree, excellent	Survey	L1, L2, L3, L4
54	The pilot has resulted in an improved/degraded quality of the services in the pilot	1=no, disagree, poor 5 = yes, agree, excellent	Survey	L1, L2, L3, L4
55	The pilot has resulted services with a quicker/slower response	1=no, disagree, poor 5 = yes, agree, excellent	Survey	L1, L2, L3, L4
56	The pilot has resulted in a lower/higher price for end-users of the services in the pilot	1=no, disagree, poor 5 = yes, agree, excellent	Survey	L1, L2, L3, L4
57	The pilot has resulted in a service that is safer / more dangerous, causes less / more damage to users, workers, the environment, etc...	1..5 (1=no, disagree, poor 5 = yes, agree, excellent)	Survey	L1, L2, L3, L4
58	The pilot has resulted in a service that is more / less reliable	1..5 (1=no, disagree, poor 5 = yes, agree, excellent)	Survey	L1, L2, L3, L4
59	The pilot has resulted in a service that is more / less sustainable (energy consumption, renewables)	1..5 (1=no, disagree, poor 5 = yes, agree, excellent)	Survey	L1, L2, L3, L4
60	Percentage of organizations (outside the pilot (organization(s)) that use the services over IPv6 compared to total services	%	Survey	L1, L2, L3, L4
61	Percentage of users (outside the pilot/organization(s)) that use the services over IPv6 compared to total # of users of the services (both v4 and v6)	%	Survey	L1, L2, L3, L4

Table 3-2: Indicators related to the Technical Implementation

3.2 Knowledge

One of the expected effects of the project will be an increase of IPv6 knowledge in the participating organizations dealing with the implementation of IPv6 (Pilot leaders, Consortium Partners, and partners outside the consortium). Increase in knowledge enables those organizations to implement IPv6 in other networks and services and transfer their knowledge to other organizations (e.g. clients, public administration). The central question here is “What did you learn?”. The monitoring on the knowledge indicators will be performed through surveys and some interviews. The knowledge indicators target the organizations actually participating in the pilot and will therefore focus on the inner three rings of the stakeholder web: pilot

leaders, consortium partners and external pilot partners.

Knowledge transfer to other organizations will be monitored through the dissemination indicators (awareness and social networks). Also, knowledge with regard to cost & benefits on different levels will be monitored through the cost & benefit indicators. The knowledge of the "organization" will be viewed from the following perspectives: project manager, user, supplier, researcher, consultant, and policy maker.

Knowledge				
#	**Indicator**	**Parameter**	**Methodology**	**Impact circle**
Input				
62	*No input indicators specific to knowledge*			
Output				
63	Increase of knowledge and expertise of the organization on ways to implement IPv6 effectively, as a result of the pilot.	rating 1 to 5; 1 = no increase; 5 = very large increase	Survey	L1, L2, L3
64	Amount of support that the pilot gave the organization in resolving existing (technological, organisational, financial etc.) barriers and difficulties in IPv6 implementation.	rating 1 to 5; 1 = no increase; 5 = very large increase	Survey	L1, L2, L3
65	Increase of knowledge of the organization with respect to the specific requirements for IPv6 tools, technologies, components etc. for IPv6 implementation in governmental / public service settings.	rating 1 to 5; 1 = no increase; 5 = very large increase	Survey	L1, L2, L3
66	Increase of knowledge regarding the demand/needs of clients (external stakeholders, public administration etc.)	rating 1 to 5; 1 = no increase; 5 = very large increase	Survey	L1, L2, L3
Outcome				
67	Increase in efficiency (in terms of resources and time needed) of the organization in implementing IPv6 in other projects / assignments / organisation.	rating 1 to 5; 1 = no increase; 5 = very large increase	Survey	L1, L2, L3
68	Increase in effectiveness of your organization in implementing IPv6 in other projects / assignments / organisations, as a result of your participation in the pilot.	rating 1 to 5; 1 = no increase; 5 = very large increase	Survey	L1, L2, L3
Impact				
69	Increase of knowledge of networks and services technology apart from IPv6, as a result of the IPv6 pilot.	rating 1 to 5; 1 = no increase; 5 = very large increase		L1, L2, L3

Table 3-3: Indicators related to the knowledge

3.3 Awareness

One of the targets of the pilots is that they will contribute to increasing the awareness for IPv6

and facilitate learning at the level of user organisations (public administration). Therefore, the pilots need to engage in a number of dissemination activities that include pilot websites and / or section on existing websites that will be dedicated to IPv6, publications on the pilot and other IPv6 activities, demonstrations, workshops and conferences, and potentially pilot handbooks or guidelines.

To gain insight into the extent to which awareness is actually increased the project includes indicators for monitoring the investment (in time and money) in dissemination activities, the type of deliverables this has led to (website, workshops, publications, etc.), and the use of these deliverables (visitors to events / websites, information requests, etc.) by external stakeholders (L4) and the rest of the world (L5). This enables the assessment of impact outside the project and contribution to the goal of increasing the knowledge on and use of IPv6.

Awareness				
#	**Indicator**	**Parameter**	**Methodology**	**Impact circle**
Input				
70	Days spent on pilot website and publications	Avg # person days / month	Survey	L1, L2, L3
71	Money spent on pilot websites and publications	Avg € / month	Survey	L1, L2, L3
72	Days spent on co-organising demonstrations, workshops and conferences related to the pilot	Avg # person days / month	Survey	L1, L2, L3
73	Money spent on (co-)organising demonstrations, workshops and conferences related to the pilot	Avg € / month	Survey	L1, L2, L3
74	Days spent on answering questions from stakeholders and citizens, by phone and email related to the pilot	Avg # person days / month	Survey	L1, L2, L3
75	Days spent on preparing the handbook / guidelines	Avg # person days / month	Survey	L1, L2, L3
76	Money spent on preparing the handbook / guidelines	Avg € / month	Survey	L1, L2, L3
Output				
77	Website dedicated to pilot	Interactive, passive, not yet, no	Survey	L1, L2, L3
78	Pilot information availability on existing website	Interactive, passive, not yet, no	Survey	L1, L2, L3
79	Unique visitors pilot website / pilot pages existing site	#	Web statistics tool	L1, L2, L3, L4, L5
80	Publications related to the pilot	#	Survey	L1, L2, L3
81	(Co-)organised demonstrations (planned vs. achieved)	#	Survey	L1, L2, L3
82	(Co-)organised workshops for target audience (planned vs. achieved)	#	Survey	L1, L2, L3
83	(Co-)organised conference presentations (planned vs. achieved)	#	Survey	L1, L2, L3
84	Handbook or guidelines for IPv6 implementation that can be used by others as result of pilot	Yes / No	Survey	L1, L2, L3
Outcome				

85	Visitors of (co-)organised events (classified by level of participating organisation, known to the project participants vs. not known to the project participants)	#	Attendance lists	L1, L2, L3, L4, L5
	Satisfaction with organised events	0-10 scale	Short survey among attendants	L3, L4, L5
86	IPv6 information requests handled by phone and email (or Twitter, post, etc.)	#	Logs of requests	L1, L2, L3, L4, L5
87	Requests / downloads for the pilot handbook / guidelines?	#	Logs of requests	L1, L2, L3, L4, L5
Impact				
88	Did the pilot (dissemination activities) lead to contacts with organizations that then started implementing IPv6 for the first time?	Yes / No		L1, L2, L3

Table 3-4: Indicators related to Awareness

3.4 Human Capital

One of the aims of the pilots is that they will increase IPv6-related human capital within organisations that are closely involved in the pilots. Organisations involved in the pilot will dedicate employees to the pilot. Some of these employees already work for these partners, but organisations can also hire new employees. The monitoring will focus on employment effects: will the pilot partners hire new employees and will the newly hired employees stay after the pilot? The employees involved will have a specific set of skills, related to a specific level of education and experience. The monitoring of the pilots will follow whether employees working in the pilot will receive training in IPv6 and whether they will acquire new skills and capabilities because of the pilot. Transferring knowledge from the pilot environment to other initiatives and organisations will also contribute to developing human capital and increasing skills. The monitoring will follow whether the pilots will develop training courses in IPv6 targeting both pilot participants and external stakeholders. Another important 'body' of knowledge transfer will be the mobility of employees participating in the pilot to other IPv6 implementation projects or other organisations (other suppliers, stakeholders, consultancy firms etc.) not involved in the pilot yet.

Human capital				
#	**Indicator**	**Parameter**	**Methodology**	**Impact circle**
Input				
89a	Total number employees involved in the pilot	# of employees	survey	L1, L2, L3
89b	Number of newly hired employees involved in the pilot	# of employees	survey	L1, L2, L3
90	Education / experience level of people working in the pilot	% division of employees in pilot to experience / education level	survey	L1, L2, L3
Output				
91	Number of people that received training in IPv6 during the pilot	# of people trained per type of training	survey	L1, L2, L3, L4, L5

92	Costs made for training people in IPv6 during the pilot	K€	survey	L1, L2, L3, L4, L5
93	Number of training courses, workshops for pilot participants organised during the pilot	# of events per target audience (technical, decision makers)	survey	L1, L2, L3
94	Number of training courses, workshops for end-users of implemented IPv6 service / network organised during the pilot	# of events per target audience (technical, decision makers)	survey	L1, L2, L3, L4, L5
Outcome				
95	New qualifications (skills and capabilities) of employees involved in pilot	Yes, No, specify type of skills and capabilities	survey	L1, L2, L3
96	Number of newly hired employees involved in the pilot that will stay after the pilot has been finished	# of employees	survey	L1, L2, L3
Impact				
97	Mobility of employees involved in the pilot to other IPv6 implementation projects	# of employees involved in the pilot that moved to other IPv6 implementation project	Survey	L1, L2, L3, L4, L5
98	Mobility of employees involved in the pilot to other organisations	# of employees involved in the pilot that moved to: - other IPv6 suppliers - other IPv6 consultancy firms - other IPv6 stakeholders	survey	L1, L2, L3, L4, L5

Table 3-5: Indicators related to Human Capital

3.5 Social Networks

Pilots aim at increasing the social networks between the different parties – suppliers, users and support - that collaborate in the implementation of IPv6. Within GEN6, the cross border pilots aim at increasing the social networks between the cross border member states that collaborate in the implementation of IPv6. Through these social networks, pilot participants gather new information, develop new ideas, expand their network with new contacts and build new collaborations, both in the current pilot and in other, new initiatives. The monitoring will focus on the creation of new partnerships within the pilot as well as the establishment of new IPv6-based contacts and partnerships with parties not involved in the pilot. Other indicators will follow the development of existing partnerships: will these linkages get stronger or more intense because of their participation in the pilot? The establishment of new IPv6 related networks, both national and international, and the participation by the pilot participants will also be included in the monitoring. Moreover, the monitoring will also address the question whether participation in the pilot also strengthens the relationships with other organisations in other technology domains and/or sectors.

Social networks				
#	**Indicator**	**Parameter**	**Methodology**	**Target group**
Input				
99	Type of organisation	Public, private, non-profit	survey	L1, L2, L3, L4
100	Location	City and Country	survey	L1, L2, L3, L4
101	Total number of employees	<50 employees, 50-100 employees, >100 employees	survey	L1, L2, L3, L4
102	Role in relation to the pilot	supplier of hardware/ supplier of software/ pilot manager/ supplier of services/research/consulting /user/policy maker/regulator/other	survey	L1, L2, L3, L4
103	IPv6 Usage	Existing / potential user of IPv6	survey	L1, L2, L3, L4
Output				
104	Existing partnerships in the pilot	# of partners in the core team of the pilot have been partners before	survey	L1, L2, L3
105	New partnerships in the pilot at the start of the pilot	# of new partners in the core team of the pilot + their role in the pilot	survey	L1, L2, L3
106	New partnerships in the pilot at a later stage	# of new partners that joined the pilot later + their role in the pilot	survey	L1, L2, L3
Outcome				
107	Change in the type of relationships between pilot partners from the start of the pilot.	# of partners in the core team of the pilot with which the relationship evolved from weak tie (e.g. inspiration, occasional supplier, client or consultant) into a strong tie (e.g. preferred partner or supplier)	survey	L1, L2, L3
108	Change in the type of relationships with partners that joined the pilot later.	# of pilot partners that joined the pilot later with which the relationship evolved from weak tie to strong tie	survey	L1, L2, L3
109	Participation in other IPv6 pilots and research programmes after joining / getting involved in this pilot and partly as result of the pilot	Yes, No to regional, national, European pilots and research programmes	survey	L1, L2, L3, L4, L5
110	New IPv6-related contacts at events (co-)organised in the context of the pilot	# of new organisations met and their role	survey	L1, L2, L3, L4, L5
Impact				
111	Newly established IPv6 networks due to the pilot	- Invited to join: yes, no, international/national - Initiated: yes, no, international / national	survey	L1, L2, L3, L4, L5
112	New contacts in other technology / activity domains than IPv6 due to IPv6	# of new contacts and their technology / activity	survey	L1, L2, L3, L4, L5

	pilot activities	domains		
113	Change in the type of relationships with partners in other technology / activity domains than IPv6 due to involvement in IPv6 pilot.	# of partners in other technology / activity domains with which the relationship evolved from weak tie to strong tie	survey	L1, L2, L3, L4, L5

Table 3-6: Indicators related to Social Networks

3.6 Economic and social costs & benefits

Insights about a number of societal and economic benefits and costs of introducing IPv6 will provide useful input to the 'lessons-learned' and 'best practices' that will result from the pilots' experiences. The monitoring will investigate the costs involved in the pilot, in total and for each participant. These costs will concern equipment and human resources. Costs can also be classified into different activities or steps in the pilot, including design, implementation, testing, requirements, configuration settings etc. Regarding the benefits, the monitoring will focus on changes (savings) in the costs of implementation, operations and management because of the introduction of IPv6. Another relevant benefit from the pilot could be the creation of new IPv6 enabled services and applications. Important outcome indicators will target the creation of new standards, practices, tools, technologies and components for IPv6 implementation in the pilot as well as filing for intellectual property rights (IPR). Improved capabilities for identification and authentication because of the IPv6 implementation can be a benefit as well. Some of the potential impact of the pilots will only be realised in the longer term. Improved security of the IPv6 network or applications compared to IPv4 may lead to lower security costs. The newly developed standards, practices, tools, technologies and components may also be used by other organisations outside the pilot. Another example of longer-term beneficial effects of the pilot could be the continuation and extension of the pilot partnerships and activities in other IPv6-related initiatives. The introduction of IPv6 enabled government services could also lead to higher quality in service delivery and, hence, improved user satisfaction with the services offered and even more fee-for-public-service clients. For the pilot participants, especially for the suppliers and consultancy firms, participating in the pilot could in the longer term also lead to new business opportunities and increased investments in R&D and innovation related to IPv6 specific and ICT and e-government more general.

Knowledge				
#	**Indicator**	**Parameter**	**Methodology**	**Impact circle**
Input				
114	Total costs of the pilot	€ in total € for equipment € for personnel	survey	L1, L2, L3
115	Amount of personnel hours used by the pilot	Working hours (man days or man months)	survey	L1, L2, L3
116	Amount of resources used on requirement setting	% of total costs % of total hours	survey	L1, L2, L3
117	Amount of resources used on	% of total costs	survey	L1, L2, L3

	architecture	% of total hours		
118	Amount of resources used on technology and market evaluation (inquire and /or RFI/RFQ)	% of total costs % of total hours	survey	L1, L2, L3
119	Amount of resources used on design	% of total costs % of total hours	survey	L1, L2, L3
120	Amount of resources used on implementation	% of total costs % of total hours	survey	L1, L2, L3
121	Amount of resources used on test and release	% of total costs % of total hours	survey	L1, L2, L3
122	Amount of resources used on maintenance & support	% of total costs % of total hours	survey	L1, L2, L3
123	Investment by stakeholders outside the pilot team	- Costs in K€ - Number of working time - Number of tools / technologies - Number of facilities	survey	L4
Output				
124	Change in the costs of network management	% Increase or decrease (or 1 to 5 scale)	survey	L1, L2, L3, L4
125	Change in the costs of network repair time / trouble shooting	% increase or decrease (or 1 to 5 scale)	survey	L1, L2, L3, L4
126	Change in the costs of network/ application operations	% increase or decrease (or 1 to 5 scale)	survey	L1, L2, L3, L4
127	New IPv6 enabled services / applications developed in the pilot	# of new IPv6 services / applications from the pilot	survey	L1, L2, L3
Outcome				
128	New standards / protocols / practices / procedures developed for IPv6 implementation / operation / management	# of newly developed standards / protocols / practices specified for implementation / operation / management	survey	L1, L2, L3
129	New tools / technologies developed for IPv6 implementation / operation / management	# of newly developed tools / technologies specified for implementation / operation / management	survey	L1, L2, L3
130	New components (products) developed for IPv6 implementation	# of newly developed components for IPv6 implementation	survey	L1, L2, L3
131	New IPR applications based on technology developed in the pilot	#	survey	L1, L2, L3
132	New business models enabled by IPv6 implementation	Yes, specify No, specify	Survey	L1, L2, L3
133	Improved capabilities for privacy, authentication and identification of users of IPv6 network / services	Yes, specify No, specify	survey	L1, L2, L3
Impact				
134	Cost reductions resulting from improved security	Yes, No, % decrease (or 1 to 5 scale, 1=increase in costs, 5 = decrease in costs)	survey	L1, L2, L3, L4
135	Use of newly developed standards / protocols / practices for IPv6 implementation / operation / management by stakeholders and other external organisations	Yes, specify No	survey	L4, L5

136	Use of newly developed tools and technologies by stakeholders and other external organisations	Yes, specify No	survey	L4, L5
137	New IPv6 implementation initiatives developed after / because of the pilot	Yes, specify No	Survey	L1, L2, L3, L4, L5
138	Expansion of the pilot to other parts of the network, other e-government services, other applications	Yes, specify No	Survey	L1, L2, L3
139	Expansion / Extension of the pilot partnership to sustain IPv6 implementation	Yes, specify No	Survey	L1, L2, L3
140	Possibility of expansion / extension of pilot to other network / services / organisations because of pilot design and implementation approach	Yes, specify No, specify	Survey	L1, L2, L3
141	Change in end-user experience of the public services offered now they are IPv6 enabled	Yes, % change (or 1 to 5 scale, 1 = decrease user experience, 5 = improved user experience) No	Survey	L4, L5
142	Change in reputation / appreciated of services offered by the general public / end-users now these services are IPv6 enabled	Yes, % change (or 1 to 5 scale) No	Survey	L4, L5
143	Change in number and value of fee-for-public-service clients now these services are IPv6 enabled	Yes, % change (or 1 to 5 scale) No	Survey	L1, L2, L3
144	Change in level of investment in IPv6 since involvement in the pilot	Yes, % change (or 1 to 5 scale) No	Survey	L1, L2, L3, L4
145	Introduction of new business processes enabled by IPv6 (applications) since involvement in the pilot	Yes, specify (or 1 to 5 scale) No	Survey	L1, L2, L3, L4
146	Change in activity in R&D and innovation related to IPv6 since involvement in the pilot	Yes, % change (or 1 to 5 scale) No	Survey	L1, L2, L3, L4
147	Change in activity in R&D and innovation in communication / network / service technology in general since involvement in the pilot	Yes, % change (or 1 to 5 scale) No	Survey	L1, L2, L3, L4
148	Development of new or improved products / services since involvement in the pilot	Yes, specify No	Survey	L1, L2, L3, L4
149	Change in market sales since involvement in the pilot	Yes, % change (or 1 to 5 scale) No	Survey	L1, L2, L3, L4
150	Change in market share since involvement in the pilot	Yes, % change (or 1 to 5 scale) No	Survey	L1, L2, L3, L4
151	Change in turnover since involvement in the pilot	Yes, % change (or 1 to 5 scale) No	Survey	L1, L2, L3, L4
152	Change in profitability since involvement in the pilot	Yes, % change (or 1 to 5 scale) No	Survey	L1, L2, L3, L4
153	Change in competitiveness since	Yes, % change (or 1 to 5	Survey	L1, L2, L3, L4

	involvement in the pilot	scale) No		

Table 3-7: Indicators related to Costs & Benefits

3.7 Governance

As was mentioned in Section 2.1.6, the monitoring framework covers governance. The indicators and survey questions about governance address the decisions about IPv6 implementation. Different types of motivations may have played a role in decisions about the adoption and implementation of IPv6 (e.g. by public organisations), prioritization of IPv6 in research and consulting services and the supply of IPv6 hardware, software and services (e.g. by vendors and operators). "Decisions" refers to decisions about the timing of IPv6; when does an organisation start using IPv6 or launch IPv6 hardware, software or services? The focus on timing reflects the necessity for all actors to adopt IPv6, at some point. Given the importance and challenges of IPv6, government policies have been launched and may have influenced decisions about IPv6. This will be addressed explicitly in the set of indicators.

Governance				
#	**Indicator**	**Parameter**	**Methodology**	**Target group**
154	People deciding on the timing of IPv6 adoption or (for suppliers) the launch of IPv6 hardware, software and services?	Functions/job descriptions (head of X, director of Y, etc.)	Survey	L1, L2, L3
155	People or departments that called for an early or accelerated adoption or supply of IPv6?	Functions/job descriptions (head of X, director of Y, etc.) and types of departments (financial, IT, etc.)	Survey	L1, L2, L3
156	People or departments that called for a postponed or delayed adoption or supply of IPv6?	Functions/job descriptions (head of X, director of Y, etc.) and types of departments (financial, IT, etc.)	Survey	L1, L2, L3
157	Main perceived - expected - benefits?	Max. 3	Survey	L1, L2, L3
158	Importance of perceived benefits of IPv6, for the decision of the organisation to adopt IPv6 (or to launch IPv6 hardware, software or services)?	5 point scale	Survey	L1, L2, L3
159	Importance of government policies for informing or confirming your organisation of the benefits mentioned above?	5 point scale	Survey	L1, L2, L3, L4, L5
160	Relevant government policies, the nature of the policy instrument, and its influence?	Policies	Survey	L1, L2, L3, L4, L5
161	Management readiness, e.g. in terms of priorities, knowledge and personal involvement related to ICT and innovation?	5 point scale	Survey	L1, L2, L3

162	Importance of management readiness for the decision of the organisation to adopt IPv6 (or to launch IPv6 hardware, software or services)?	5 point scale	Survey	L1, L2, L3
163	Influence of government policies on management readiness?	5 point scale	Survey	L1, L2, L3, L4, L5
164	Relevant government policies, the nature of the policy instrument, and its influence?	Policies	Survey	L1, L2, L3, L4, L5
165	Sensitivity to costs in your organisation, taking into account the overall incentive structure, management and activities of your organisation?	7 point scale	Survey	L1, L2, L3
166	Costs that were expected to be decreased by IPv6?	Type of costs	Survey	L1, L2, L3
167	Costs that were expected to be increased by IPv6?	Type of costs	Survey	L1, L2, L3
168	Importance of sensitivity to costs for the decisions of the organisation to adopt IPv6 (or to launch IPv6 hardware, software or services)?	5 point scale	Survey	L1, L2, L3
169	Influence of government policies on the costs of adopting IPv6 or providing IPv6 hardware, software and services?	5 point scale	Survey	L1, L2, L3, L4, L5
170	Relevant government policies, the nature of the policy instrument, and its influence?		Survey	L1, L2, L3, L4, L5
171	Actors that provided external pressure on your organisation, with respect to decisions about the timing of IPv6?	Actors and their main roles	Survey	L1, L2, L3, L4, L5
172	Importance of external pressure for the decision of the organisation to adopt IPv6 (or to launch IPv6 hardware, software or services)?	5 point scale	Survey	L1, L2, L3, L4, L5
173	Importance of external pressure by government policies for your organisation's decisions about IPv6?	5 point scale	Survey	L1, L2, L3, L4, L5
174	Relevant government policies, the nature of the policy instrument, and its influence?	Policies	Survey	L1, L2, L3, L4, L5
175	Actors that influenced your organisation's decision about the timing of IPv6? This question refers to peer pressure, inspiring examples, collaboration and other social mechanisms, rather than external pressure.	Actors and their main role	Survey	L1, L2, L3, L4, L5
176	Importance of social influence for the decision of the organisation to adopt IPv6 (or to launch IPv6 hardware, software or services)?	5 point scale	Survey	L1, L2, L3, L4, L5
177	Importance of government policies in - for example - stimulating, organising or hindering social	5 point scale	Survey	L1, L2, L3, L4, L5

	influence on the IPv6 decisions of your organisation?			
178	Relevant government policies, the nature of the policy instrument, and its influence?		Survey	L1, L2, L3, L4, L5
179	other motivations that influenced your organisation's decisions about the timing of IPv6?		Survey	L1, L2, L3

Table 3-8: Indicators related to Governance

4. MONITORING

This Chapter describes the approach to the monitoring of the indicators in Section 4.1. Also it describes several methods for collecting data on the indicators in Section 4.2 for non-technical indicators and Section 4.3 for the technical indicators.

4.1 Monitoring approach

The data will be collected by means of an online survey and the data collection will start with a baseline (zero-point) measurement at the end of the first year of the project. A check-up on the monitoring will take place in the second year of the project. The final measurement that will be used to gain insight in the overall impact of the GEN6 project will take place in the third year of the project, after finalization of the pilots.

Due to the nature of a number of particularly input and output indicators - e.g. several costs incurred during the pilot, number of questions received, visitors to events, number of publications - all organizations will be stimulated to collect information continuously during the course of the entire project. This enables the organizations to provide accurate and complete responses to the questionnaires in the final measurement.

The baseline measurement will mainly be used for determining the expected outputs, outcomes and impact of the individual pilots. Because the pilots and participants have their specific focus in the project, some indicators will be more relevant to one pilot or participant than they are to the other. The baseline measurement, together with the check-up in 2013, will enable the final measurement to focus on the most relevant indicators for an individual pilot. The goal of this focus is to perform time-efficient monitoring, while maintaining a high enough level of detail for each of the relevant subjects.

The check-up in the second year (2013) will be used to monitor the pilot achievements half-way the project and monitor the changes in expectations that may have taken place during the project. These changes will be used to focus on the relevant indicators for the specific pilots during the final measurement. Interviews will assist in getting a clear view on this.

Not all indicators are relevant to all participants in the pilots and to prevent overlap in the work being done for filling out the questionnaires the following procedure will be used:

1. The pilot leaders (L1) are responsible for providing the stakeholder web, see Section 2.2, of the pilot; indicating stakeholders to the pilot, including pilot partners (inside and outside the consortium), and external stakeholders;

2. The three inner circles - pilot leaders (L1), consortium partners (L2), and pilot partners

not part of the project consortium; L3) receive questionnaires about all indicators. However, only the pilot leader will be asked to provide parameters for the input and output indicators in technical implementation since these indicators are unique to a pilot and the indicators are highly objective;

Information on the fourth and fifth circle will be derived from the information provided via the questionnaires by the three inner circles. For example, questions about social networks and awareness will generate information about the number of organizations interested in the pilot results.

4.2 Description of methods for non-technical indicators

The survey for the data collection needed for the indicators will be presented as an online survey. An online survey will support the efficient and user-friendly collection of data as well as the efficient analysis of the data. It will also allow directing the various respondents to the relevant questions. External stakeholders can also be invited to this online survey and respond to tailored questions. The survey will be prepared in English.

As mentioned in Section 4.1, some indicators will require recording and counting specific events or occurrences. Other indicators will require technical measurements. Consortium partners will be provided with data collection sheets and suggestions for collecting these types of data.

In addition to the data collected via surveys and on-paper, more background information on the indicators and their context in a certain pilot or organization is required to perform a good analysis of the data. This additional background and context information will be obtained by performing interviews with key stakeholders. Another method for this purpose is the 'fly-on-the-wall' method where an observer is present at for example a pilot meeting. These two methods are also very suitable for getting more insight in the lessons learned of the project.

4.3 Description of methods for technical indicators

Partners can choose their own methodology for measuring and collecting the parameters needed for the indicators. However, there are indicators that require a specific method, e.g. the diagram of the architecture. The reason for this is that some uniformity is required to compare how effectiveness and efficiency have been dealt with. In this paragraph these specific methods will be described and some examples of tools/methods that can be used by the partners to obtain measurement results are given.

4.3.1 Specific monitoring methodologies

4.3.1.1 Current and new network architecture, design and high-level information on implementation.

For this indicator each pilot will be asked to provide a graphical schematic of the network architecture. In order to achieve a uniform representation of the different networks in each pilot and in order to allow an objective comparison between the architecture when the project started (IPv4) and the architecture achieved at the end of the project each pilot is asked to use the same instrument to create these graphical representation.

Because of the general availability of Microsoft Excel and the fact that most partners are skilled in using Microsoft Excel, MS-Excel was used to setup a drawing platform with a number of network elements pre-designed. Figure 4-1 displays a screen shot of a number of network elements. Each element can be, either IPv4-only, IPv6-only, or dual-stack (IPv4 and IPv6 capable). This is indicated by the colour of the edges of the symbols.

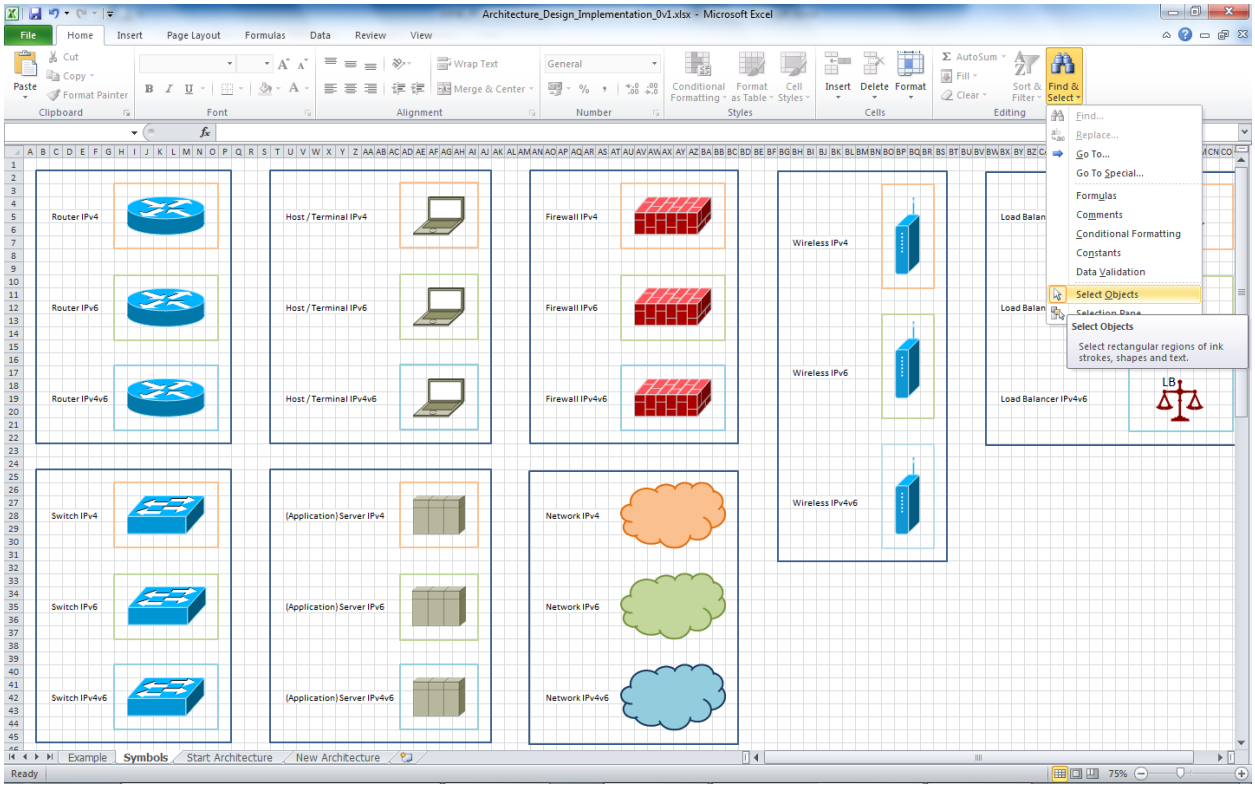

Figure 4-1: A selection of the network elements for describing the network architecture

A limited set of network elements and functions will be provided to ensure readability and avoid uncontrolled growth of symbols when combining the different responses from the pilots.

Through selecting these predefined symbols, placing them on a square grid and connecting them with lines a graphical drawing can be made in little time. In order to provide more detail,

text boxes or the cells of the Excel worksheet can be used to add relevant information. For example a generic server symbol can be designated as a Domain Name Server (DNS) or an Authentication, Authorisation and Accounting (AAA) server and links can be provided with an indication of the line rate, bandwidth and technology.

In case network elements are missing, a network element with similar functionality can be selected or a new element will be created and added to the repository of symbols.

4.3.1.2 Bandwidth, round-trip times, and packet loss

Surveys will be used as the transport vehicle to aggregate results on the performance of IPv6 networks and legacy, reference or IPv4 networks.

It is left to the responsibility of the pilots to implements a method that works. Each pilot is different in objective, architecture, and equipment. As a result a pilot may choose to rely on a network management platform to obtain information from counters present in network equipment, while others prefer the use of probing or deployment of robots and sensors at certain vantage points in the network.

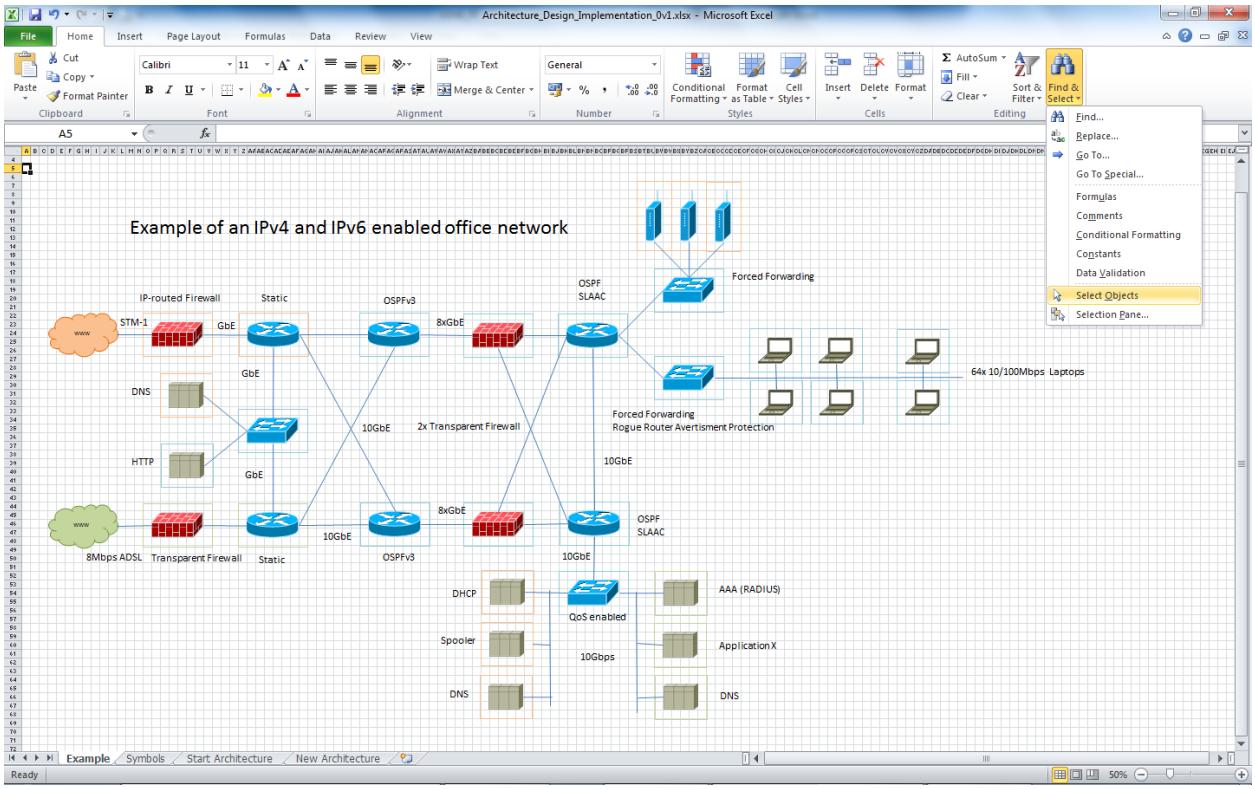

Figure 4-2: Example of an IPv4 and IPv6 enabled office network

Example of tools that can be used to measure the indicators related to bandwidth, roundtrip times, and packet loss are:

- iPerf for IPv4 and IPv6.

- Wireshark.
- Ping/Ping6.
- Traceroute tooling.
- Network analysers.
- Using the performance management implementation in one's own network.
- Click-router! Foundation with own designed measurement configuration file.
- Participating in external measuring schemes such as RIPE Atlas.

An overview of more tools can be found at SLAC site[11].

4.3.1.3 Content, user and service ratios using IPv6 compared to legacy, reference or IPv4 networks.

When measuring content and services available and used on IPv6 several approaches can be chosen. WP5 does not aim to prescribe any particular methodology but would like to leave this up to the pilot partners, since they have the appropriate knowledge on the best way to implement a measurement tool.

Examples of tools / methods are:

- Analysis of log files from servers, firewalls, load balancers, etc.
- Interviewing or questioning end-user that visit a website.
- Participating in external measuring schemes such as RIPE Atlas.
- Counting of storage devices and their volumes

[11] *http://www.slac.stanford.edu/xorg/nmtf/nmtf-tools.html#public*

5. VALIDATION

External experts will review the monitoring framework and methods, as well as the results of the monitoring efforts. An external expert in impact assessment, monitoring and evaluation of EU-funded research, development and technology programmes will review the monitoring framework. Michael Dinges from Joanneum Research in Austria will review the set-up of the monitoring framework and methods, as well as the results of the monitoring activities in M8 and M24/30. In addition, the results of the monitoring will be discussed with an external expert in IPv6, for example Prof. Dr. Erik Huizer as representative from the IPv6 Task Force in the Netherlands. Finally, a representative of one of the pilot partners will test the logic, the time it takes and the user-friendliness of the survey.

6. CONCLUSIONS & NEXT STEPS

In this Deliverable the monitoring framework for the GEN6 project has been described. Indicators for determining the impact and success of the pilots and the EC project goals have been categorized according to six impact channels: technical implementation, knowledge, awareness, human capital, social networks and costs & benefits. Governance has been included as well as a separate topic.

Crucial to a good monitoring is the way information is collected. This process has been described in this deliverable, as well. The most important next steps and their timing are depicted in Figure 6-1.

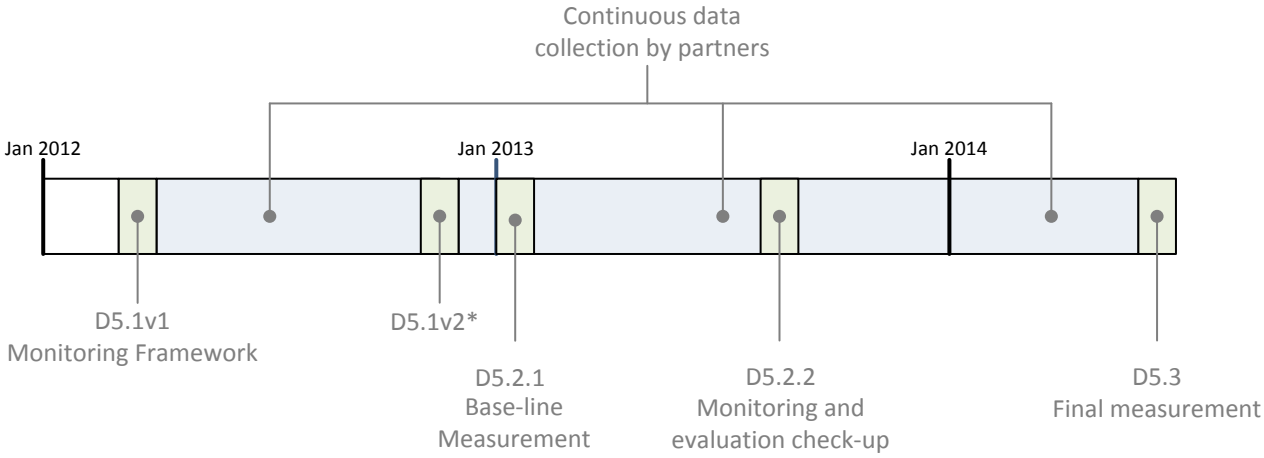

Figure 6-1: Timeline of the impact monitoring activities of WP5

*Chapter 4 and 6 of D5.1 were updated to reflect the new deliverable structure of WP5. This update resulted from a request by the EC during the first technical review meeting of the project. The monitoring framework and its contents are still the same.