TREN/D3/91-2007/Lot 26

Preparatory Studies for Eco-design Requirements of EuP

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EuP Preparatory Studies

Lot 26: Networked Standby Losses

First Stakeholder Document

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1 Introduction

With this document we would like to start an effective stakeholder dialogue and hereby invite all stakeholders to participate actively right from the beginning of the study. Experience from previous EuP Preparatory Studies teach us two benefits form close and early stakeholder collaboration. Firstly, the quality of the study's results increase substantially with a regular input of information and data from the stakeholders. Secondly, the stakeholders themselves benefit from timely status updates and the option for direct feedback for their individual questions.

In the following we will outline some relevant aspects in conjunctions with the study's main tasks. This will include the definition of networked standby mode, related products scope and market analysis as well as technical questions and assessments. However, this is not yet a draft Task Report. The document will explain our considerations concerning possible results of the study and how we intend to proceed within the study to reach certain objectives.

Due to the horizontal character of the study there is an obvious pressure to develop definitions and possible technical requirements as general and broad as possible. The dynamic technical progress however creates the challenge to cover a certainly wide span of product groups, feature-rich product designs, and a whole range of network technologies including hardware and software aspects.

Against this spectrum of necessary expertise we would greatly appreciate your active contributions. The study is particularly in need of current market data and forecasts, information on new technologies and best available technologies in terms of low power solutions. Please contact us directly for discussions and preferably send data, information, and comments in written form.

<u>Disclaimer</u>

The findings presented in this document are results of the research conducted by the IZM consortium and are not to be perceived as the opinion of the European Commission.

2 The study's objective and tasks

The term "networked standby losses" is a relatively new construct. It derives primarily from the previous TREN Lot 6 Study. This earlier EuP preparatory study on standby and off-mode losses introduced two standby modes that are distinguished by an allocated set of functions.[1] This distinction of the (passive) "standby mode" and the "networked standby mode" was deliberately done in order to acknowledge the somewhat higher power requirements of products that feature remote network reactivation and/or network integrity communication functions.[2] Whereas simple standby functions consume only about 1 Watt, it was considered that networked standby functions demand more energy in the range of 2 to 10 Watts and for certain product configurations even more.[3] Additionally, networked standby requires looking at the interaction of more than one product, which considerably increases the complexity. Even networked standby configurations, which can operate at the power levels of "passive standby" will therefore remain in the investigation scope.

The TREN Lot 6 Study therefore not only introduced the new mode but also investigated its environmental impact and improvement potential. According to the study's assessment the electricity consumption related to networked standby was an estimated 26 Terawatt-hours for EU-25 in the year 2005.[4] The study finally indicated that networked standby mode energy consumption will increase over the coming years and therefore suggested minimum power level requirements for three different types of networks.[5] This policy recommendation for harmonizing low power levels for the set of functions defined as networked standby mode seemed to be desirable against the EuPs general objective to improve the energy efficiency of products.

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[1] This "functional approach" of the TREN Lot 6 study has been acknowledged by the European Commission and resulted in the Commission Regulation No 1275/2008 of 17 December 2008: "Ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment." Published in the Official Journal, available on the internet: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:339:0045:0052:EN:PDF

[2] In this context we recommend to all stakeholders reviewing the previous EuP preparatory studies TREN Lot 6 (standby and off-mode losses) and TREN Lot 4 (imaging equipment). Both studies provide already extensive research on the issue of networked standby. For orientation please check the respective sections on networked standby in the final reports including definitions (task 1), best available technology (task 6), and in particular the policy recommendations (task 8). The Lot 6 reports are available for download at the study's website: http://www.ecostandby.org/documents.php. The Lot 4 reports are available for download at the following website: http://www.ecoimaging.org.

[3] See more detailed discussion of power consumption levels and influencing factors further below.

[4] This amount of energy consumption was estimated in TREN lot 6 Study. Scenarios vary according to allocated product scope, assumed power consumption level and duration of networked standby mode. The TREN Lot 26 Study will have to check this original estimate based on new market data, technical assessments and use assumptions.

[5] See Annex I of this document for the original proposals by TREN Lot 6 and TREN Lot 4 Study.

But the novelty and obvious complexity of the topic resulted in the postponement of implementing measures for networked standby mode. The European Commission opted for a more thorough investigation of the issue by launching the TREN Lot 26 Study.

The general motivation of the new study can be characterized by three aspects:

- Networked products still remain in high power states, while not fulfilling their primary function(s). A general improvement of this situation is desirable.
- There is a potential for energy saving by facilitating a proactive power management that shifts the networked product automatically in a lower power state when the product is not fulfilling its primary function(s).
- The power consumption level of existing low power states for networked products is still considered high and has a potential for improvement. Harmonized power levels related to a functionally defined networked standby mode are desirable.

Against that background is the primary purpose of every EuP Preparatory Study to provide a technical, environmental and economical analysis for the preparation of potential implementing measure.[6]

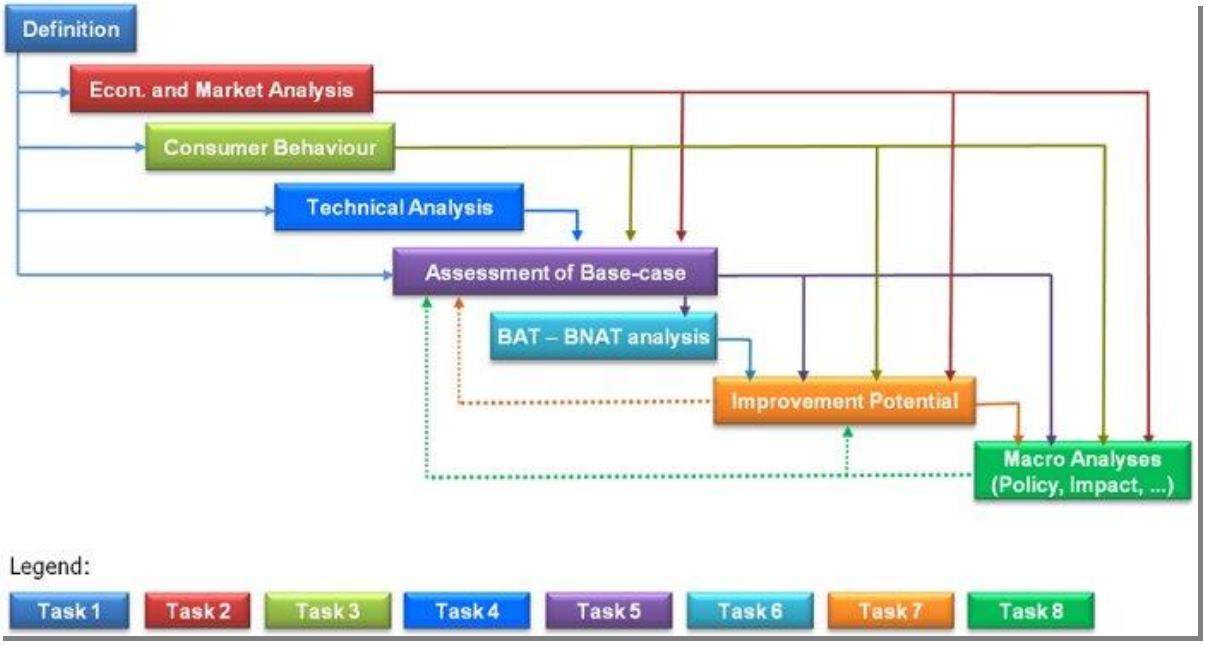

Figure 1: Method for the Evaluation of Energy-using Products

In the given methodical framework of each EuP Preparatory Study, the Method for the Evaluation of Energy-using Products (MEEuP), there are 8 tasks to be covered by the study

[6] Purpose of the EuP preparatory studies in the "Invitation to tender No. TREN/D3/91-2007": http://ec.europa.eu/dgs/energy_transport/tenders/doc/specifications/2008/s163_219637_specifications.pdf

(see Figure 1). In the following we will outline some relevant aspects in conjunctions with the study's main tasks. This will include the definition of networked standby mode, related products scope and market analysis as well as technical questions and assessments.

3 General terminology

The definition of "networked standby mode" is the first essential requirement for the study. This definition however does not stand alone. It needs to be "embedded" in a more extensive terminology that covers related power modes and allocated functions as well as power management and other issues. Unfortunately, at the present time we have to notice a largely un-harmonized situation with respect to environmental terminology.

For the mode definition we prefer the so called "functional approach". This kind of mode definition based on allocated function(s) has been acknowledged by Commission Regulation (EC) No 1275/2008 "Ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment". This is therefore our first reference for standby terminology.

Codes of Conduct (CoC) under the direction of the European Commission's Joint Research Centre (JRC) are also featuring product and mode definitions.[7]

For definitions of products, modes, and functions many stakeholders refer to the ENERGY STAR® Program and its product specific conformity requirements.[8] These definitions are commonly used and referenced for power consumption requirements. The definitions of modes however are not harmonized either and are therefore not in general usable for a horizontal approach.

The IEA Implementing Agreement for a Co-operating Programme on Efficient Electrical End-Use Equipment (IEA-4E), a mixed stakeholder initiative, is currently addressing low network power consumption according to its strategic plan.[9] The IEA 4E Standby Annex has now been officially created and a detailed discussion paper including the network standby issue is expected later in 2009.

ECMA International TC32-TG21 is in the process of specifying Network Proxying to reduce energy consumption. Proxies maintain network presence so sleeping, higher powered, ICT hosts reduce energy consumption. The goal of this ECMA activity is the development of a

[7] Relevant for TREN Lot 26 are the latest Code of Conduct on energy consumption of Digital TV Service Systems, Broadband Communication Equipment. http://re.jrc.ec.europa.eu/energyefficiency/

8 Relevant for TREN Lot 26 are the latest ENERGY STAR® program requirements for computers, imaging equipment, televisions, home audio & DVD products, set-top-boxes. http://www.energystar.gov

[9] http://www.iea-4e.org/

proxy behavior specification (technical standard), the planed adoption of proxying specifications by US ENERGY STAR® for Computers (V06 in 2010/11).[10]

There are furthermore quite a few scientific and industry supported initiatives in the field of information and communication technology that study energy efficiency of networks and respective equipment. These activities contribute to the work of standardization bodies.[11]

For the purpose of the TREN Lot 26 we consider primarily the definitions and test procedures from IEC standards There are quite a few IEC standards available or in the status of final draft that defines energy related operating conditions such as power management, power states, particular modes and related functions.

The following IEC standards are a relevant input to the study:

- IEC 62542 Ed. 1.0: Environmental standardization for electrical electronic products and systems – Standardization of environmental aspects – Glossary of terms.
  This standard is forecasted to be published in late 2009 or early 2010. It serves as a glossary of terminology for the environmental aspects of all work in IEC.

- IEC 62301 Ed. 2.0: Household electrical appliances – measurement of standby power.
  This standard (forecast publication date July 2009) provides terminology, test conditions, and measurement procedures.

- IEC 62087 Ed. 2.0: Methods of measurement for the power consumption of audio, video and related equipment. This standard has been published in 2008 and provides with “active standby low” and “active standby high” references for networked standby mode as well as test conditions and measurement procedures.

- IEC 62075 Ed. 1.0: Audio/video, information and communication technology equipment – environmentally conscious design. This standard has been published in 2008 provides terminology, particular energy modes and related energy efficiency measures.

- IEC 62430 Ed. 1.0: Environmental conscious design for electrical and electronic products. This standard has been published in 2009 and provides terminology and documentation of environmental impacts, information disclosure.

At the present time we consider the final draft of the IEC 62542 as a good foundation for a holistic glossary of terms. To our knowledge (it is not yet public), the glossary covers power states of products as well as individual mode definitions including networked standby mode. It largely corresponds with our distinctions of modes, proposed in the previous TREN Lot 6,

[10] http://www.ecma-international.org/memento/TC32-TG21.htm

[11] Activities include: Ethernet Alliance (http://www.ethernetalliance.org); Energy Efficient Digital Networks by LBL (http://www.efficientnetworks.lbl.gov); The Green Grid (http://www.thegreengrid.org)

based on specific sets of functions. Figure 2 shows the allocation of functions (not complete) to specific modes.

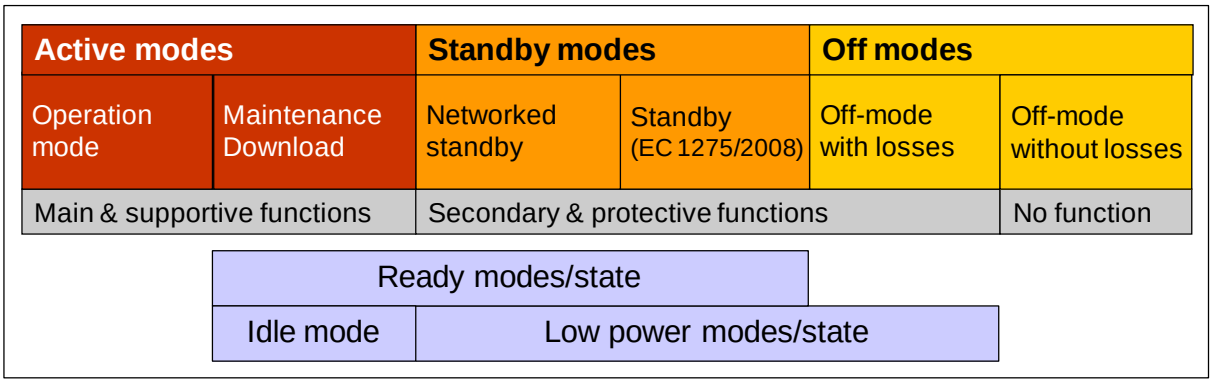

Figure 2: Main terminology overview

Please also keep in mind that all possible policy measures, particularly with respect to power management and power consumption levels, need feasible testing.[12]

4 Definition proposal by DigitalEurope

As proactive input to the Lot 26 study, DigitalEurope provided in July 2009 the consultant Fraunhofer IZM and DG TREN with the following draft definition proposal for Network Standby:

> Network Standby is a low energy state in which a networked product suspends its main function, but still maintains some level of network connectivity allowing it to reactivate to a main function or some subset of the main function. The Low energy state is higher than a pure standby (device has no network function and no main function) but lower than an idle state (device has main function capability, but is currently not performing any main function work).
>
> Network Standby is automatically achieved after defined and/or adjustable (by user) time (time based on common standards if available).
>
> The reactivation functions as defined for standby in regulation (EC) 1275/2008 can be present.

Comment: This proposal by DigitalEurope reflects considerations similar to our own. It has the same "functional approach" with similar set of functions. The proposal refers to the EC

[12] According to the revised MEEuP the TREN Lot 26 Study has been tasked to provide recommendations for new standards or the amendment of existing test procedures by the end of Task 4 (technical assessment). Based on these recommendations the European Commission may issue mandates to European standardization bodies.

1275/2008 in order to mark the networked standby mode for lower power standby and higher power active modes. It particularly recognizes networked standby mode as integral part of an automatic power management.[13] However, we like to point out that we prefer the terminology "mode" and not "energy state" as well as "networked standby mode" instead of "network standby".

Regarding the proposed limitation of the scope (digital communication technologies only, feasibility to cover Home Entertainment Networks) we need to postpone a comment at this point of time. These proposals by DigitalEurope need further examination.

5 Definition of Networked Standby Mode

The primary definition of "networked standby mode" derives from TREN Lot 6:

> When the EuP is in Lot 6 standby according to (iii.) and offers either a remote network reactivation and/or network integrity communication, then the product is considered to be in networked standby mode.

In our opinion this definition is generally still applicable and only needs minor changes regarding certain terminology. It seems necessary to add some conditions to this definition in order to clarify the scope and application of this definition.

In the following sections we therefore intend to update, clarify, and analyse some aspects of networked standby mode. This description might not be fully comprehensive. However it should provide a good foundation for an effective stakeholder dialogue.

Due to first stakeholder questions we would also like to point out that networked standby mode applies to mains powered equipment. It does not apply to complete networks of multiple products or even larger infrastructure networks. In other words TREN Lot 26 addressed the networked standby and related energy management of single products and not networks. Nevertheless, the study may indicate the contribution of single product's eco-design to the overall energy efficiency of a network. Also network products may inhibit or support good networked standby behaviour of the end user products, so they are relevant for the investigation.

Automatic power management

A pre-condition for networked standby mode is the existence of an integrated power management that shifts the equipment form active mode into networked standby mode according to a user-defined or preset automatic algorithm.

Maintaining networked standby mode without interruption is a second aspect related to an effective power management. Studies have indicated that product software configurations

[13] This is already an integrated ecodesign requirement.

sometimes inhibit continuous low power states by presetting internal servicing programs or other interrupts.[14]

A third aspect in that respect is related to active downloads that could occur during phases of networked standby mode. We consider network downloads as a form of active mode that should be covered by an advanced power management that shifts the equipment automatically into networked standby mode after the end of the download.

Networked Standby Mode in conjunction to the Standby Mode definition according to EC 1257/2008

According to EC 1275/2008:

> "Standby mode(s)" means a condition where the equipment is connected to the mains power source, depends on energy input from the mains power source to work as intended and provides only the following functions, which may persist for an indefinite time:
>
> - Reactivation function, or reactivation function and only an indication of enabled reactivation function, and/or
> - Information or status display;

Networked standby mode is considered a standby mode according to EC 1275/2008 where the equipment provides two further functions:

- Network integrity communication and/or
- Reactivation via network.

Network integrity communication

The term network integrity communication basically indicates that a product (equipment) is linked to another product or network and maintains connectivity in networked standby mode. There have to be however certain equipment configurations and network conditions to be considered that may alter this understanding. Following "networked" conditions can be distinguished:

- Equipment is connected and enabled: The equipment is connected by wire or wireless network technology to another single device or multiple devices. The network interface is enabled and scans incoming signals. This condition will definitely be considered networked standby mode.
- Equipment is disconnected and enabled: The equipment is disconnected (e.g. cable is unplugged) but the network interface is fully operational and therefore considered

[14] 1E; Alliance to Save Energy (March 2009): PC Energy Report 2009, United States, United Kingdom, Germany. http://www.1e.com/EnergyCampaign/downloads/PC_EnergyReport2009-US.pdf

in networked standby mode. It is assumed that the disconnected equipment draws similar power as if connected. For wireless the situation is more complex: In case of an interruption of a wireless signal during standby it could be possible that the equipment draws even more power due to an active adjustment of signal strength in order to re-establish the connectivity with the access point. The allocation of this "re-connecting" function to standby or active mode is not fully clear and needs further discussion (please comment on this issue).

- Equipment is connected and disabled: The equipment is physically connected (only in case of wired networks) but the network interface(s) has been disabled by the user for various reasons (e.g. saving energy). Because the equipment is not linked nor can it be woken up via the network we consider this status as standby mode (simple reactivation).

- Combinations of multiple network interfaces: The interface in the highest mode will generally determine the mode of the product, but this will need to be reinvestigated regarding e.g. testing procedures and potential power allowances.

With respect to the level of power consumption the equipment draws while maintaining network integrity communication, it is necessary to analyze the equipment configuration in conjunction with network characteristics including transmission technology, used protocols, network architecture and topology. The following aspects need to be investigated:

- Signal transmission (network technology): Previous studies indicate that the frequency or frequency spectrum (bandwidth), the data or bit rate (speed) as well as the transmission medium (wired or wireless) all influence on the power consumption of the respective network interface.[15] A higher bandwidth correlates to some extent with a lower efficiency of the receiving power amplifier. A higher speed requires higher clock speed and memory capabilities, and the frequency and transmission medium defines effective attenuation. It is necessary to note that in the present scope of products (see further below) network bandwidth and speed vary by many orders of magnitude from kbps to Gbps.

- Network protocols, architecture and topology: The actual configuration of a network, particularly the dimension, security, and quality of service requirements all influence signal traffic for maintaining respective connectivity. This network infrastructure communication is assumed to have an effect on power consumption requirements of the networked equipment.

- Network capability of the equipment: Power consumption of the networked equipment is influenced be the types and number of network interfaces (e.g. Ethernet, USB, W-LAN, HDMI, DVI-D, etc.), the equipment type and position within a network, one-way or two/multiple-way communication, routing equipment supports.

[15] See distinction of three network types according to final task 8 reports of both studies TREN Lot 4 and TREN Lot 6.

The listed criteria above show the considerable number of influencing factors for connectivity and related power consumption. We assume however that speed and bandwidth are the factors with significant impact on the equipment's power consumption for maintaining network integrity communication. We will consider this assumption in the selection of product cases for the technical analysis and subsequent assessment of base cases. Within the scope of this TREN Lot 26 study it is obviously not possible to investigate all network types and configurations. For the selection of a reasonable number of representative product cases further selection criteria should be considered.

This shifts our attention from pure technical aspects to individual use conditions and through that to the second function which defines networked standby mode – the reactivation capability via the network interface.

Reactivation via network

The second functional purpose and considerable growing application for networked standby mode is the reactivation of the equipment via a command over the network. For a better understanding we have listed some typical examples and discuss related technical issues. Examples for reactivation via network are:

- The first typical example for reactivation via network is a printer.[16] Most printers feature today an advanced power management, which shifts the devices after fulfilling a print-job into lower power states in order to save energy. Let's assume that this lower power state is networked standby mode. The device maintains network integrity and waits to receive a new print-job from a server. When this command arrives via network the printer shifts into active mode in order to fulfil the required task. Most printers and multifunctional devices feature USB network interfaces for considerably high data transfer rates.[17] Another significant technical aspect of printers is the subsequent power consumption in active mode. This power consumption can range from under 15 Watt for simple inkjet-machines to more then 1500 Watt for high speed laser-machines. This example indicates that the rated power consumption of the power supply unit (PSU) could have a significant influence on the power consumption level in networked standby mode just through the conversion losses of the PSU. But the printer example indicates a further aspect – the reactivation time or latency period between network command and active operation. In the case of printers a latency period of a few seconds (10-15 sec) is acceptable.[18]

- The second example is a personal computer or small server in home and small office environments. Broadband communication and virtual private networks (VPN) allow for

[16] According to common network terminology, the printer in our example is a typical network endpoint (terminal or client devices) which is connected or networked to the redistribution equipment (host or server). The equipment that build communication networks are generally considered as nodes.

[17] USB 2.0 max. bit rate specification: 480 Mbps; new USB 3.0 max.bit rate specification is 4.8 Gbps.

[18] For more details regarding this particular aspect please refer to the final report of TREN Lot 4.

instance users today to access their databases on their computers remotely via fixed or mobile networks. Wake-on-LAN (WoL) is a feature available in most computers today. It provides remote reactivation via network from a low power state, such as the sleep mode (ACPI S3).[19] The WoL-option is most often not preset in conjunction with sleep mode and has to be enabled by the user in the system (BIOS). The ENERGY STAR® program requirement for computer allows a "functional adder" of 0.7 Watt for Wake-on-LAN in conjunction with sleep mode.[20] The home and small office PC example is also characterized by access networks with increasing bandwidth/speed but with less complex network topology than in larger office environments. Note that WoL from the soft-off state of a computer (e.g. ACPI S5) is also possible, but is not considered an Off-mode in the EuP sense, but rather belongs to networked standby.

- The third example is another WoL-application typically in office environments where a system administrator needs remote access to a larger number of distributed computers over the LAN-infrastructure. This example can have two basic scenarios. In the first scenario the administrator requires a "full" reactivation in order to initiate a larger service update or other task, which requires a shift into active mode. In the second scenario the administrator might only want to monitor the status of the distributed computing equipment and manage security, while maintaining the equipment "out-of-band" or in "networked standby mode". For this kind of remote system administration various companies have developed specific technologies. As an example, the Intel Corp. has developed the so called Active Management Technology (AMT) built into personal computers with vPro Technology.[21] This specific technology provides a certain energy saving potential due to the avoidance of "full" reactivation of the equipment for general task of remote system administration. On the other hand the power consumption of this solution is considered somewhat higher than the 0.7 Watt allowance for "simple" Wake-on-LAN solution.

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[19] According to ENERGY STAR® definition:
Wake On LAN (WOL): Functionality which allows a computer to wake from Sleep or Off when directed by a network request via Ethernet.
Sleep Mode: A low power state that the computer is capable of entering automatically after a period of inactivity or by manual selection. A computer with sleep capability can quickly "wake" in response to network connections or user interface devices with a latency of ≤ 5 seconds from initiation of wake event to system becoming fully usable including rendering of display. For systems where ACPI standards are applicable sleep mode most commonly correlates to ACPI System Level S3 state (suspend to RAM).

[20] ENERGY STAR® V4.0: 4.0 Watt sleep-mode allowance for desktops, integrated computers, desktop derived servers and gaming consoles. 1.7 Watt sleep-mode allowance for notebooks and tablet PCs.
ENERGY STAR® V5.0: Energy efficiency for desktops and notebooks is only measured by TEC value. No specific sleep mode and Wake-on-LAN allowance are specified. For small scale servers and thin clients the latest version specifies 2.0 Watt off mode and 0.7 Watt allowance for Wake-on-LAN.

[21] For information on Intel AMT see: http://www.intel.com/technology/platform-technology/intel-amt/

- The fourth example is related to the TV and consumer electronics environment. The reactivation functionality in this case is a provider initiated broadcasting including random service up-dates for set-top-boxes and automatic program download. The power consumption level of the residential broadcast interface might be influenced by the type of broadcast access technology (e.g. DVB-T, DVB-S, DVB-C, IPTV). Further power requirements derive from subsequent functionalities such as video recording or audio systems (not the actual recording, but the readiness for recording etc.). Networked standby mode in the field of consumer electronics (television, audio and video) is also characterized by a large diversity of network interfaces employed and respective protocols (HDMI, DVI-D, VGA, SCART, etc.).

- The fifth example is related to LAN infrastructure and customer terminals, which require near zero latency period reactivation. The example covers a whole range of products including wired modems and gateways, wireless network access points, LAN repeater, hubs, switches and routers, as well as terminal devices including conventional and IP-based telephones and to lesser degree facsimile machines. In this field we find analogue technology on the one hand and high speed digital technology on the other. The common denominator seems to be millisecond reactivation requirement in case of possible networked standby mode. This example is also useful to investigate network-related power management solutions with implications for the eco-design of equipment. For example, IEEE 802.3az task force (Energy Efficient Ethernet) is exploring methods for scaling Ethernet link rate as a function of utilization to save energy. Since integrity communication and wake-up messages are principally low bandwidth this could be useful during networked standby, if the connected products all employ this new feature.

These examples are not yet the selected product cases for the assessment. However, they are indicating a typical product scope, network technologies and configurations that should be assessed in the study. Following Figure 3 shows a simple diagram of the main system building blocks indicating a respective scope for the study. As is only indicated in the figure, the connections between the products could be distinguished further by the properties in the legend, to model a specific case.

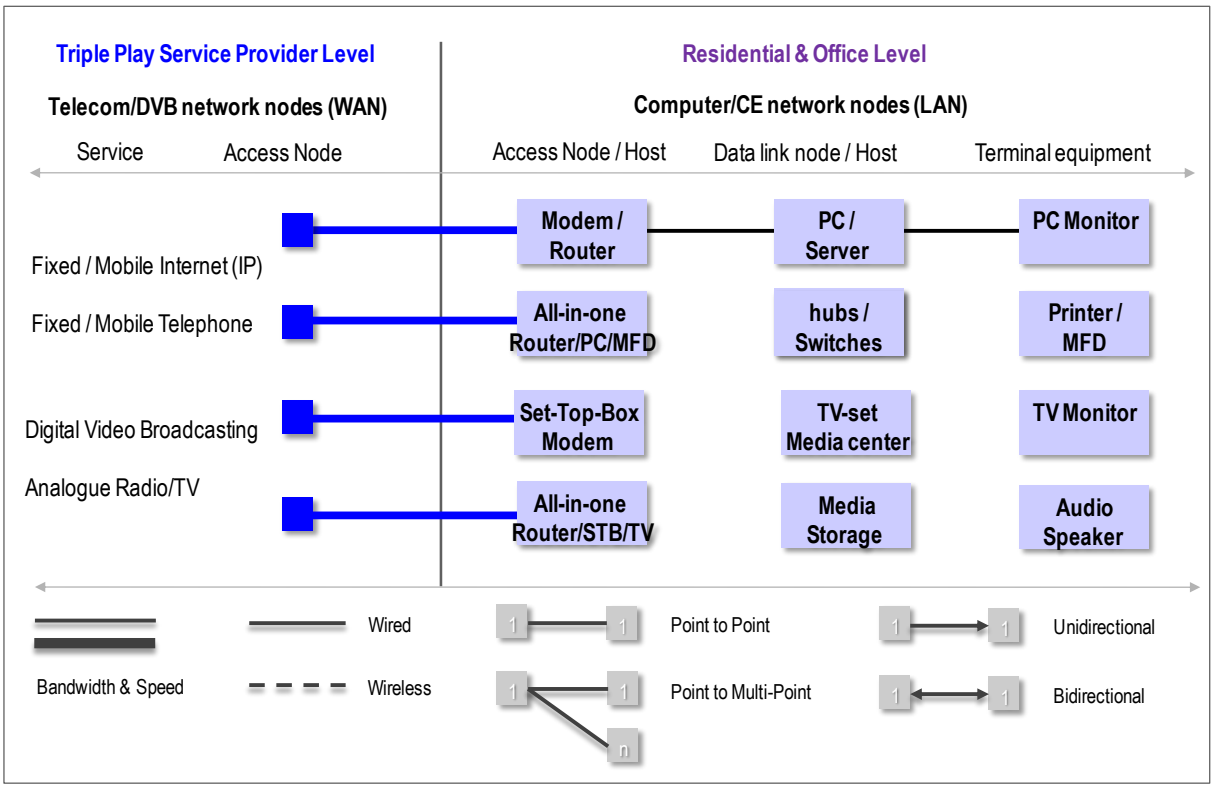

Figure 3: Basic system building blocks and scope

6 Product scope

The product scope is causally connected to the definition of networked standby mode. At this early point in the study we need a pragmatic setting of scope in order to fulfil the required tasks of economical, technical and environmental assessment. In a first step we will therefore set the scope according to the existing EC 1275/2008 namely the four categories of "electrical and electronic household and office equipment" listed in Annex I and recital of the regulation:

- Household equipment
- Information technology equipment
- Consumer equipment
- Toys, leisure and sports equipment

The product category "information technology equipment" has been further defined by EC 1275/2008, Article 2/7:

> "Information technology equipment means any equipment which has a primary function of either entry, storage, display, retrieval, transmission, processing,

> switching, or control, of data and of telecommunication messages or a combination of these functions and may be equipped with one or more terminal ports typically operated for information transfer".

The recital of the EC 1275/2008 specifies the products scope of Information Technology Equipment by stating (8):

> "The application of this Regulation should be limited to products corresponding to household and office equipment intended for use in the domestic environment, which, for information technology equipment, corresponds to class B equipment as set out in EN 55022:2006."

The EN 55022:2006 specifies: Information Technology Equipment, radio disturbance characteristics, limits and methods of measurement. Class B equipment is defined by its electromagnetic characteristic and basically allows domestic and office use. Class A in contrast has less strict EMC requirements and therefore is not intended for rooms in which persons can continuously be present.

7 Market data

This scope of Lot 26 has to be translated into specific product groups in order to support the required impact assessment. Previous and ongoing EuP preparatory studies such as the studies on personal computer and monitors, imaging equipment, consumer electronics (TVs), set-top-boxes, etc. provide the foundation for the market analysis. However, most of the available data could be outdated already and/or need a different subdivision of a product group according to standby issues.

We are basically in need of current market data and market forecasts (product stock or installed base) for following product groups:

- Computers differentiated for domestic and office use: Desktop PCs, integrated desktop computers, notebooks, small scale servers, thin clients, work stations and gaming consoles (product definition according to ENERGY STAR Computers Ed.5.0)
- Displays domestic and office use: Computer monitors, information displays, electronic display signs (differentiation of size, display technology and interfaces optional)
- Imaging equipment for domestic and office use: Mainly Inkjet (IJ) and Electro Photography (EP) marking technology; Multifunction Devices (MFD), Single function device (SFD) including printers, copiers, scanner, facsimile machine, digital duplicator and mailing machines (product definition according to ENERGY STAR Imaging Equipment Ed 1.1)
- Network equipment for domestic and office use: Modems, switches, router (all-in-one, single function wired or wireless); for Local Area Network types: IEEE 802.3 Ethernet, IEEE 802.11 (Wireless, all USB)

- Set-Top-Boxes, TV and PVR: STB with/without conditional access, all-in-one TV and TV component units, Home Cinema Systems, DVD/BluRay/HDD-player/recorder
- Audio Home Systems: Stereo systems, compact system, radio, speaker systems (with trends in interface types)
- Telephone systems for domestic and office use.

Additionally, there are a multitude of products moving towards digital network interfaces, such as networked white goods, toys, etc. For these products market data are eventually necessary.

We are aware of the broad spectrum of existing product classifications, market segments etc. and the similar spectrum of geographical and application specific market statistics. All types of market data are helpful for study.

8 Summary

Definition proposal for networked standby mode:

- Networked standby mode is a low power state
- Equipment provides:
  - standby mode functionality according to EC 1275/2008 and/or
  - Network integrity communication and/or
  - Reactivation via network command
- Conditions:
  - Any kind of network technology/interface is considered in scope including wire and wireless (t.b.d.)
  - Disconnected equipment is considered in networked standby mode if this function is enabled (t.b.d.)
  - Power management requirements need to cover connectivity interrupts and possible recovery of the link (example: signal loss of wireless connection)[22]
  - Clear distinction of networked standby mode and active modes e.g. transition, maintenance or download modes (t.b.d.)

[22] The definition has to cover this aspect under the function of “network integrity communication” or “power management”.

We favor the adoption of general terminology from IEC 62452 “Glossary of Terms”, which should be public during the course of the study.

Product scope:

- According to EC 1275/2008
- Consider also building control networks and lighting systems (previously excluded as "building infrastructure")

Technical assessments and product case studies:

DigitalEurope proposed the following product cases and outlined typical products, network protocols and standards as well as standby issues:

- Networking (passing-on data) equipment
- End-user LAN equipment
- PC to peripheral devices
- Non-IP and IP telephony
- RTV broadcast receivers
- Home entertainment networks

This is a good orientation for selection of product cases. The critical review of this early proposal by stakeholders helped to understand and structure the necessary technical assessment.

We intend to focus our technical assessment on:

- Typical LAN equipment: Wired and wireless ICT and CE equipment in households and offices
- Typical network standards: Technical characteristics such as frequency spectrum, speed, protocols and network topology; incl. options for network power management
- Typical product configurations: Number and kind of network interfaces, subsequent [active] modes and respective power requirements
- Typical applications and reactivation requirements: Wake-on-LAN, system administration, downloads, IP-communication (incl. IP-Telephony, Skype, Email)

Against this general consideration we would like to get your support for the assessment of following product cases:

- Wired network interfaces for computer LAN terminals in households and offices:

- Typical products: Desktop PC, Notebook, Printer, MFD
- Typical network standards: USB 2.0/3.0; IEEE 802.3 (10 M-BASE to 10 G-BASE Ethernet)
- Typical product configuration: up to 4 ports, power supply units (20 Watt to 2000 Watt)
- Typical application requirement: Wake-on-LAN, administration, interaction with polling protocols, reactivation time a few seconds

- Wireless network interface for computer LAN terminals in households and offices
  - Typical products: Desktop PC, Notebook, Printer, MFD
  - Typical network standards: IEEE 802.11 (all WLAN), IEEE 802.15 (Bluetooth)
  - Typical product configuration: integrated WLAN, WLAN cards
  - Typical application requirement: maintain/recover wireless link
- IP-communication equipment in households and offices
  - Typical products: Home gateways/access points (modems/router), LAN hubs and switches/router (OSI-layer 2/3), personal computers, telephone
  - Typical network standards: build on IPv4 and IPv6
  - Typical product configuration: multiple network interfaces, transceiver capability (passing on-data), products with existing power management (idle, sleep mode) or generally moderate power consumption of 5 to 20 Watts (e.g. LAN switches).
  - Typical application requirement: instant response to data, voice and video communication demand (IP-telephony, Skype)[23]
- Digital Video Broadcasting (TV) receiver and home entertainment equipment
  - Typical products: Set-Top-Boxes, TV
  - Typical network standards: network access (e.g. DOCSIS), intra-device network interfaces (HDMI, DVI-D, SCART, VGA, large spectrum of legacy)
  - Typical product configuration: multiple interface options available, component units, all-in-one products

[23] We are aware that data link switching, IP-telephony, Skype or Email requires active programs running on the operation system. Such functionality is generally considered active mode. However, it is these applications in our opinion that are demanded by users (in networked standby mode). The study intends to check such scenarios and technical options and best available technology.

- Typical application requirement: service downloads, timed program recording, deactivation of non-required interfaces

9 Specification of stakeholder support

Based on the consideration and ideas outlined in this document we would appreciate your active support by providing:

- Comments on the proposed definition and conditions for networked standby mode
- Comments on general terminology necessary in conjunction with networked standby mode
- Comments on the resulting product scope (please focus on technical aspects that help to specify the scope)
- Market data and forecasts (!!!); this is very important for the quality of the study and the estimate of the overall environmental impact. Please provide market data regardless of direct applicability to the outlined scope of European Union (EU-27). We are interested in following data:
  - Current product stock (installed base) and stock estimates until 2020/2030
  - Current sales and sales estimates for the coming years
  - Household and office penetration rates
  - Product categories:
    - Computers: small servers, desktop, notebooks, thin clients, gaming consoles, etc.
    - Displays: PC-Monitors, digital picture frames, signing, building control displays, etc.
    - Imaging equipment: inkjet and electro photography based single function and multifunction devices (similar to the scope of TREN Lot 4)
    - Network access equipment: fixed-line modems and home gateways (ISDN, xDSL, FTTH), wireless access points, (WLAN, WiMAX), all-in-one router, etc.
    - Telephone equipment: wired and DECT telephones, multimode telephones, IP-telephone systems, etc.
    - LAN networking equipment: Ethernet and USB hubs, switches, home router

  - Set-top-Boxes, TV-sets (all-in-one, component units), Media Center (all-in-one or single unit DVD, BluRay, HDD recording systems), Radio-Audio-Stereo-systems (decks, amplifier, speaker), etc.
  - Other. e.g. networked building control and security equipment

- Current power requirements & best available technology for typical network interfaces (how much power requires network integrity communication)
- Technical information on network maintenance issues (e.g. polling, disconnect and signal recovery, Quality of Service requirements)
- Technical information on intra-device power management
- Technical options and best available technology for network power management, which could apply during networked standby (e.g. adaptive link rate)
- Information on product designs and user behavior:
  - Requested functionality of product designs
  - Typical use patterns for certain devices (please review in that respect the previous EuP Studies)
  - Reactivation requirements (e.g. acceptable latency durations, comfort options)
  - Data security requirements that impact power requirements

Please provide comments, market data and technical information if possible in written form.

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Annex 1

As mentioned in the introduction the previous TREN Lot 6 Study (standby and off-mode losses) and TREN Lot 4 Study (imaging equipment) provide extensive research on the issue of networked standby mode. Both studies considered minimum power consumption requirements for networked standby mode as a means to improve energy efficiency.

As a matter of fact in the task 8 reports of both studies it was suggested to differentiate three types of network classes in order to reflect differences in network characteristics such as speed and bandwidth performance.

Lot 6 task 8 final report (page 8-14): “This [structure] is partially adapted to the differentiation of the Energy Star for Imaging Equipment (e.g. high speed could be >500 MHz), but the lower rate networks of Lot 6 Type I target even simpler networks than the A class in the functional adder. A few of the results from Task 6 and 7 are generalised in the following list:”

Type I simple networks

- Inter-device networks for wake-up signalling/detection: The wake-up of monitors and TVs can be directly via the signal feed (analogue event detection) and will cost practically no additional power compared to passive standby. For digital interfaces like DVI and HDMI this might not be true anymore, as the digital stream might have to be decoded (unless of course the source is not transmitting any signals). So, detecting, whether any signal is present on SCART, VGA or DVI should be energetically "cheap", but detecting whether a "black screen" or a real picture is transmitted would require more energy.

Type II standard networks

- Telephony networks: below 1.5 W is sufficient to monitor for incoming signals or for user action. For cordless phones, keeping the DECT connection is already included in the same budget.

- Computer network/LAN: The wake-up on LAN functionality is set at 0.7 W additional power allowances in the new Energy Star for computers (V4.0) . Thus it is considered possible to keep a network connection alive and decode the incoming traffic for wake-up commands within this power budget.

- Non-continuous TV broadcast reception: if the device is not required to always stay in networked standby then the power requirements drop substantially, e.g. from 10 W or more to 2 W or less. This is effectively an average of Type III networked standby and passive standby with an active timer, which as a mix should be considered as Type II network type.

Type III high speed networks

- Continuous broadcasting reception (at least tuner, decoder, processor active): The devices should keep only one tuner active. Currently 7.5 W "while listening" is

definitively possible for the set-top-boxes. According to [Bush 2007] "active standby" is possible at 3.7 W, and even the lowest on-mode consumption for a simple set-top-box was 5.9 W. Set-top-boxes not listening all the time bring substantially lower averages.
Networked standby for TV receivers with recording capability also covers waiting for the start signature for a programmed recording job. While this function is set (traditionally this was done via timers, then additionally via VPS, now shifting towards electronic program guides and Tivo) power consumption of TVs is for example 9.5 W (this is an example value from a stakeholder, not a lowest possible value). Although this would statistically not be activated all the time, it could easily be running continuously for a week or more, when programming series recordings or during holidays.

- High speed wired and wireless networks potentially will also have higher power consumptions than the Type II class. In the future, network protocols and hardware should support switching down the transmission rates, when traffic is comparatively low or when all connected end devices are detected to be in standby (for example with IPv6).

Lot 4 task 8 final report (page 11): EICTA had made following preliminary proposal:

Type I networks:

- Point to point (i.e. imaging product to computer) connections with low frequency bandwidth (Including analogue connections).

Type II networks:

- Point to point (i.e. imaging product to computer) connections with high frequency bandwidth, including all types of USB, Bluetooth, IEEE 1394 (FireWire), SCSI-2 (Small Computer System Interface), IEEE 1284 (Parallel Communication Interface). It can be argued to include in type II networks low frequency Wireless LAN networks, because these are widely spread for household applications including wireless USB, IEEE 802.11b (11 Mbps), IEEE 802.11g (54 Mbps)

Type III networks:

- Point to network connections, where the imaging product is connected to an office network for multiple users: 10BASE-T (wired LAN, 10 Mbps), 100BASE-TX (wired LAN, 100 Mbps), (etc: e.g. Gigabit LAN), High frequency (> 100 Mbps) Wireless LAN: IEEE 802.11.

The rationale of this classification is the type of interface present in the imaging equipment: point to point connections allow the imaging product to virtually shut down and be woken up from the computer to which it is connected: the computer can exert direct control over the imaging product.

When an imaging product is part of a network in which many products communicate (intranet), waking up from network standby requires intelligence present in the interface of the imaging product to recognize specific wake-up signals (magic packet, ARP, etc). This intelligence requires the network interface of the imaging product to be “awake”. Currently, the only way to have a reliable wake on LAN in an imaging product is to have a processor in idle mode on-board. Power consumption will require up to 30W. A new standard has been launched by Microsoft (PC99) which allows the processor to go to S3 mode and still wake up on specific signals. This standard will be generally available for application in imaging equipment in a number of years from now. Then it is possible to achieve type III network standby of approximately 10W for products up to 65-70ipm.