D7.2.1: Results of the usability tests and recommendations for improvement

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Short Description:

This report aggregates the results and recommendations derived from the usability evaluation that was conducted before and during the Rural Wings test runs.

D7.2.1: Results of the usability tests and recommendations for improvement

List of Recipients:

ICCS; all partners

Contents

1 Purpose of the Usability Evaluation Report

This report aggregates the results and recommendations derived from the usability evaluation that was conducted before and during the Rural Wings test runs.

For the usability evaluation a triangulation of different methods was used in order to evaluate and improve the usability of the Rural Wings project at different levels (technical infrastructure, Central Access Point (RW-CAP), user trainings and Rural Wings applications), from different perspectives (feedback from usability experts, end users, project members [national coordinators] and technical monitoring of network usage) and at different stages (before and during the test runs).

The methods and instruments used for the different parts of the usability evaluation are described in detail in deliverable "D7.1.1 Design of the Usability Evaluation Plan and the Usability Tests" and will only be briefly summarized in this report where necessary. For more in-depth information on usability evaluation, methodology and relevant criteria the reader should consult the usability evaluation plan as mentioned above.

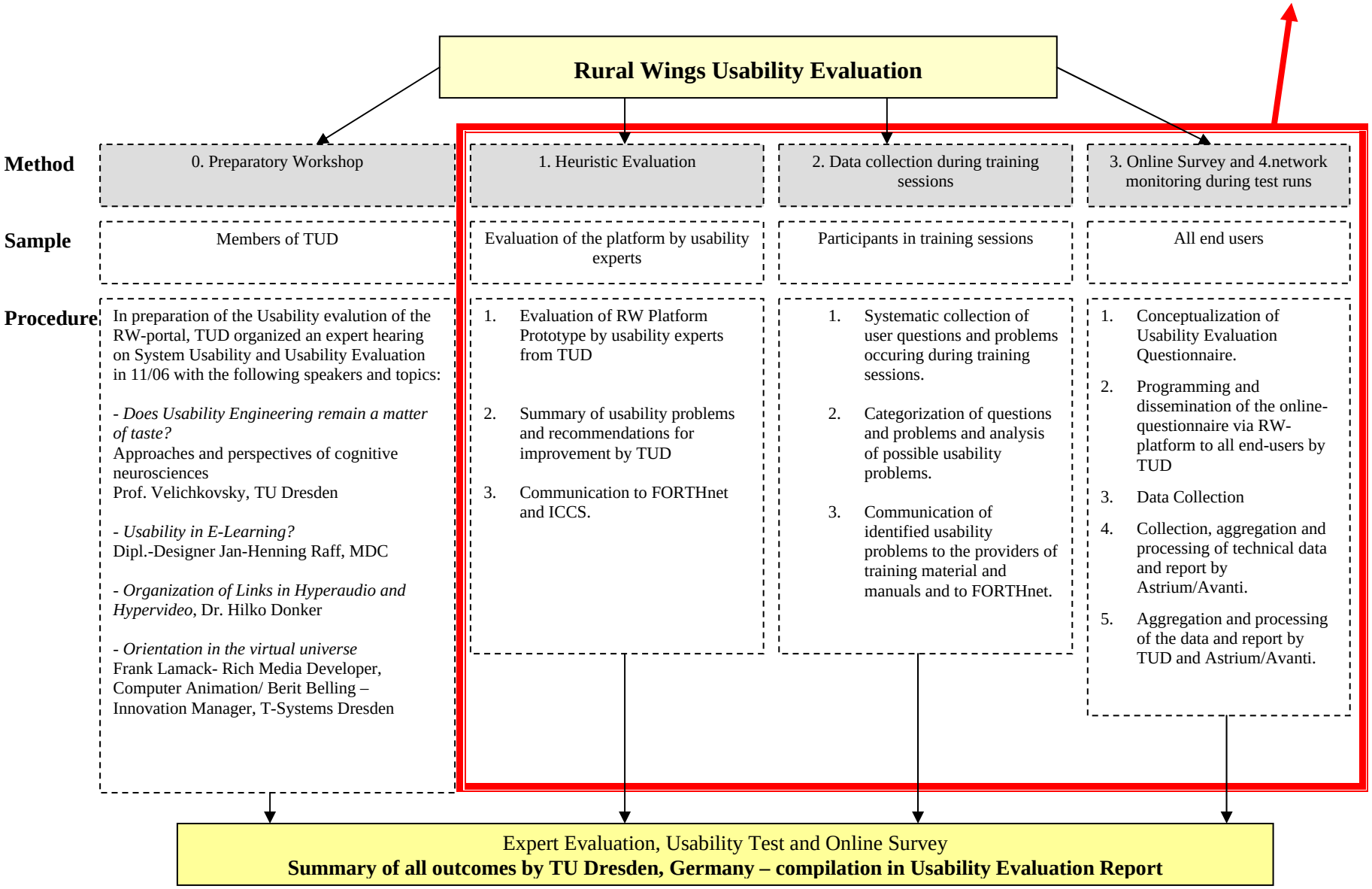
Following a preparatory usability workshop in Dresden in 2006 four different studies were conducted.

1. Usability heuristic Evaluation of Rural Wings CAP – prototype stage (8/2007)
2. Usability Testing through monitoring of questions and problems – during implementation and training sessions (6/2007-2/2008)
3. Usability Assessment through Questionnaires – after a few months of usage (11/2007-2/2008)
4. Technical Evaluation – continued monitoring during test runs (11/07- ongoing)

The next page provides an overview of the evaluation methods, procedure and timeline. The areas that are marked red are subject of this deliverable.

Overview of the usability evaluation procedure

Results reported in this deliverable



2 Heuristic Evaluation

The rural wings "Common Access Point" (RW-CAP), contains direct links to all the available applications of Rural Wings. It offers the same content for all pilot sites but will be available in various languages (at least English and Greek at the first period of implementation). The available applications will be set up at the local servers of the responsible partners, for more convenient updating and maintenance. RW-CAP implements the following functions:

- Registration procedure
- Short descriptions of application
- Direct links to all available applications
- Comment function
- Categorization of available applications according to users' attributes (students, teachers, common users, medical related users, etc.).

An expert evaluation of the RW-CAP prototype was conducted by usability experts from TUD in 8/07 in order to ensure good usability of the RW-CAP at the start of the test runs. To identify possible usability problems in an early stage of the prototype a checklist of recognized usability principles (heuristic) was used according to the heuristic evaluation method.
Heuristic evaluation (Nielsen and Mack, 1994; Nielsen 1993) is a commonly used usability engineering method for finding the usability problems in a user interface design so that they can be attended to as part of an iterative design process. Heuristic evaluation involves having a small set of evaluators examine the interface and judge its compliance with recognized usability principles (the "heuristics").

2.1 Procedure

The web usability index (WUI) was chosen as heuristic for the evaluation. It is based on the Keevil Usability Index (Keevil, 1998) and was found to have a medium to high validity when compared to other usability inspection methods (Othmer 2006). It includes 137 items in the following five categories:

- Navigation and orientation

- Interaction and information exchange
- Timeliness and quality
- Information- and text design
- Findability and accessability

The heuristic evaluation involved five usability experts and was conducted on the 1st of August 2007 at the Technical University in Dresden. The procedure applied was defined as follows:

1.Step:
- 10 min. Free surfing of the website
- 5 min written account of first impression

2. Step:
- 60 min. Heuristic evaluation with the web-usability-index (wui)
- 15 min written account of the result for reporting and group-discussion

- 15 min. Break -

3. Step:
- 60 min. Group discussion of the results (including severety-rating of identified usability problems)

2.2 Results

The results of the heuristic evaluation were aggregated in a list of usability problems and communicated to FORTHnet and ICCS in the internal Rural Wings report “Expert Usability Evaluation of RW-CAP” on the 20th of August 2007.

The observed problems and recommendations for improvement of RW-CAP were grouped in seven different categories. For a complete list of the comments provided by TUD please refer to ANNEX 8.1. In the following a brief summary of the results will be given.

1. General problems

   The homepage triggers wrong expectations as the introductory text and its deep structure suggest much content and depth although the scope is to provide commented link-lists to RW applications. The scope has to be made clearer in the introductory text and the

navigation should be simplified as the information provided can not be accessed quickly enough.

2. Missing features

- Imprint with contact details
- Disclaimer
- Date of publication for each content unit
- Help-page or function (accessible from each page)
- FAQs
- Site-map to help orientation
- Print options should be provided for longer texts

3. Structure

The prototypes structure was not clear/consistent (i.e. some categories could only be accessed via “all Rural Wings” and not via the different learning fields). Navigation and paths indicated should always match in order to prevent confusion.

4. Design/Layout

Fonts and other elements (i.e. lists) should be formatted consistently and fonts should have more contrast to the background.

5. Broken links and missing attributes

A list with broken links and missing attributes was aggregated.

6. Other features that should be improved

Links should always feature a mouse-over explanation and a different colour when visited. Internal and external links should be distinguishable. The wording should be target-group specific (i.e. tools for students) and the final URL international and easy to remember.

7. Comments on single pages

Extensive comments and recommendations were made to improve single pages of the RW-CAP. Please refer to ANNEX 8.1 for more details.

In a collaborative and iterative process the recommendations were discussed with FORTHnet and solutions were elaborated. A large number of the identified problems could be resolved and improved by FORTHnet. This procedure during the engineering period was intended to allow the presentation of a thoroughly usable access point for the test runs. It is self-evident that the adaptation of the RW-CAP to the end user needs and expectations is an ongoing process and will continue during and after the test runs. To this end TUD will continue to give feedback on problems encountered and expectations addressed by end users derived from the usability questionnaires and the usability monitoring during user training.

3 Usability monitoring during user training

User problems and questions can be indicative for aspects of the technical infrastructure, the manuals, the central access point or the rural wings platforms and applications that are not designed intuitively (see Kato, 1986). They can thus be used to identify possible usability problems and areas of improvement during the training of the end users. The method used for the rural wings scenario is also closely related to the coaching method described by Nielsen (Nielsen, 1993, pp.199; see also Mack and Robinson 1992 and Deliverable 7.1.1).

3.1 Procedure

In order to identify possible usability problems, a structured template (see Annex 5.1 of D 7.1.1) for the collection of user questions and problems arising during the training of end users was provided to all National Coordinators. Workshop leaders and/or trainers were asked to fill in the form on the computer during and after training sessions and e-mail it back to TUD for data analysis.

3.2 Results

Data was collected during user trainings that took place between June 14th and February 2nd and forwarded to TUD by the NCs of the following countries: Spain, Estonia, UK, Sweden, Romania and France.

In the template problems or questions could be related to five different categories. As the following table shows most occurring questions and problems were related to the Rural Wings tools and infrastructure (some questions were attributed to two categories).

Manuals:	9
Tools:	31
Infrastructure:	14
Central Access Point:	6
Other:	9
Overall questions/problems	*64*

In the annex of this deliverable an aggregation of reported problems can be found which is grouped according to the categories presented to the NCs (see ANNEX 8.2). From this list an analysis and bundling of topics was carried out by TUD that results in four areas for improvement of the usability of the Rural Wings project:

1. Competencies

In some pilot sites it became obvious during the training sessions that additional competencies are required to enable the end users to confidently and successfully use the RW applications and services. Topics that turned out to be relevant in this context are information about and training for online-collaboration and online moderation as well as knowledge in safety-related aspects.
Some NCs did already develop tutorials on this behalf or gave oral presentations. NCs are advised to observe carefully deficits and uncertainties of their local users and take actions to train them in the concerned areas.

2. Language

As the target group of Rural Wings consists of a wide variety of end users in different countries with very different levels of foreign language skills localization and translation of resources forms an important aspect. As reactions in some pilot sites (i.e. France) show, acceptance of the projects resources (website, CAP, applications and manuals) can be very low if translations into the local language are not available and the end users have no or not sufficient English skills.
All NCs should check thoroughly if interfaces, manuals and trainings should be translated to the local language to increase user acceptance, usage and participation. This does not apply to all pilot sites as some end users have a good knowledge in English (i.e. Sweden, Estonia) but it is an issue that should be taken very serious. Some NCs already took actions and translated critical documents (i.e. manuals) or provided web sites in the local language (i.e. Spain).

3. RW-applications and CAP

Feedback from some pilot sites indicates that users found it hard to register and use RW applications in several cases (i.e. HET, Web-TV, YouRa) so that support (i.e. with plug inns,

sound settings) and additional training was given or tutorials developed. In some cases platform providers were contacted when problems could not be solved during the training session.

It is suggested that tutorials that were developed for critical tasks and competencies that are relevant for all RW users should be translated in English and made centrally available by the NCs in the RW-CAP for all users in order to share resources and to develop a common database of RW related training material.

As mentioned above more localized versions should be integrated in the RW-CAP. Those should contain translations of the RW-CAP content as well as direct links to potential local RW websites and tutorials and to the respective language versions of RW applications if available. Furthermore the structure and navigation of RW-CAP still does not seem to be intuitive enough as feedback during user trainings and in the evaluation questionnaire (compare 4.2.5) shows. As some users expressed disappointment on low activity and amount of content in the RW-CAP it should be considered to elaborate some features further (i.e. community features like “contact other users” or display of online status of registered RW users).

4. RW infrastructure

Problems with the RW infrastructure were encountered in several pilot sites as delays in the installation of equipment, problems with the reliability of the satellite service and the available bandwidth (i.e during video conferences or after a new hub was installed).

Those issues are also addressed in the NC reports and in the sections 4.2.5 and 5.2.3 of this deliverable.

Concerning the acceptance of the RW services, the cost structure of the satellite service compared to ADSL providers seems to be relevant to end users. This aspect should explicitly be addressed and made transparent when explaining scope and necessity of the RW project.

4 Usability Questionnaire

A survey with an online questionnaire was conducted after the start of the test run and after the users had gained some experience using the RW-CAP, the RW-applications and the technical infrastructure (summative evaluation).

The questionnaire was developed by TUD in cooperation with the partners of WP7 and covers all user groups identified in the user needs analysis (WP3). No sampling of the target group was done, as the survey aims to reach all end users of the test runs.

The structure of the questionnaire for usability evaluation is as follows (for the complete questionnaire see D7.1.1 ANNEX 5.2):

a) Choice of language
b) Introductional text
c) Personal data
d) Infrastructure
e) Usage profile
f) Performance/Usability of technical infrastructure
g) Usability of CAP
h) Usability of applications

After an extensive research on available instruments the „Questionnaire for User Interface Satisfaction“ (QUIS) was chosen to cover all relevant usability aspects. It has a high validity (0.95 Cronbach's Alpha) and consists of 15 different scales that form a modular structure. From those scales 22 items were chosen that cover all of the following important criteria of system usability that were derived from a literature analysis.

a) Learnability (Shackel, 1991)
b) Efficiency (Shackel, 1991)
c) Flexibility (Shackel, 1991)
d) Transparency (Ulich, 1986)
e) Constistency (Ulich, 1986)
f) Acceptance (Shackel, 1991)
g) Suitability for the task (Ulich, 1986)
h) Support (Ulich, 1986)
i) Conformity with user expectations (Ulich, 1986)
j) Error tolerance (Ulich, 1986)
k) Feedback (Ulich, 1986)
l) Controllability (ISO, 1996)

4.1 Procedure

The links and password for accessing the online-questionnaire in all languages were communicated to all NCs on the 26th of November 2007 who were responsible to distribute it to the end users in their pilot sites and to assist them while completing the survey. In order to allow presentations and/or testing of the questionnaire without creating invalid data, a test version was made available that includes all languages and can be accessed via the following address: http://ww3.unipark.de/uc/ruralwings_test.

4.2 Results

For the data analysis it was decided to only consider completed questionnaires where a pilot site was specified in the beginning to allow the presentation of pilot site specific data.

4.2.1 Response rates

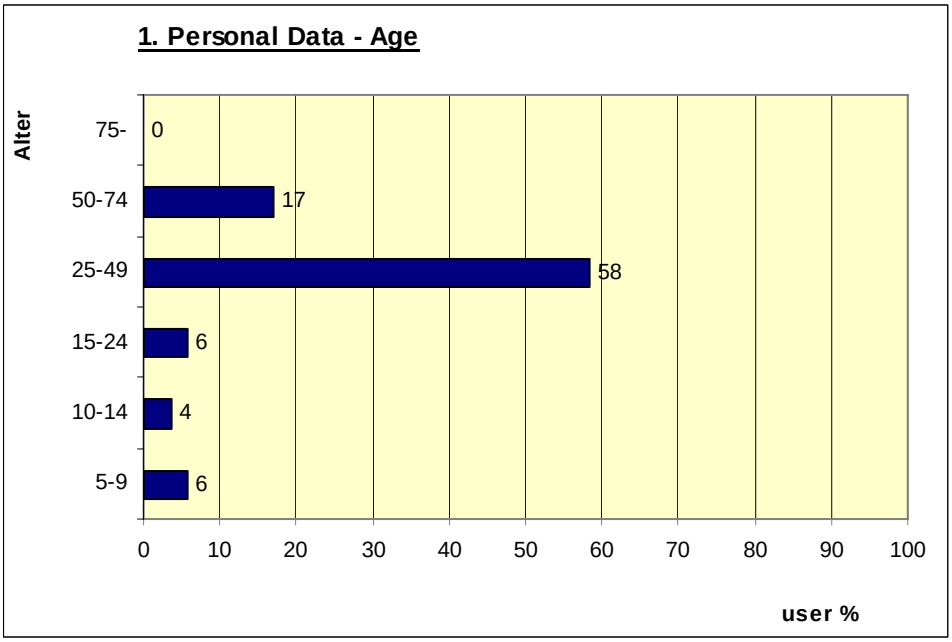
The usability evaluation questionnaire has been completed by 53 end users. The following table shows how they are distributed to the pilot sites and which RW applications have been used and rated in the questionnaire.

Country	*Pilot site*	*Participants*	*RW applications used and rated*
All sites		**53**	
UK		**10**	
	Bewholme	4	webTV, CONNECT
	Cilcennin	5	webTV, CONNECT, D-Space
	Biggar	1	-
Greece		**11**	
	Mesta	1	webTV, VEMUS
	A.Nikolaos	2	VEMUS, YouRA
	Pyles	1	NEMED, AgroTeleDiag.,
	Aigiali	1	YouRA, D-Space, CONNECT
	Salakos	1	YouRA, D-Space, CONNECT
	Geraki	3	agroweb, webTV, Health Training
	Valtetsiniko	1	YouRa, Teacher net

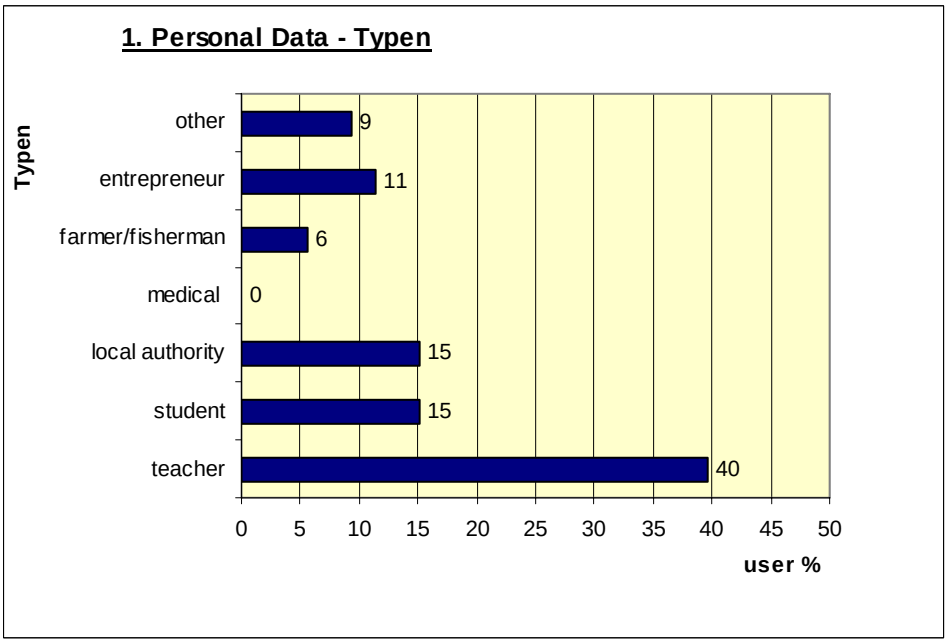
	Fourna	1	webTV, YouRa, Xplora
Spain		**9**	
	Campos	1	NEMED, AgroTeleDiag.
	Prats+Sampsor	1	NEMED, AgroTeleDiag.
	Ramallosa	7	NEMED, AgroTeleDiag., agroweb, webTV, Xplora, YouRA
Sweden		**1**	
	Avaviken	1	MEDSKY
France		**7**	
	Martinique	6	webTV, Xplora, UNITE, RCCM, MEDSKY
	Manso	1	D-Space, Teacher net, MEDSKY
Romania		**8**	
	Dezna	8	VEMUS, webTV, Xplora, YouRA, UNITE, D-Space, ExperiNet, CONNECT, Teacher net, NEMED, AgroTeleDiag., Health Training, RCCM
Cyprus		**2**	
	Parakentro/Lemythou	1	-
	Kritou Terra	1	Health Training
Estonia		**3**	
	Ruhnu	2	webTV, Health Training
	Piirissaare	1	-
Poland		**2**	
	Zawoja	1	-
	Polana	1	D-Space, Teacher net

4.2.2 Personal data

21 participating end users are female, 30 male, two did not specify their sex. The majority (58%) is between 25 and 49 years old. The following diagram shows the distribution of age in more detail.



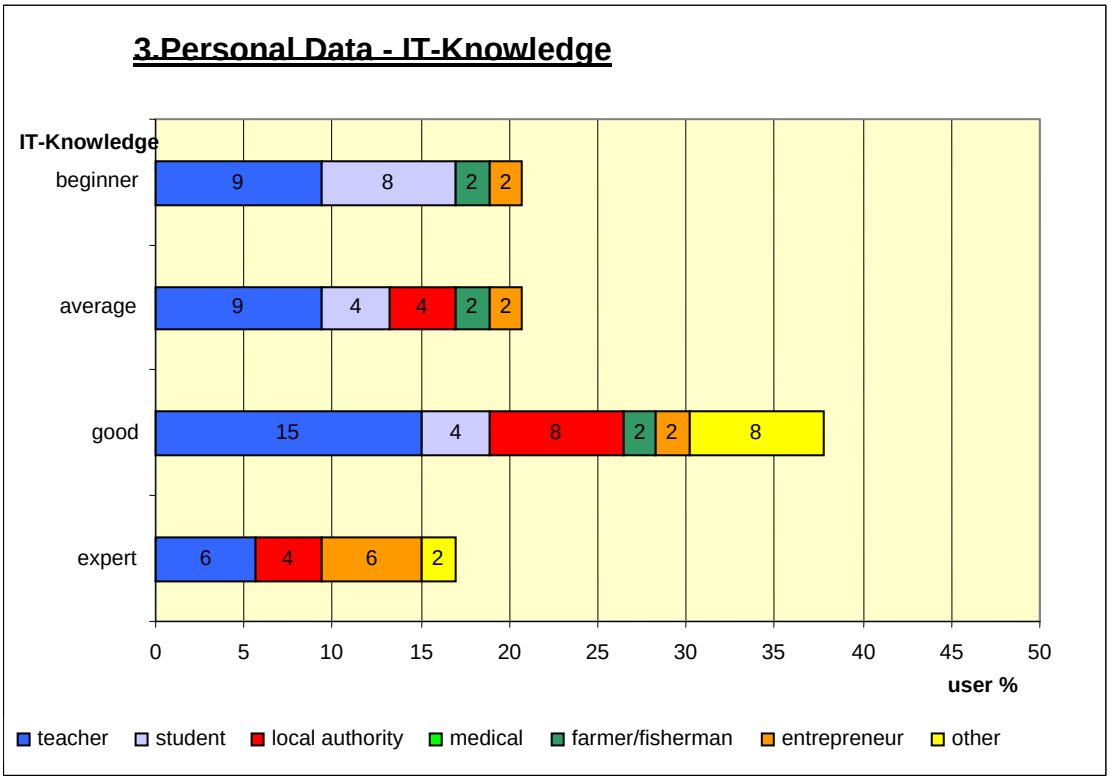
As diagram 2 depicts, nearly 40% of the participants are teachers, 15% students, 15% are local authority personnel, 11% entrepreneur and nearly 6% are farmers or fishermen. No medical personnel participated and 9% of the participants did not specify their user type.



In the following table shows the distribution of user types for the pilotsites.

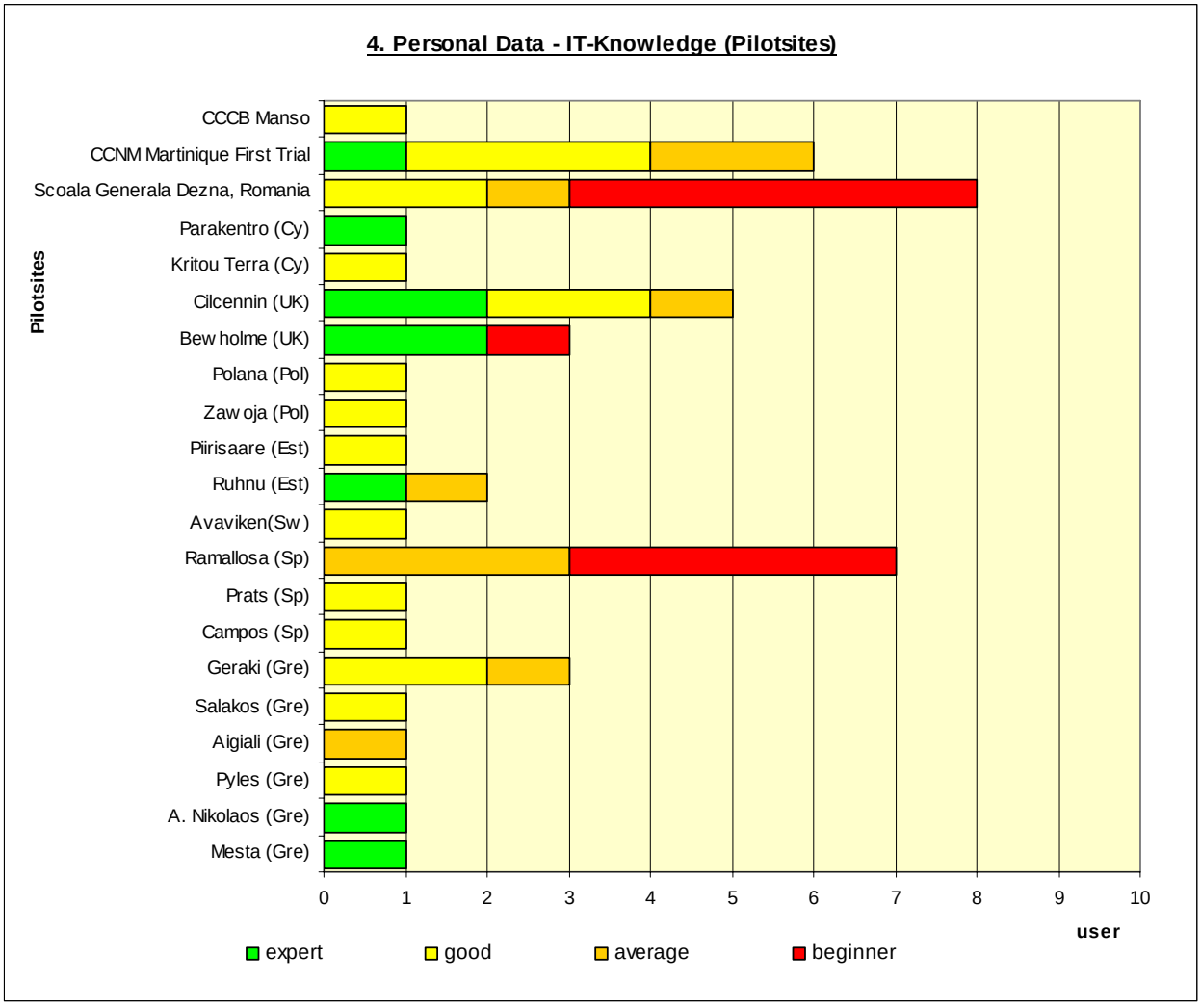
	teacher	student	local authority	medical	farmer/ fisherman	entre-preneur	other
Mesta, Greece	0	0	0	0	0	1	0
A. Nikolaos, Greece	1	0	0	0	0	0	0
Valtetsiniko, Greece	1	0	0	0	0	0	0
Fourna, Greece	1	0	0	0	0	0	0
Pyles, Greece	1	0	0	0	0	0	0
Aigiali, Greece	1	0	0	0	0	0	0
Salakos, Greece	1	0	0	0	0	0	0
Geraki, Greece	0	0	0	0	2	0	0
Campos, Spain	1	0	0	0	0	0	0
Prats, Spain	0	1	0	0	0	0	0
Ramallosa, Spain	6	1	0	0	0	0	0
Avaviken, Sweden	0	0	0	0	0	0	1
Ruhnu, Estonia	0	0	1	0	0	1	0
Piirissaare, Estonia	0	0	0	0	0	0	1
Zawoja, Poland	0	0	0	0	0	0	1
Polana, Poland	1	0	0	0	0	0	0
Bewholme, UK	0	0	0	0	0	2	2
Cilcennin, UK	1	2	0	0	0	2	0
Biggar, UK	0	0	0	0	1	0	0
Kritou Terra, Cyprus	1	0	0	0	0	0	0
Parakentro, Cyprus	1	0	0	0	0	0	0
Scoala Generala Dezna,Romania	4	4	0	0	0	0	0
CCNM Mar-tinique, France	0	0	6	0	0	0	0
CCCB Manso, France	0	0	1	0	0	0	0

The variance in the participating end users rating of their IT knowledge is rather high with 21% beginners, 21% of the users with average IT-knowledge, 39% with good IT knowledge and 18% experts (see diagram 3). Concerning the different user types, the diagram illustrates that 50% of the participating entrepreneurs consider themselves as IT-experts, while more than 50% of the students and nearly 25% of the teachers think of themselves as beginners.



This underlines the need to provide different training and additional measures for competence development for those end users who classify themselves as beginners to enable them to fully profit of the RW-services.

The following diagram (diagram 4) shows the distribution of IT-Knowledge for each pilot site in order to enable NCs to take adequate measures.



4.2.3 Infrastructure

Nearly all responding RW users (98,1%) have windows installed as operating system. Only two use a Linux system and one uses a Macintosh.

operating system	Win	Win Vista	WinXP	Linux	Mac	other
	47	8	39	2	1	2
	15 %	74 %	15 %	4 %	2 %	4 %

Half of the users have between one and nine personal computers connected to the RW internet access, six users between ten and nineteen and only one user between 20 and 49.

number of PCs	1-9	10-19	20-49	50-
	27	6	1	0
	51 %	11 %	2 %	0 %

32% of the RW users are connected to the RW internet access via Sat modem 36% via local area network. An indoor wireless network connection is used in 4 cases (8%) an outdoor wireless network in 10 (19%).

type of connection	Sat modem	LAN	Indoor WLAN	Outdoor WLAN
	17	19	4	10
	32 %	36 %	8 %	19 %

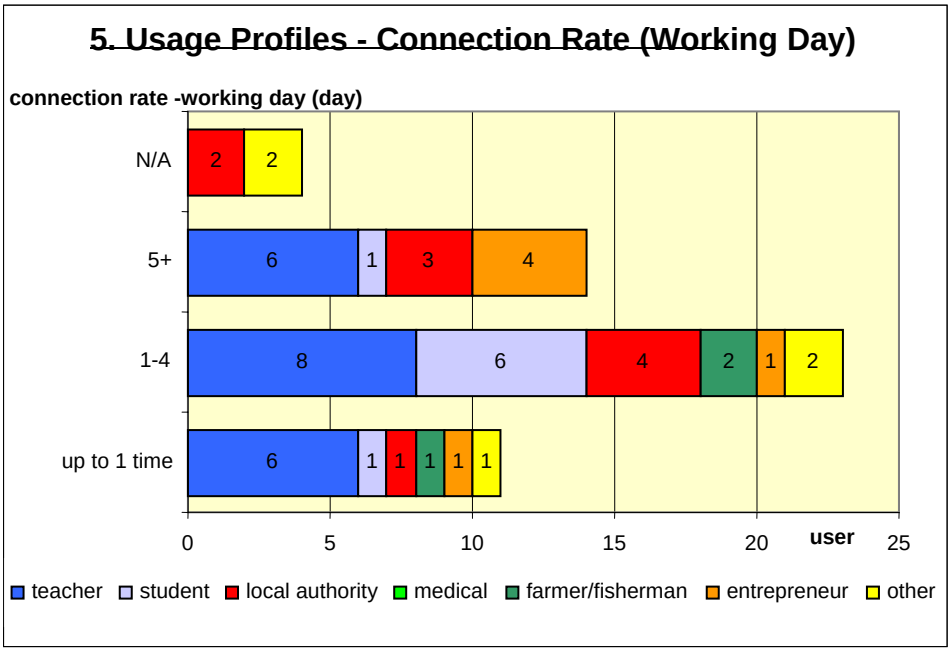
Over two thirds (68%) of the RW users use MS Internet Explorer as webbrowser, Firefox is used by 28% of the users.

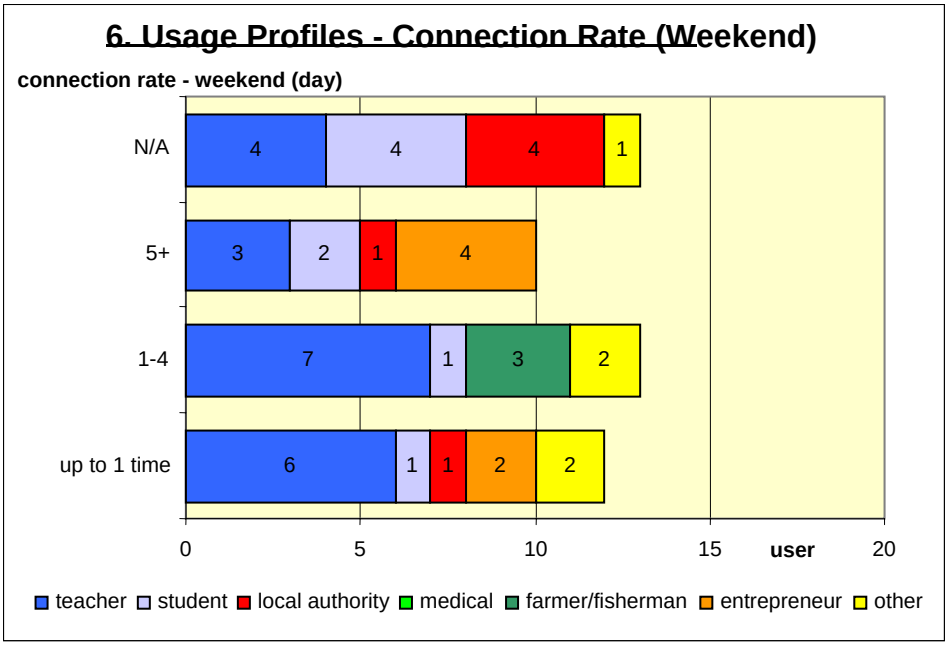
webbrowser	IE	IE 4.x	IE 5.x	IE 6.x	IE 7.x	N/A
	36	6	1	13	16	0
	68 %	11 %	2 %	25 %	30 %	0 %
	Firefox	Firefox 0.x	Firefox 1.x	Firefox 2.x	Firefox 3.x	N/A
	15	0	0	14	1	0
	28 %	0 %	0 %	26 %	2 %	0 %

4.2.4 Usage Profiles

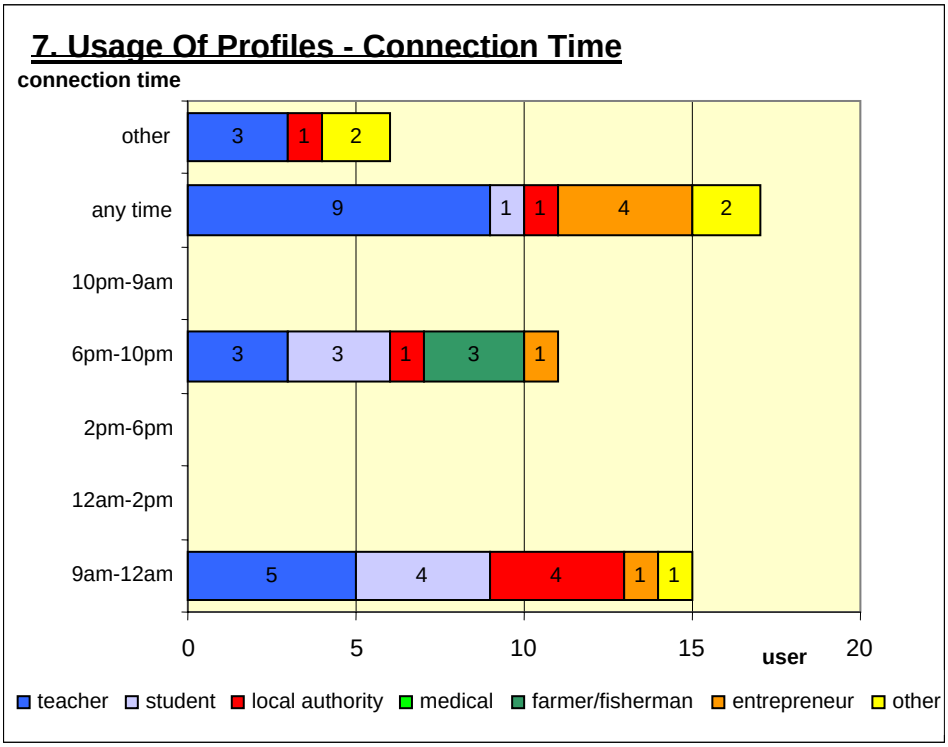
This sub-chapter presents data on the frequency and duration of the end users access to the RW internet connection, the usage of internet services and RW applications and of the RW-CAP. The corresponding usability ratings will be presented in the following chapter.
Data on usage profiles is categorized according to the different user types that were derived from the user needs analysis and from discussions with all partners when developing the questionnaire. The presentation by user groups was chosen because the authors assume that usage profiles are more stable within user types that within countries and pilot sites, that display in many cases a variety of user types. This assumption will be tested statistically by regression analysis in the next usability evaluation of the RW project when sufficient data will be available.

During the week 23 of the participants were connected to the internet by RW-satellite 1-4 times per day, 14 participants more than 5 times a day and 11 up to one time (diagram 5). On weekends (diagram 6), 12 participants connect to the RW-satellite up to one time, 13 between one and four times. 13 participants do not connect at the weekend at all, while 10 connect more than five times on weekends.
Most of the students connected to the RW-internet one to four times during the week but are rather not connected on weekends while two thirds of the entrepreneurs are connected to the RW-satellites five times or more every day.

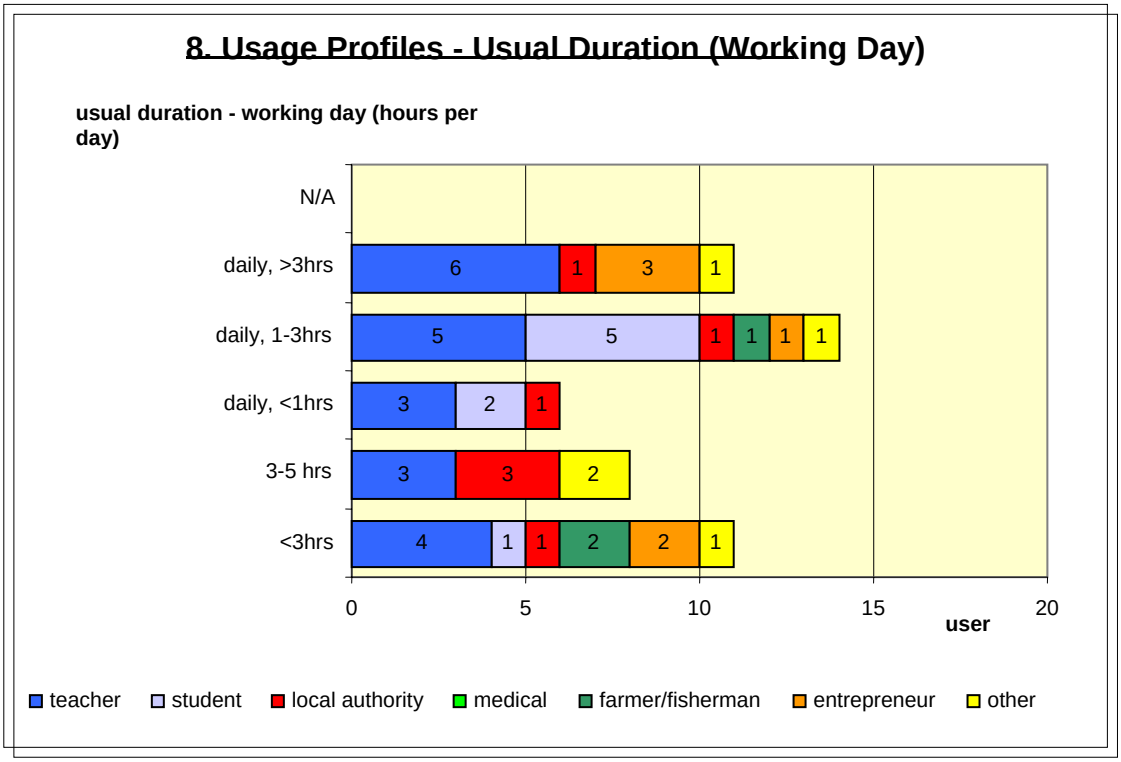

5. Usage Profiles - Connection Rate (Working Day)
connection rate -working day (day)
N/A
5+
1-4
up to 1 time
0
5
10
15
20
user
25
teacher
student
local authority
medical
farmer/fisherman
entrepreneur
other


6. Usage Profiles - Connection Rate (Weekend)
connection rate - weekend (day)
N/A
5+
1-4
up to 1 time
0
5
10
15
user
20
teacher
student
local authority
medical
farmer/fisherman
entrepreneur
other

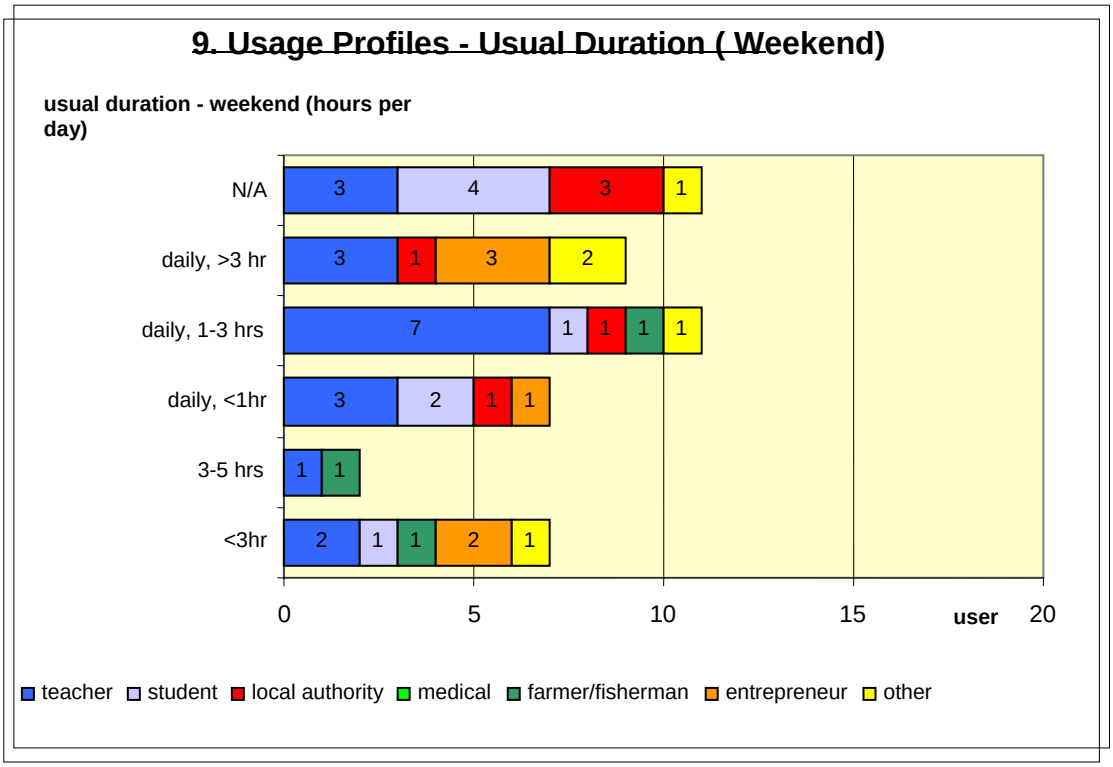
As diagram 7 shows, 17 users use the RW-internet at any time during the day, the others either between 9 and 12 am (15) or between 6 and 10 pm (11).



During the week 31 participants were connected to the internet via RW daily (diagram 8), most of those users (14) between one and three hours. Eleven participants use the RW internet access for less than three hours on all working days per week.



While all participating users are online on working days, diagram 9 shows that eleven users do not access RW internet services on weekends, most of them students who may not have internet access available on weekends.



The end users were mainly using the following internet services via the RuralWings Internet access (diagram 10, multiple answers were possible): web browsing (85%), e-mail (76%), file transfers (50%), software updates (40%) and RW applications and tools (36%).

The three most visited websites amongst RW users were search engines, online-mailing and news-sites, followed by the RW-CAP and online forums as diagram 11 shows.

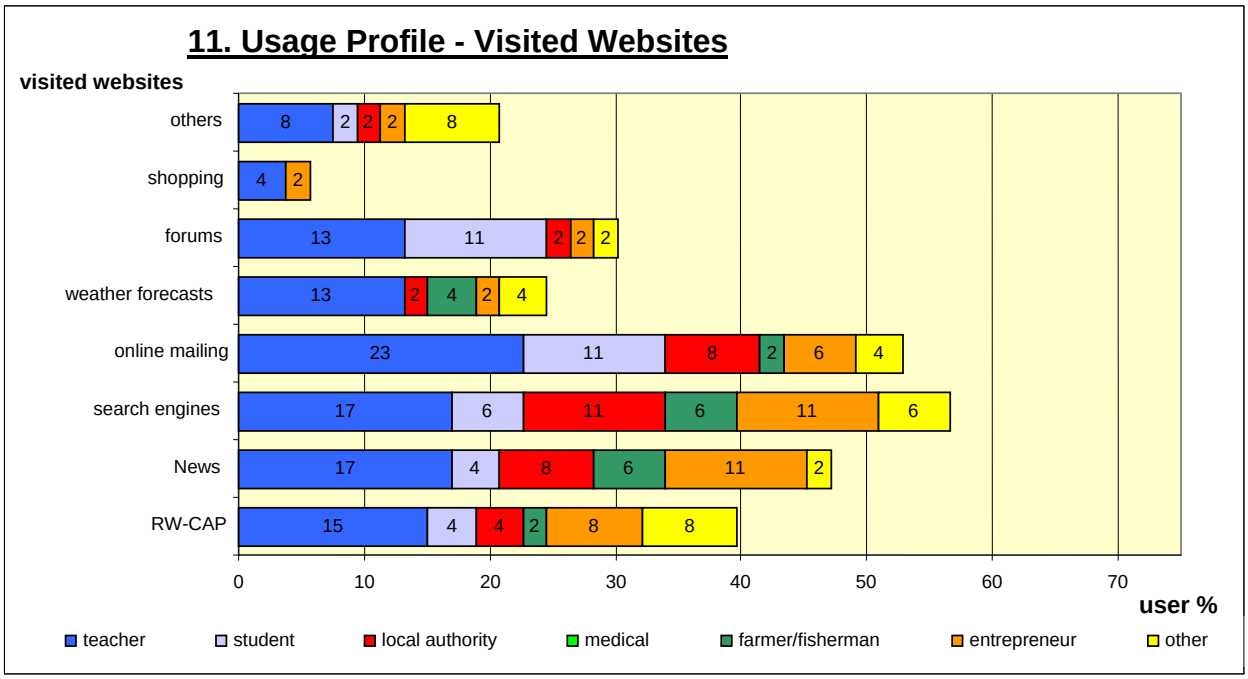


Diagram 12 presents an overview of the used RW applications by user groups. 23% of the participating end users did not use any RW applications at all. Mostly used were NEMED (31%), webTV (28%) and Health Training (25%).

In diagram 13 the usage duration of the RW-CAP per week is being shown. Most end users used the RW-CAP less than one (19 users) and between one and four hours (19 users) a week. Students, farmers and most of the teachers never used the RW-CAP more than four hours a week, while local authority, entrepreneurs and not specified users also accessed it for more than ten hours a week.

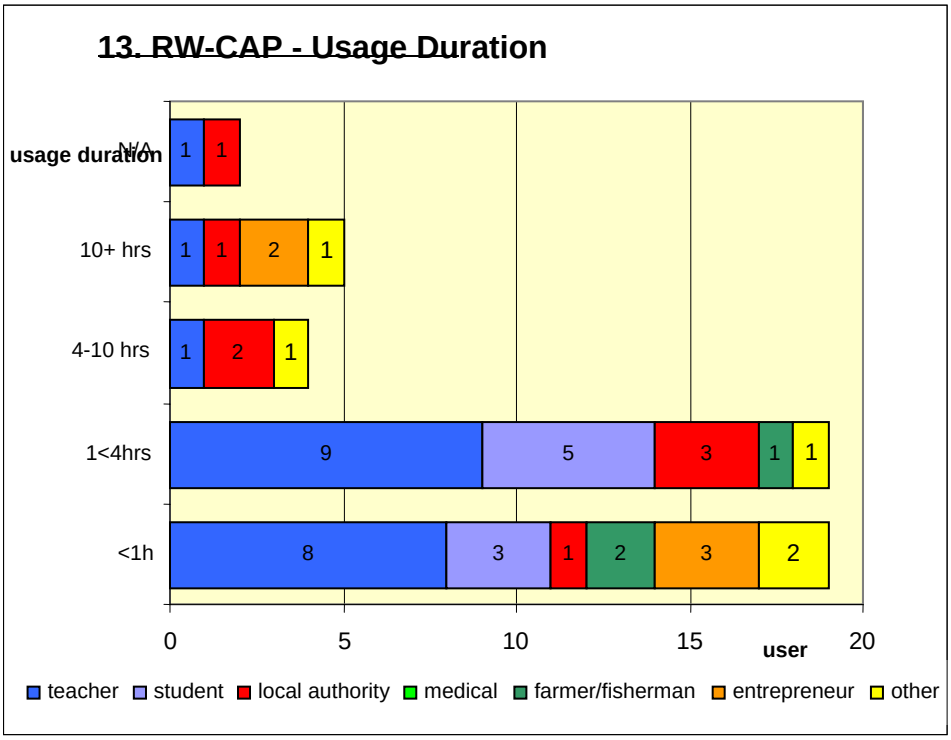
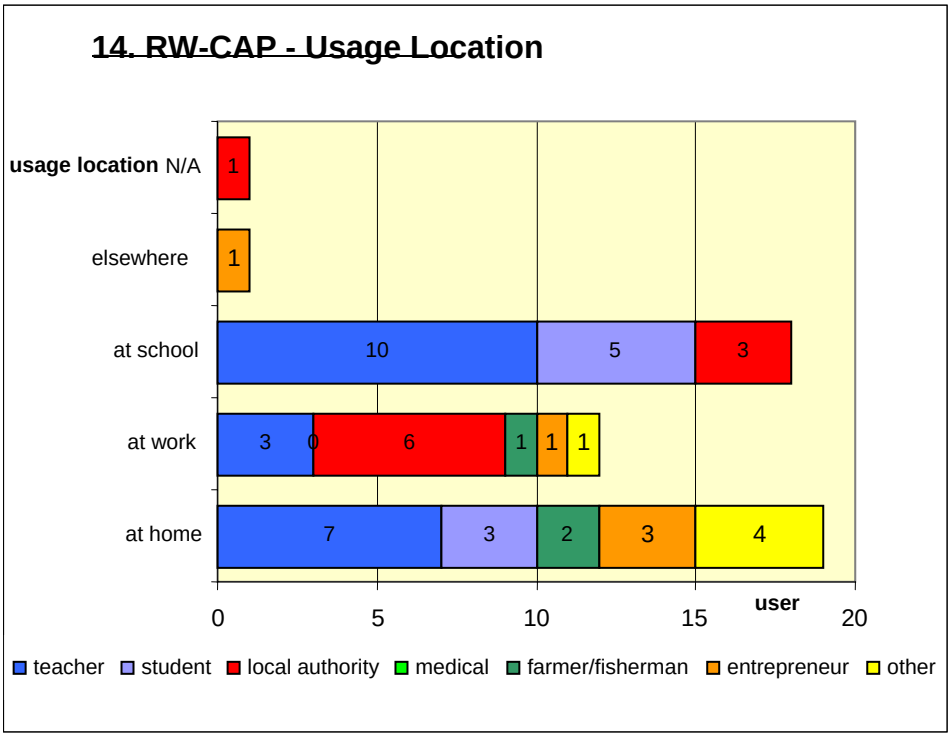
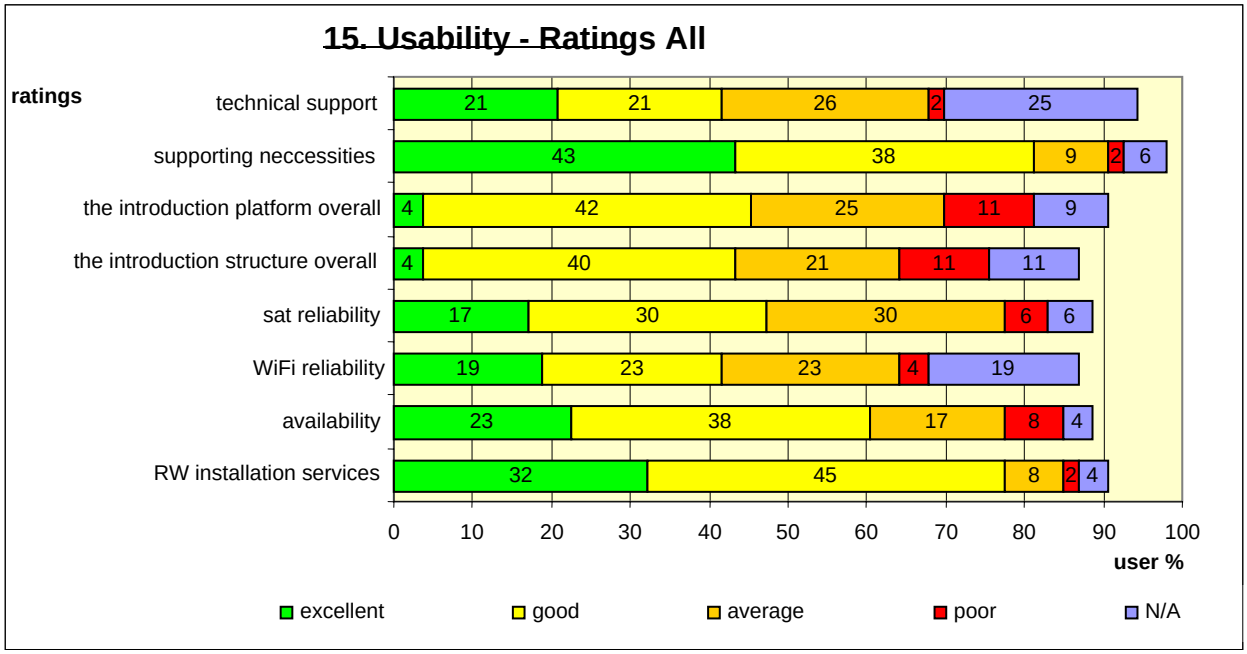


Diagram 14 depicts from where the RW-CAP is mostly accessed. 19 users enter the RW-CAP mainly from home 18 from school while 12 end users mainly accessed it from work.

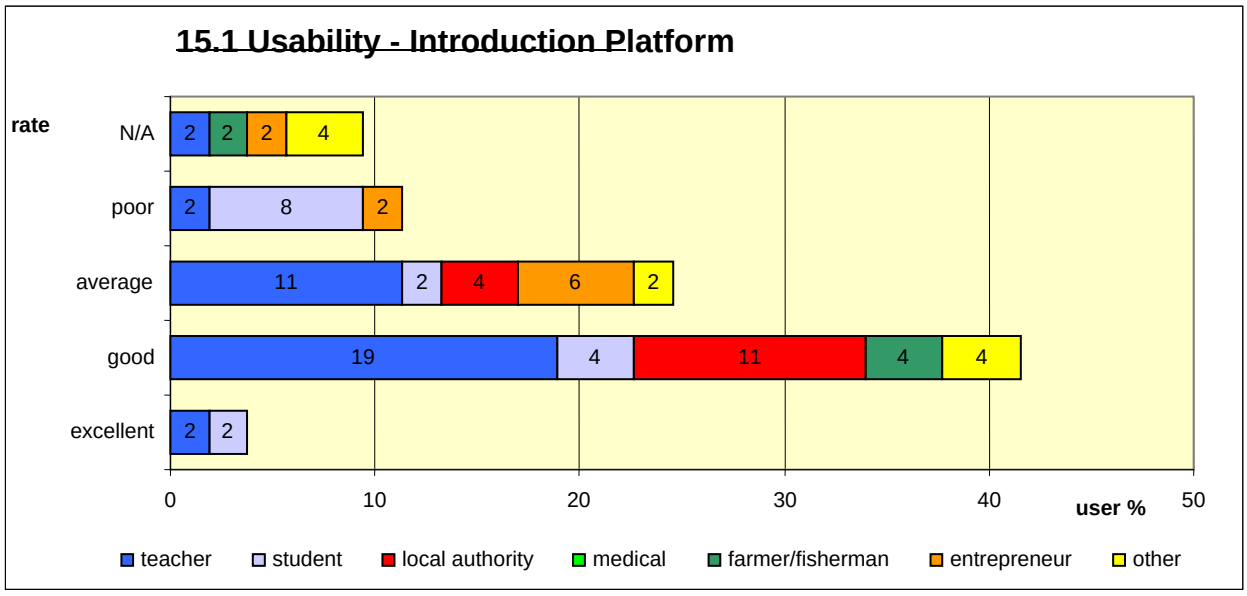


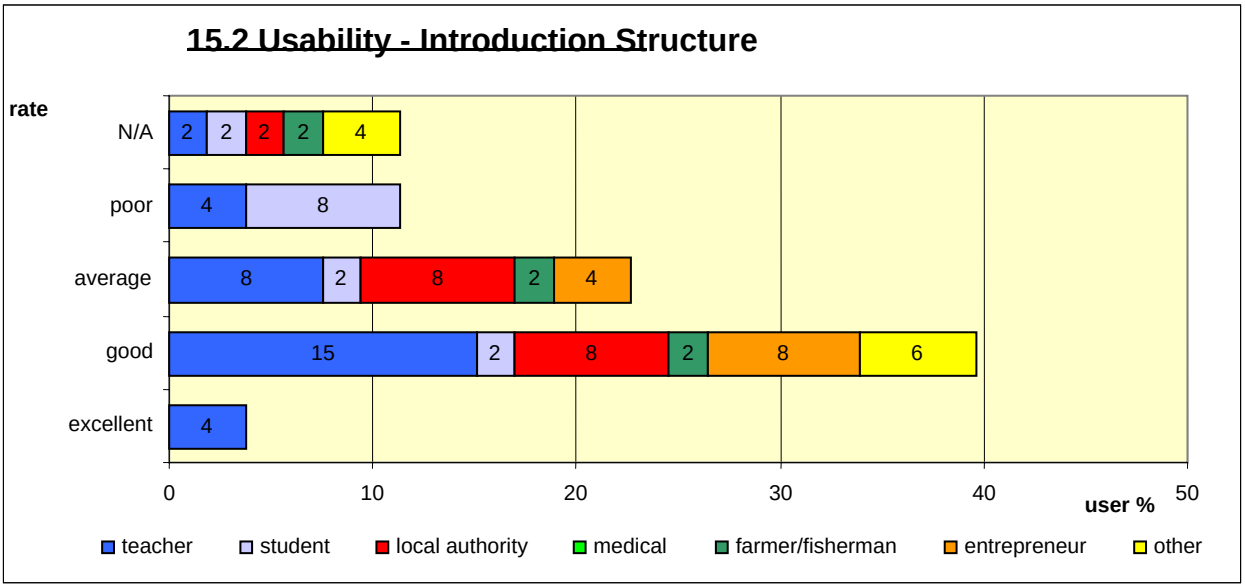
4.2.5 Usability of Rural Wings infrastructure, training and support

Diagram 15 depicts the usability ratings of all participating end users. Deficits or problems seem to have arised with the introduction to the platform and to the RW structure which has been rated as “poor” by 11% of the end users. The highest satisfaction can be seen in the areas of supporting necessities and the RW installation services which have been rated as excellent or good by over 80% respectively over 75%.

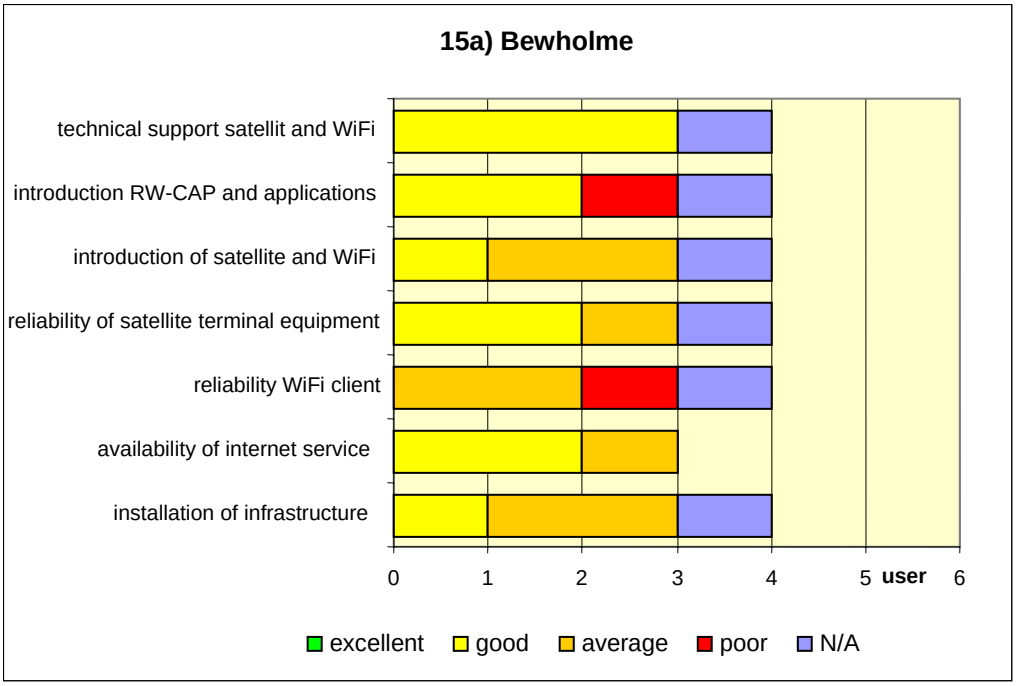


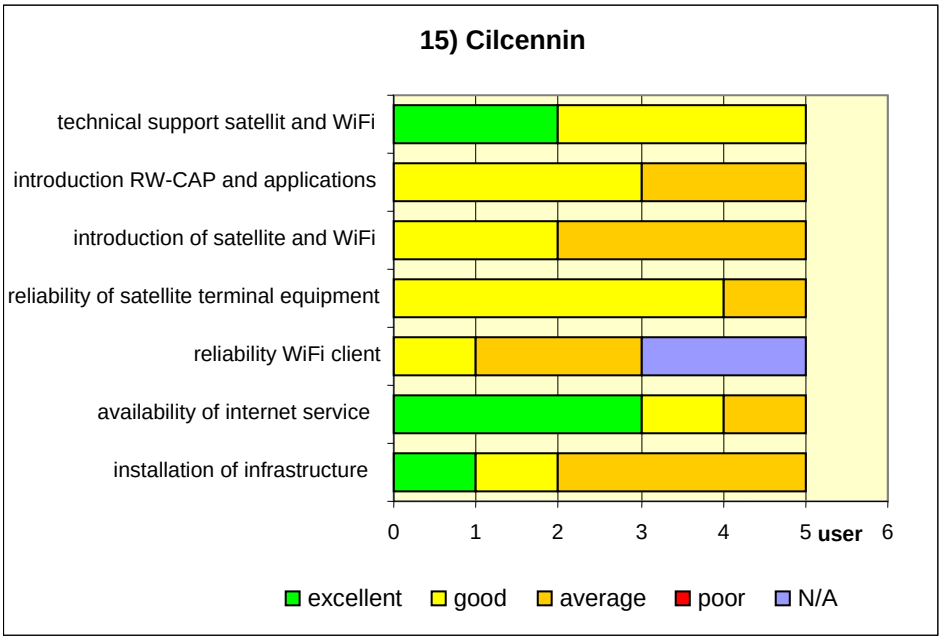
Diagrams 15.1 and 15.2 show more than 50% of the participating students rated the introduction to the RW-CAP and to the overall structure as poor. One possible explanation could be that user training focuses more on the participating teachers and that information needs of students are not fully covered by this approach.

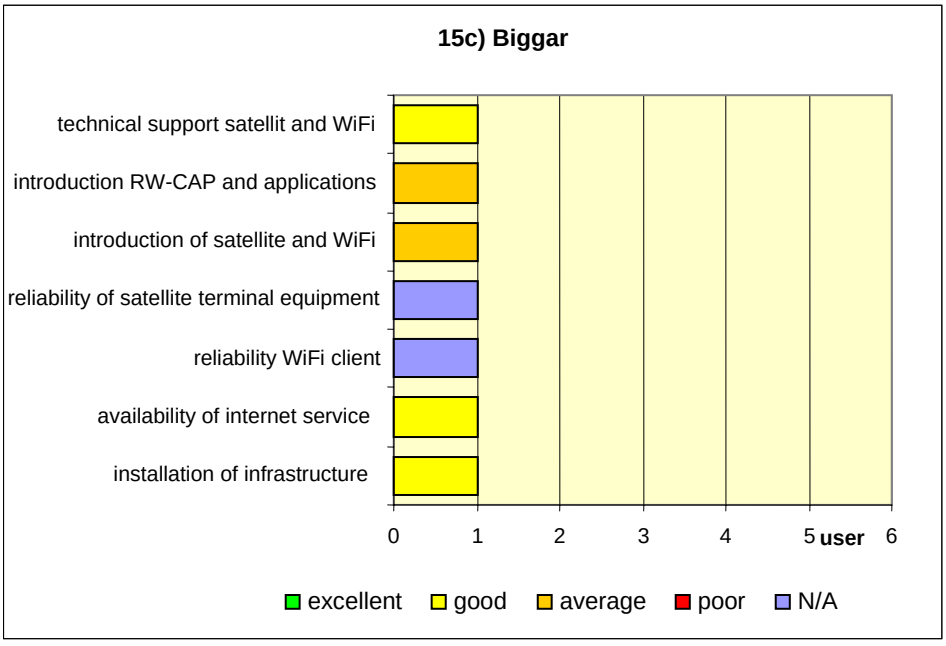




The following diagrams 15a to 15x show the usability ratings of the RW infrastructure, training and support for each pilot site. Thus it becomes easier to localize problems and support the NCs to take adequate measures.




15) Cilcennin
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
0
1
2
3
4
5
user
6
excellent
good
average
poor
N/A


15c) Biggar
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
0
1
2
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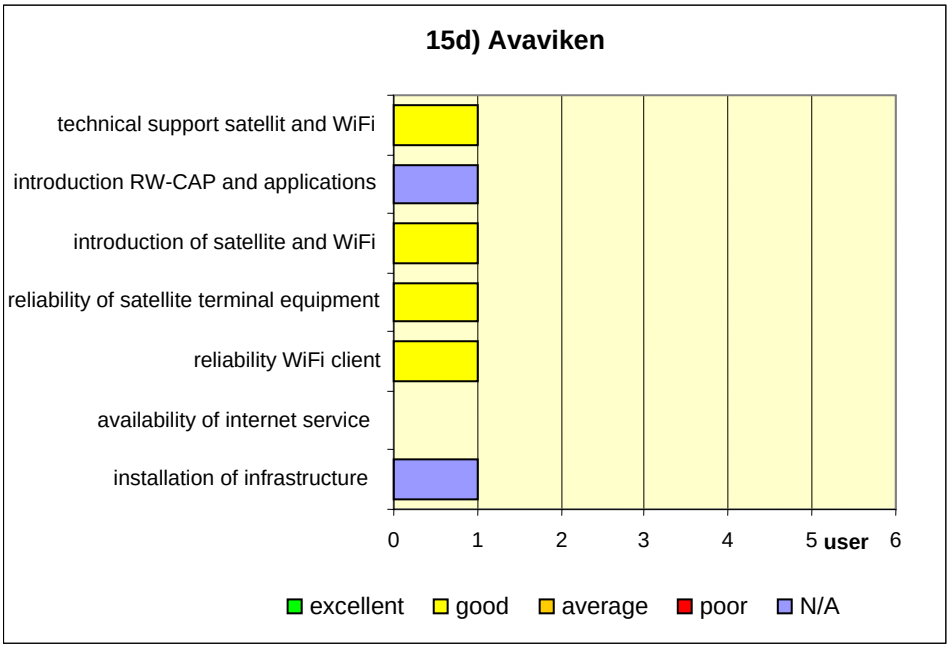
user
6
excellent
good
average
poor
N/A


15d) Avaviken
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
0
1
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user
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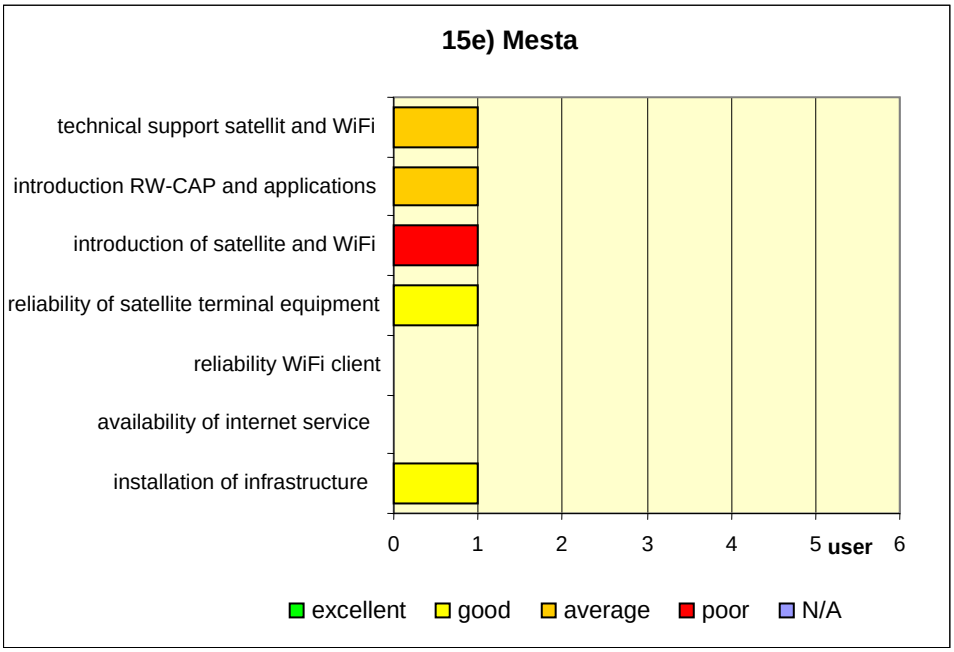
excellent
good
average
poor
N/A


15e) Mesta
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
0
1
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user
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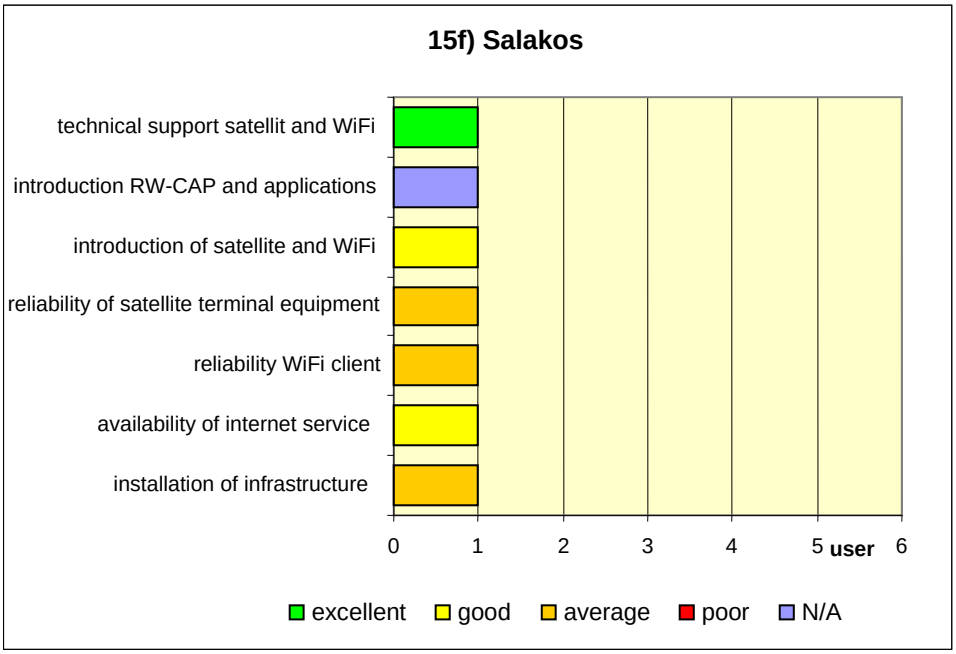
excellent
good
average
poor
N/A


15f) Salakos
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
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user
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average
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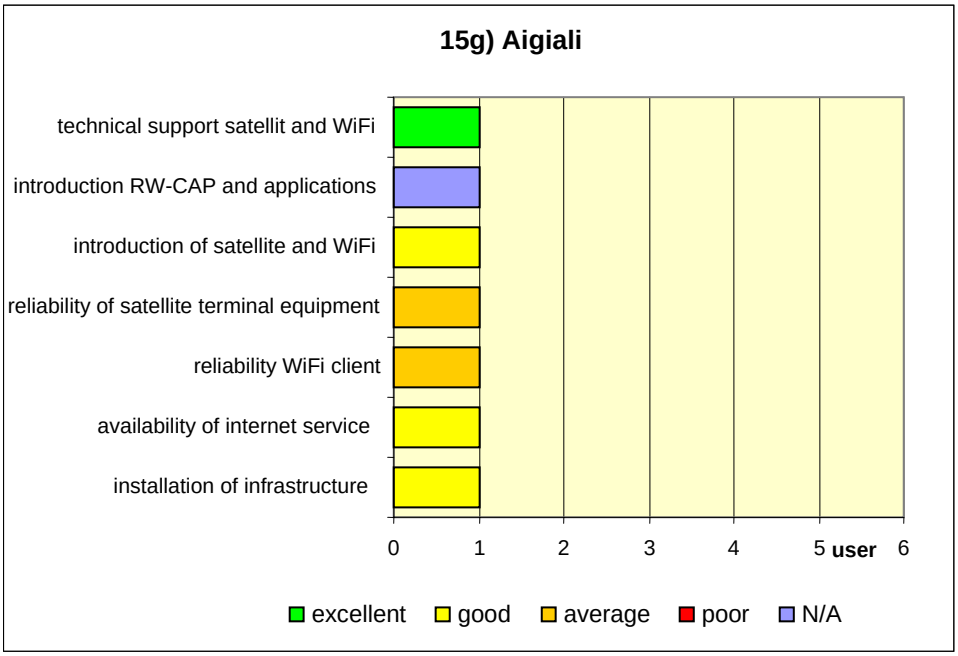
N/A


15g) Aigiali
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
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user
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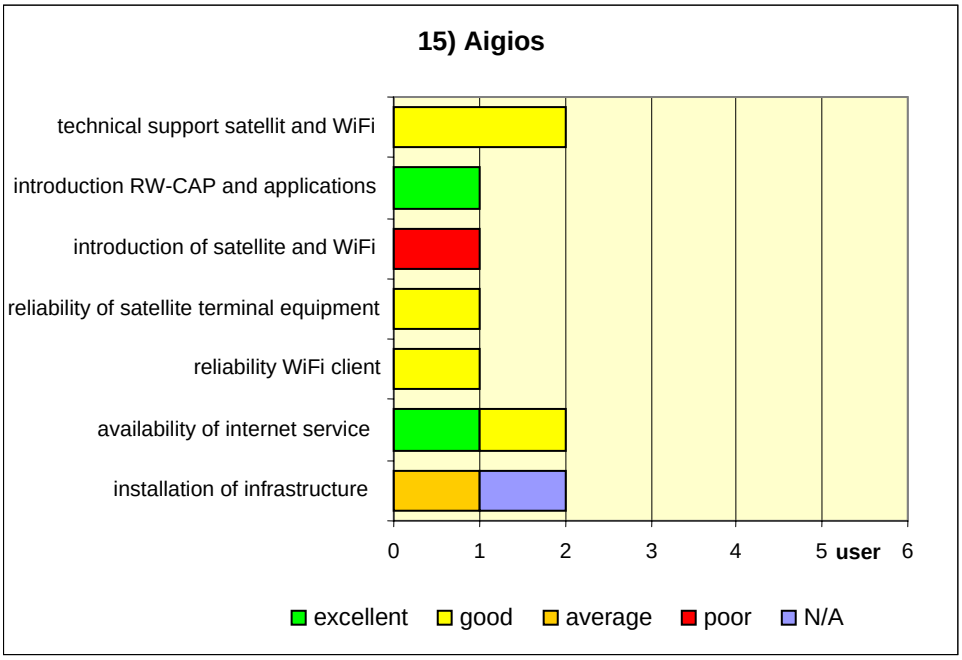
excellent
good
average
poor
N/A


15) Aigios
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
0
1
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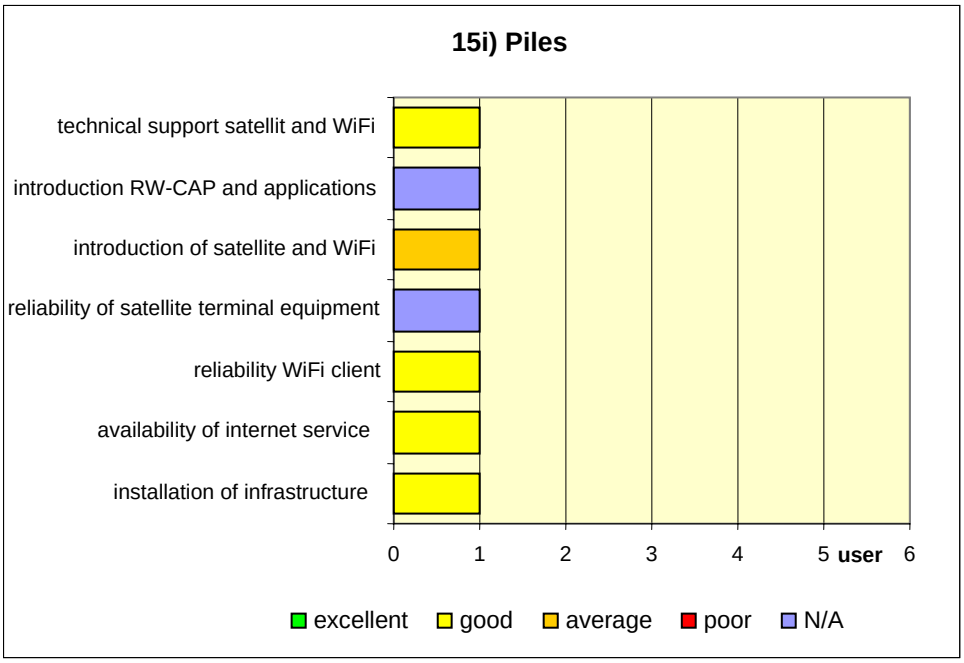
user
6
excellent
good
average
poor
N/A


15i) Piles
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
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user
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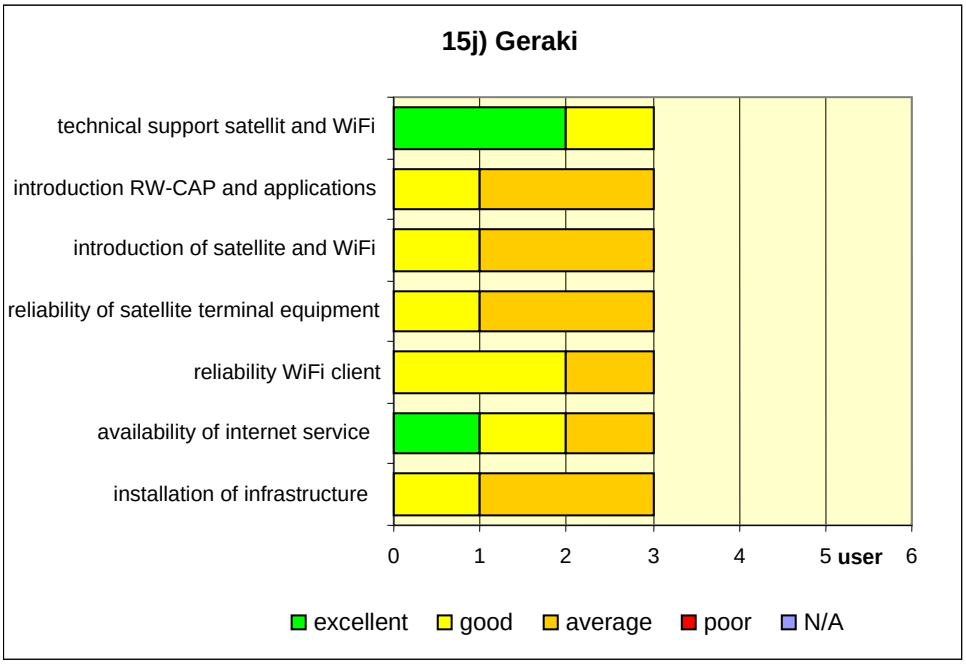
excellent
good
average
poor
N/A


15j) Geraki
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
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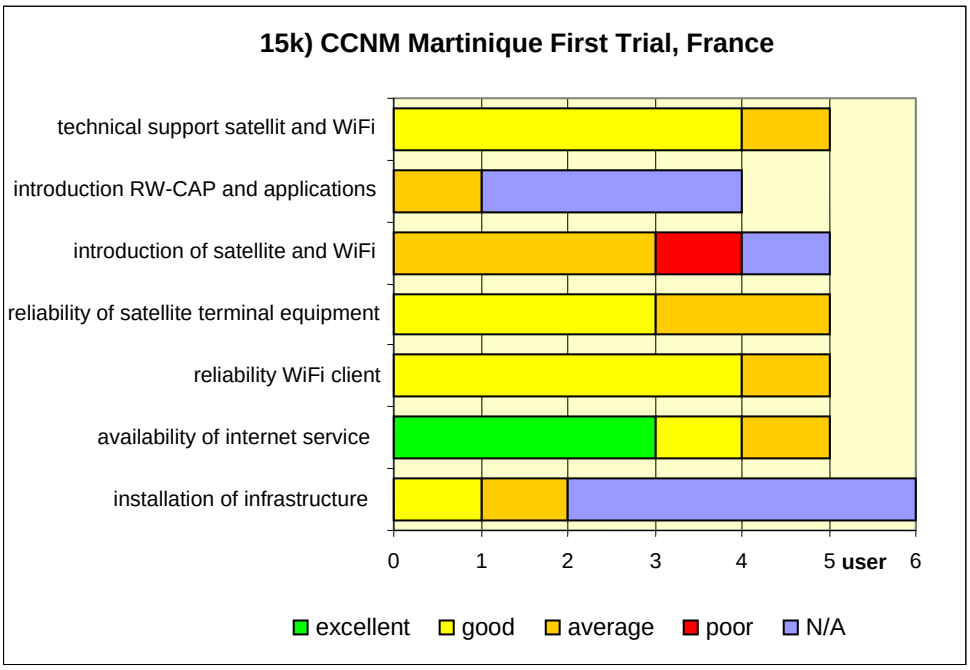
5 user
6
excellent
good
average
poor
N/A


15k) CCNM Martinique First Trial, France
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
0
1
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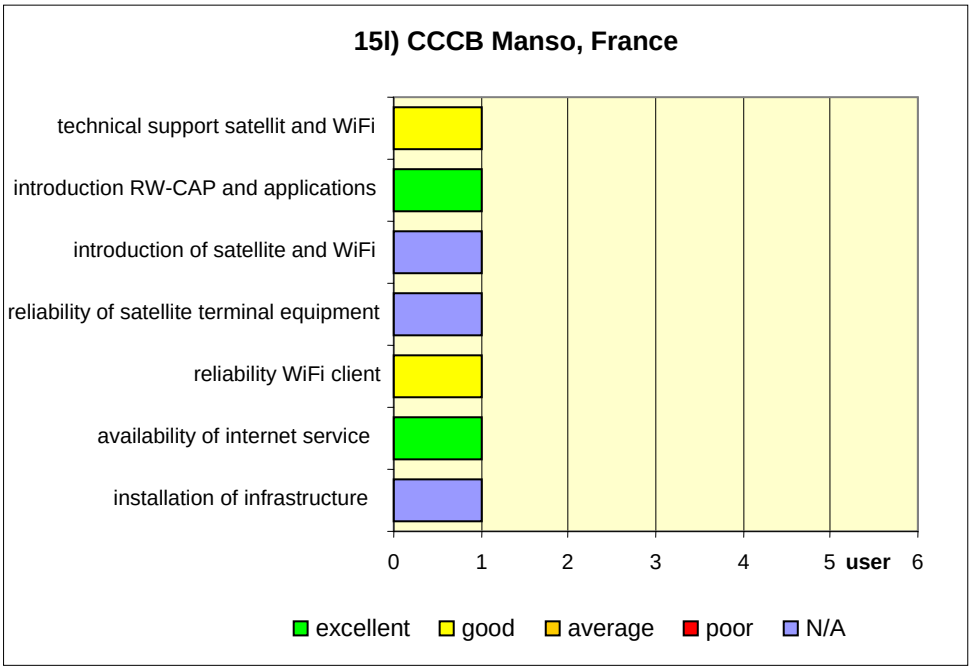
5 user
6
excellent
good
average
poor
N/A


15l) CCCB Manso, France
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
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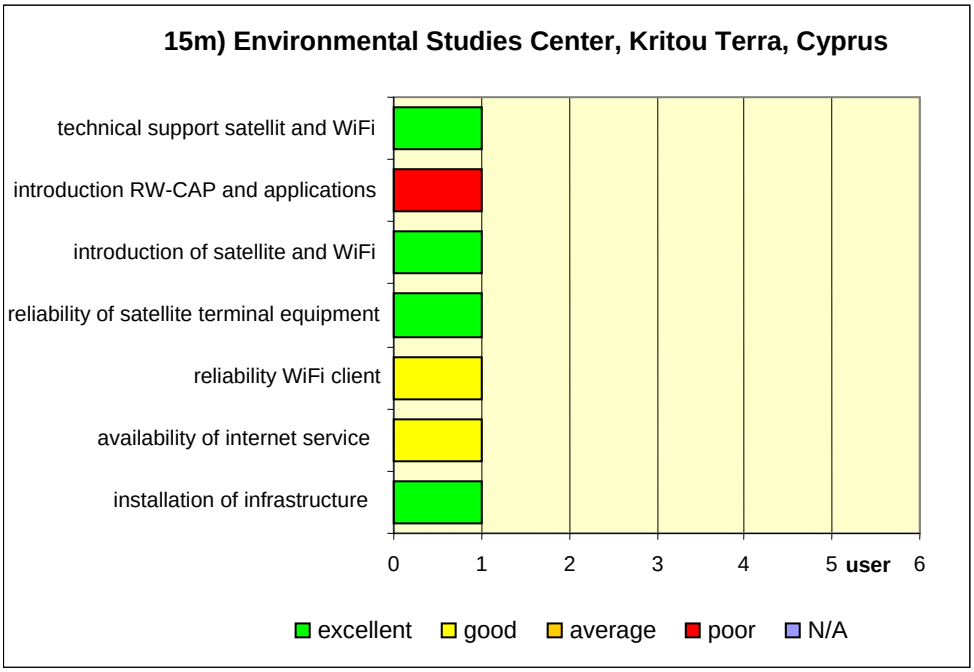
15m) Environmental Studies Center, Kritou Terra, Cyprus
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
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user
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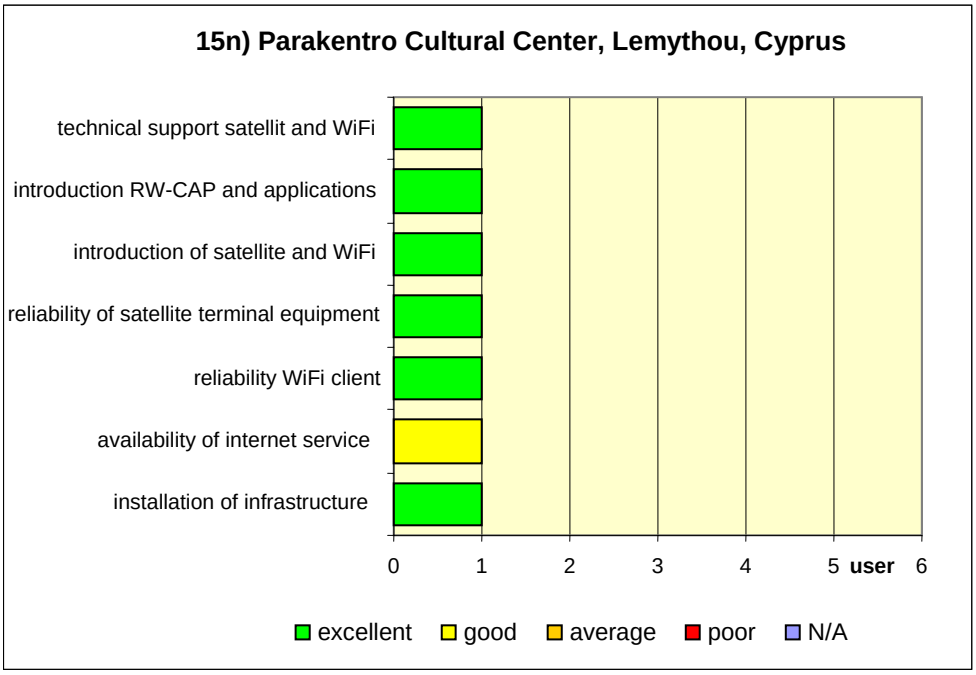
excellent
good
average
poor
N/A


15n) Parakentro Cultural Center, Lemythou, Cyprus
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
0
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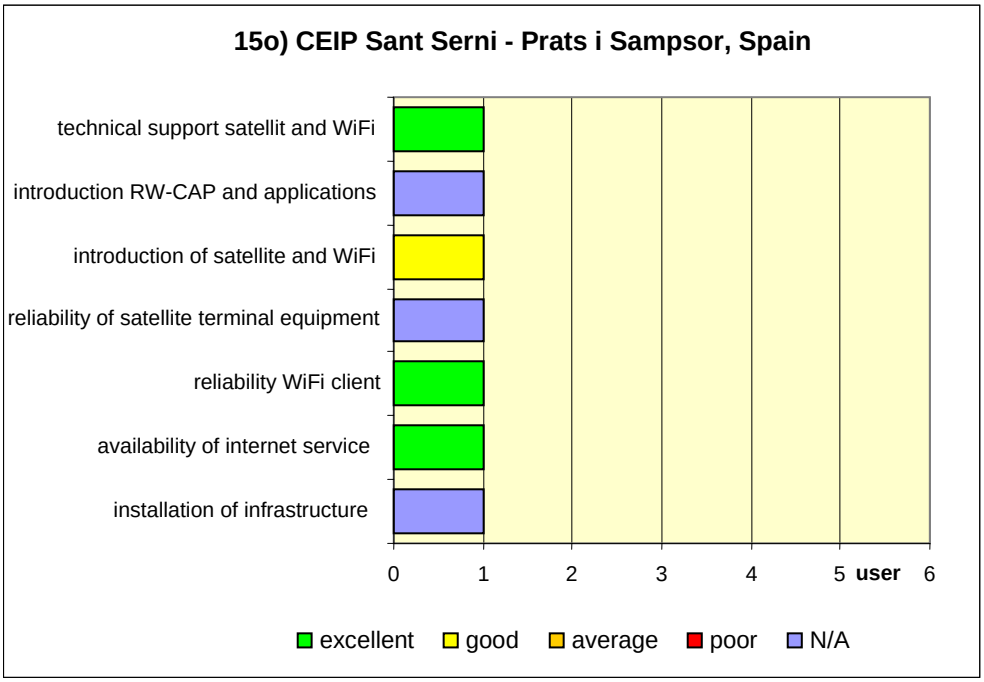
4
5
user
6
excellent
good
average
poor
N/A


15o) CEIP Sant Serni - Prats i Sampsor, Spain
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
0
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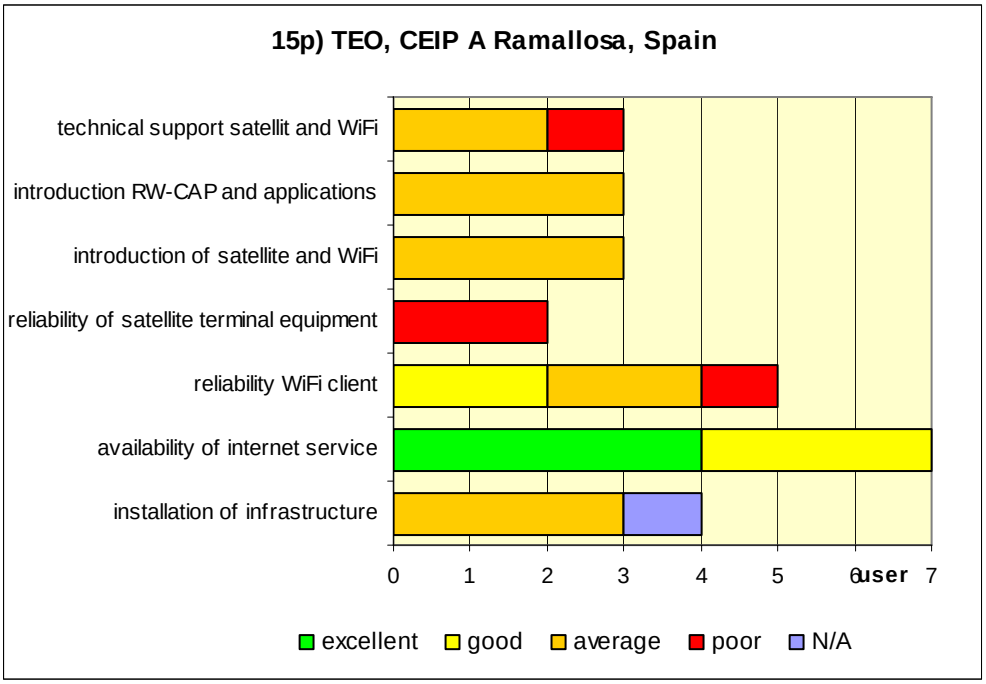
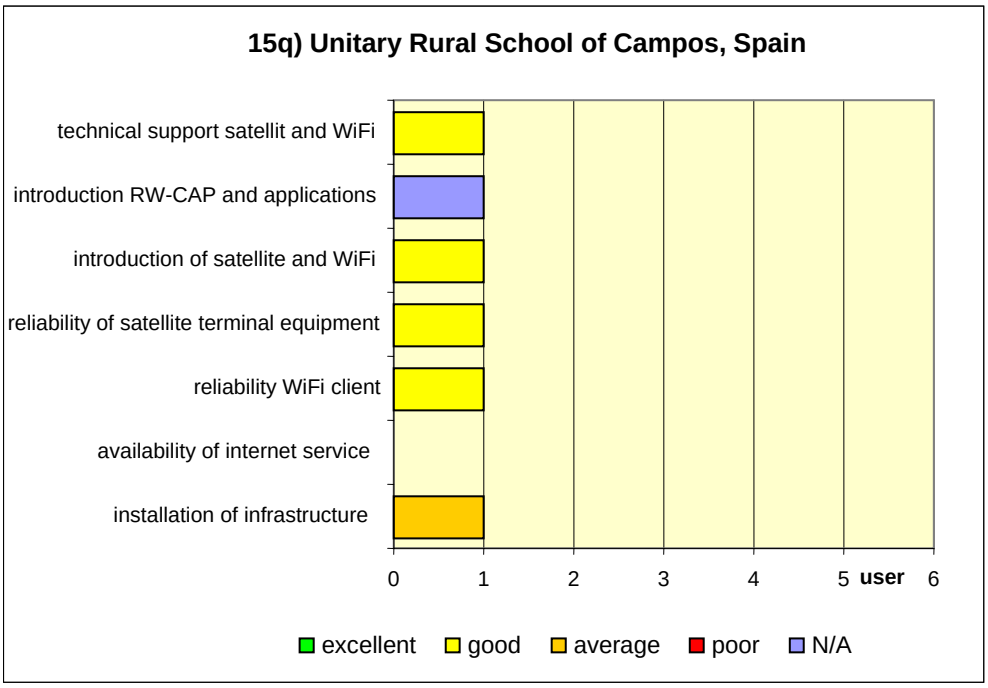
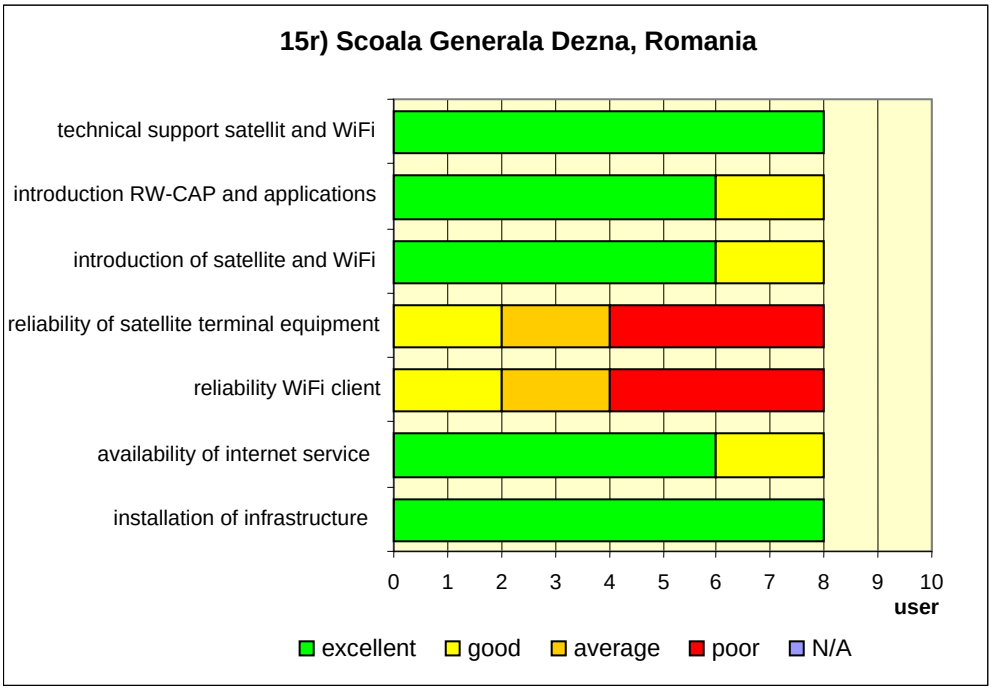
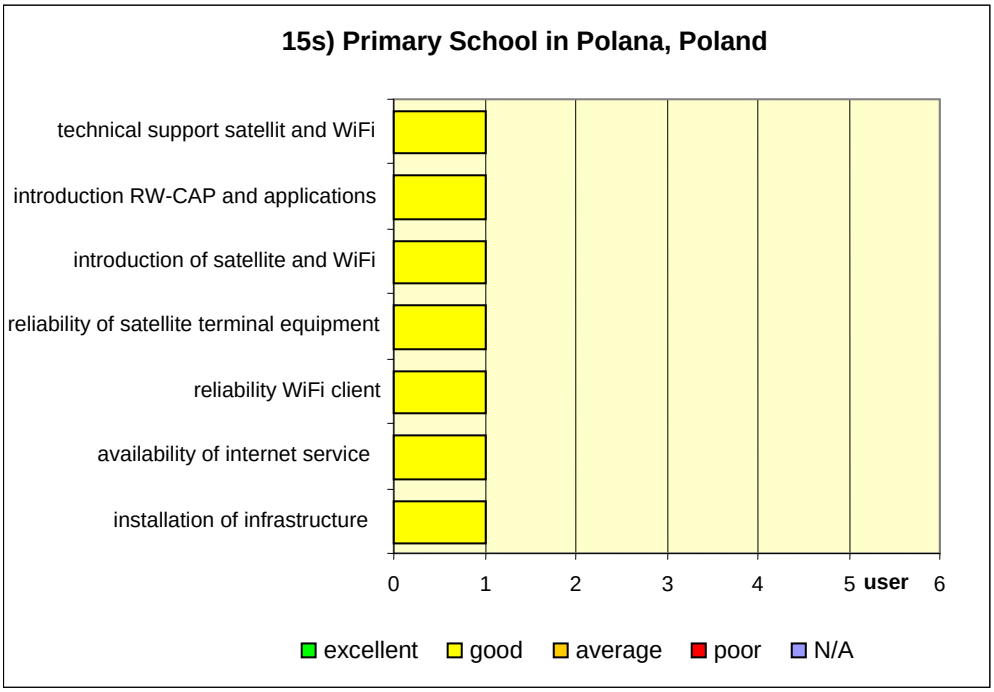
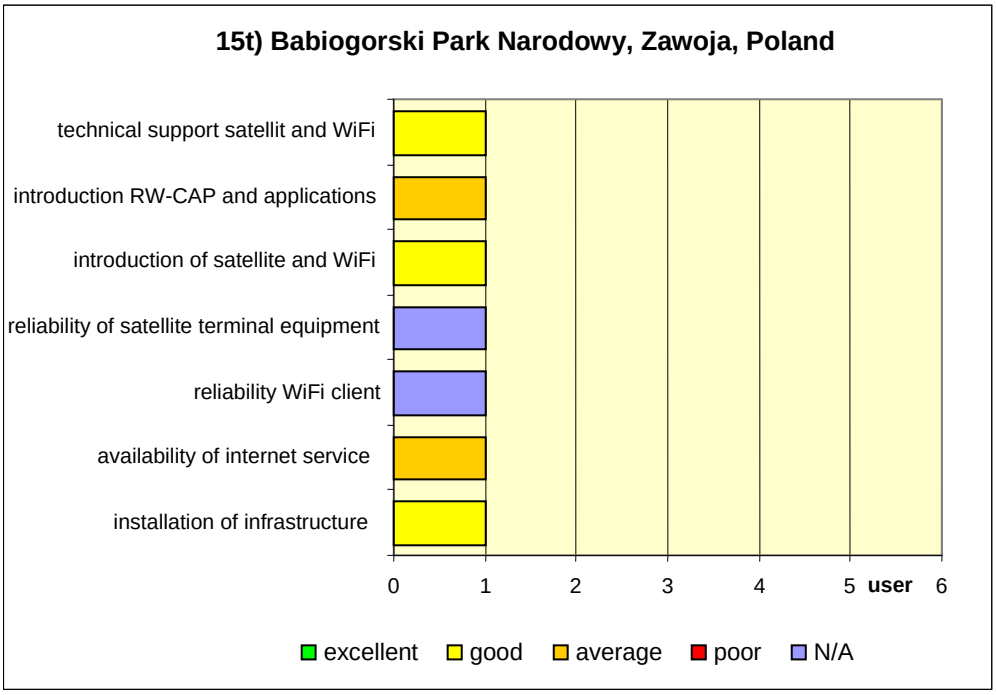
user
6
excellent
good
average
poor
N/A

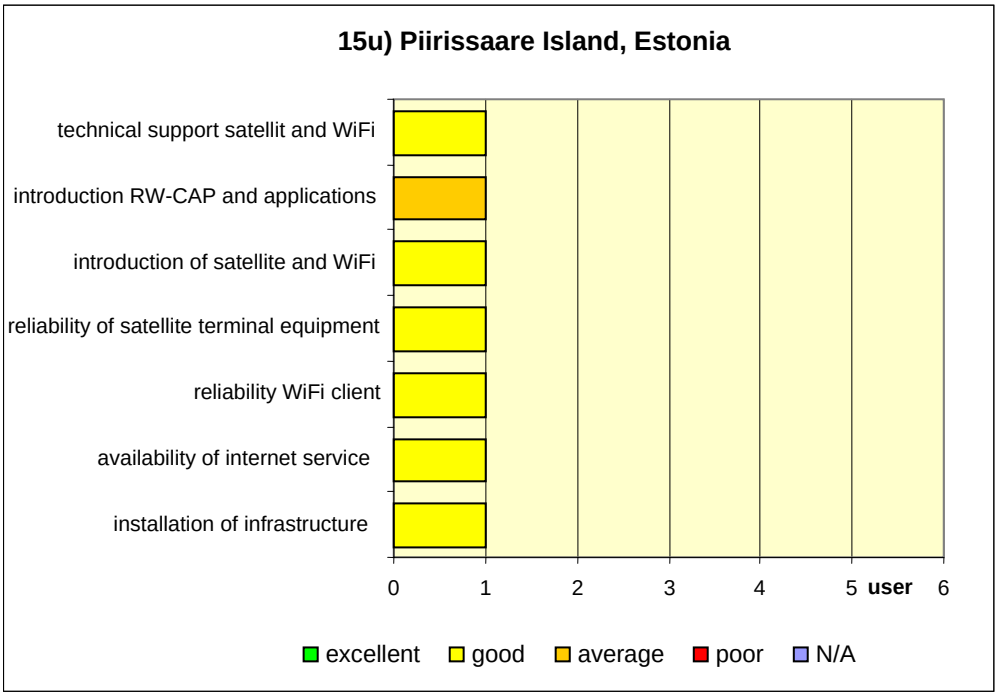

15p) TEO, CEIP A Ramallosa, Spain
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
0 1 2 3 4 5 6 7
user
excellent good average poor N/A

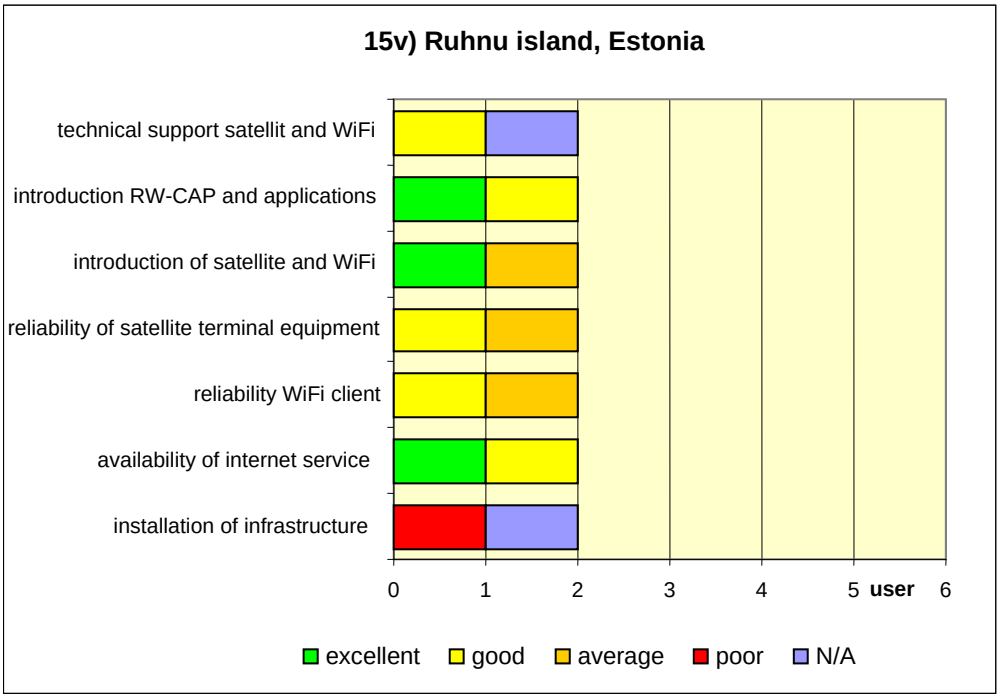

15q) Unitary Rural School of Campos, Spain
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
0 1 2 3 4 5 6
user
excellent good average poor N/A

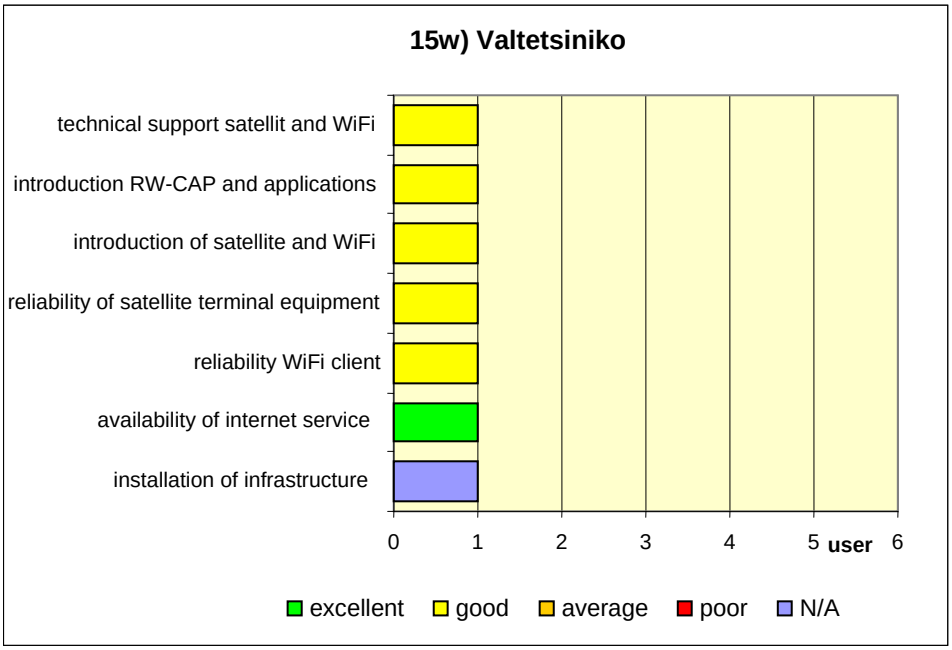

15r) Scoala Generala Dezna, Romania
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
0 1 2 3 4 5 6 7 8 9 10
user
excellent good average poor N/A

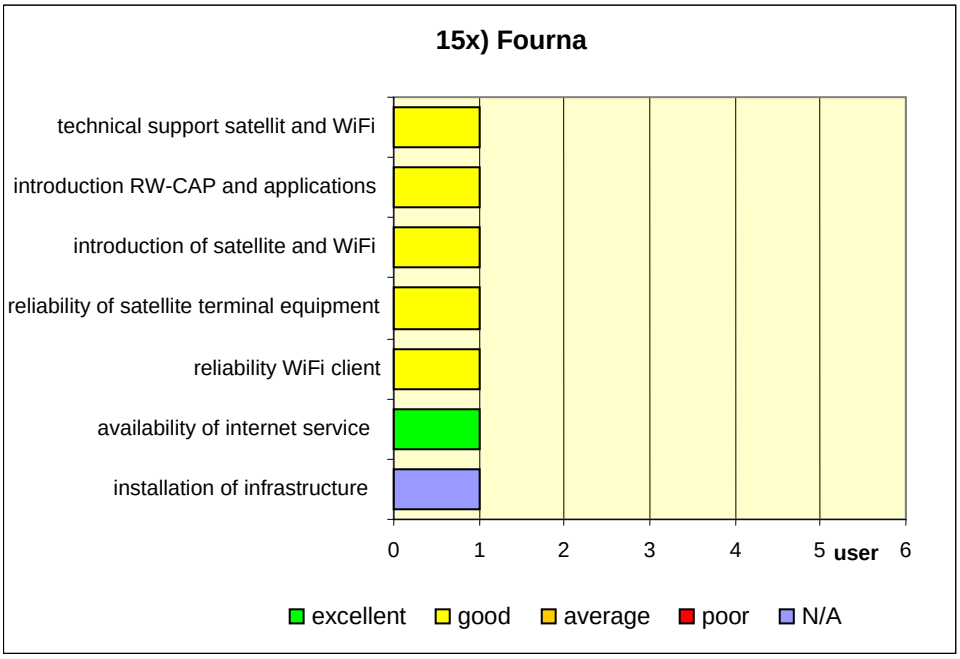

15s) Primary School in Polana, Poland
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
0 1 2 3 4 5 user 6
excellent good average poor N/A


15t) Babiogorski Park Narodowy, Zawoja, Poland
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
0
1
2
3
4
5
user
6
excellent
good
average
poor
N/A

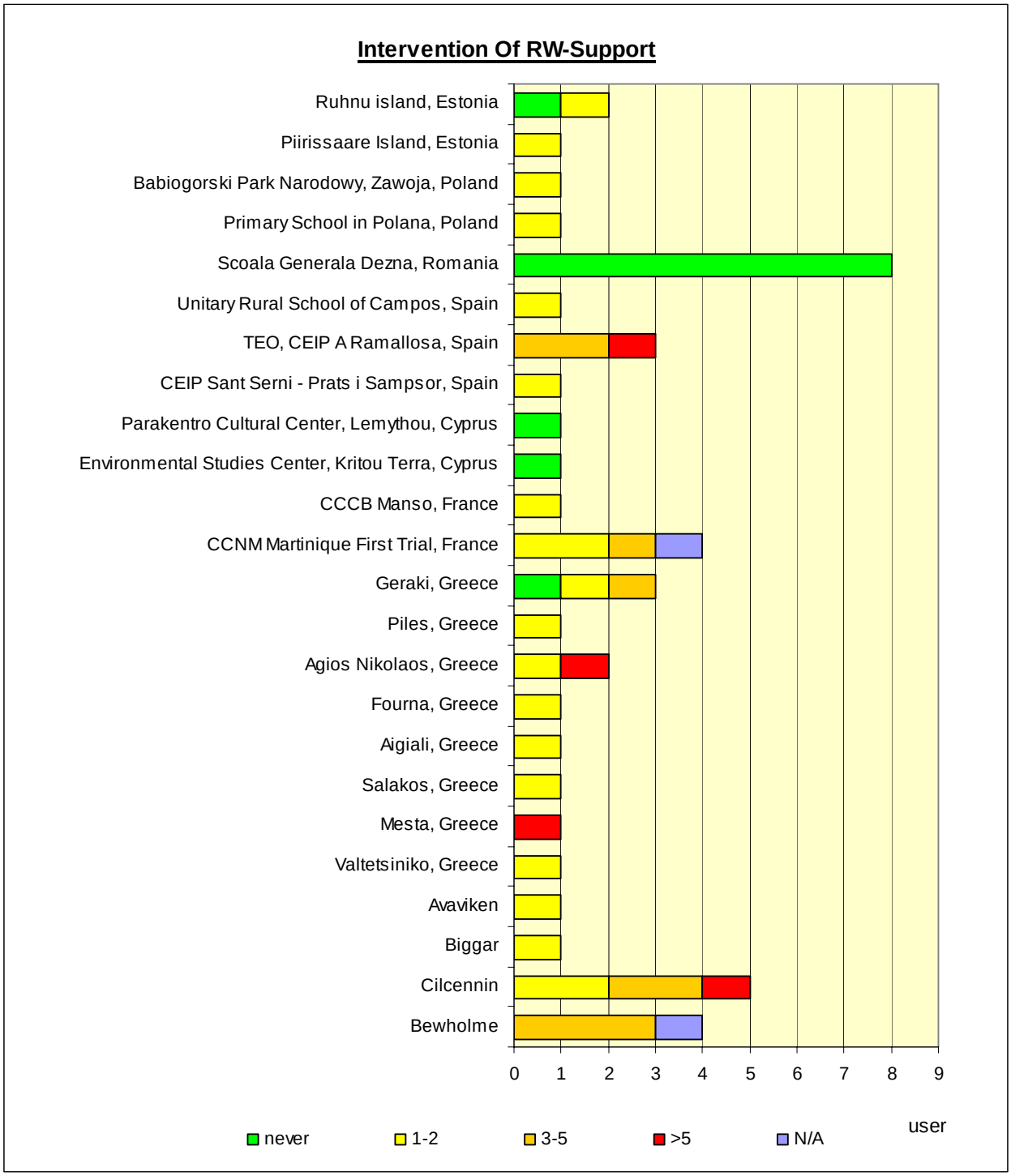

15u) Piirissaare Island, Estonia
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
0
1
2
3
4
5
user
6
excellent
good
average
poor
N/A


15v) Ruhnu island, Estonia
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
0
1
2
3
4
5
user
6
excellent
good
average
poor
N/A


15w) Valtetsiniko
technical support satellit and WiFi
introduction RW-CAP and applications
introduction of satellite and WiFi
reliability of satellite terminal equipment
reliability WiFi client
availability of internet service
installation of infrastructure
0
1
2
3
4
5
user
6
excellent
good
average
poor
N/A



The following diagram 16 provides an overview of how often the RW support has been contacted in each pilot site. Three pilot sites did never request the RW support while it was contacted more than five times in four pilot sites.


Intervention Of RW-Support
Ruhnu island, Estonia
Piirissaare Island, Estonia
Babiogorski Park Narodowy, Zawoja, Poland
Primary School in Polana, Poland
Scoala Generala Dezna, Romania
Unitary Rural School of Campos, Spain
TEO, CEIP A Ramallosa, Spain
CEIP Sant Serni - Prats i Sampsor, Spain
Parakentro Cultural Center, Lemythou, Cyprus
Environmental Studies Center, Kritou Terra, Cyprus
CCCB Manso, France
CCNM Martinique First Trial, France
Geraki, Greece
Piles, Greece
Agios Nikolaos, Greece
Fourna, Greece
Aigiali, Greece
Salakos, Greece
Mesta, Greece
Valtetsiniko, Greece
Avaviken
Biggar
Cilcennin
Bewholme
0 1 2 3 4 5 6 7 8 9
user
never
1-2
3-5
>5
N/A

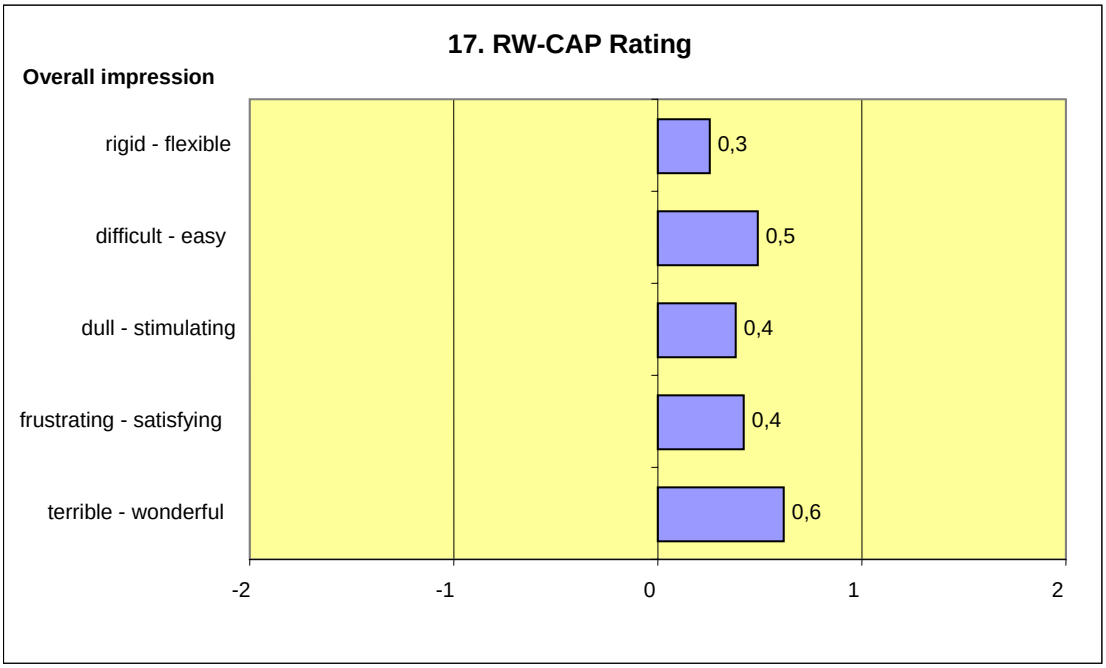
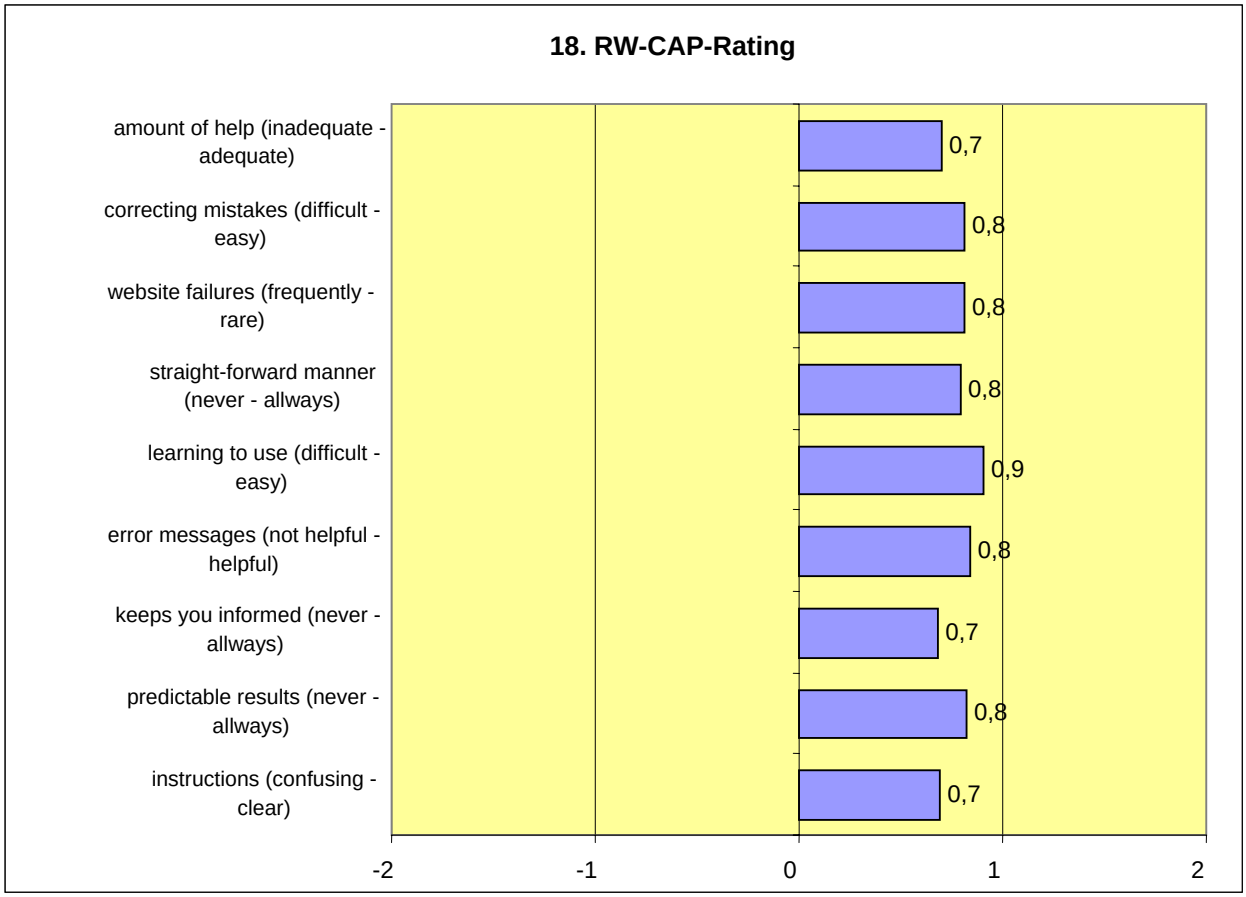


Diagram 17 shows the overall impression of the RW-CAP that was rated by the end users on a scale with five grades.

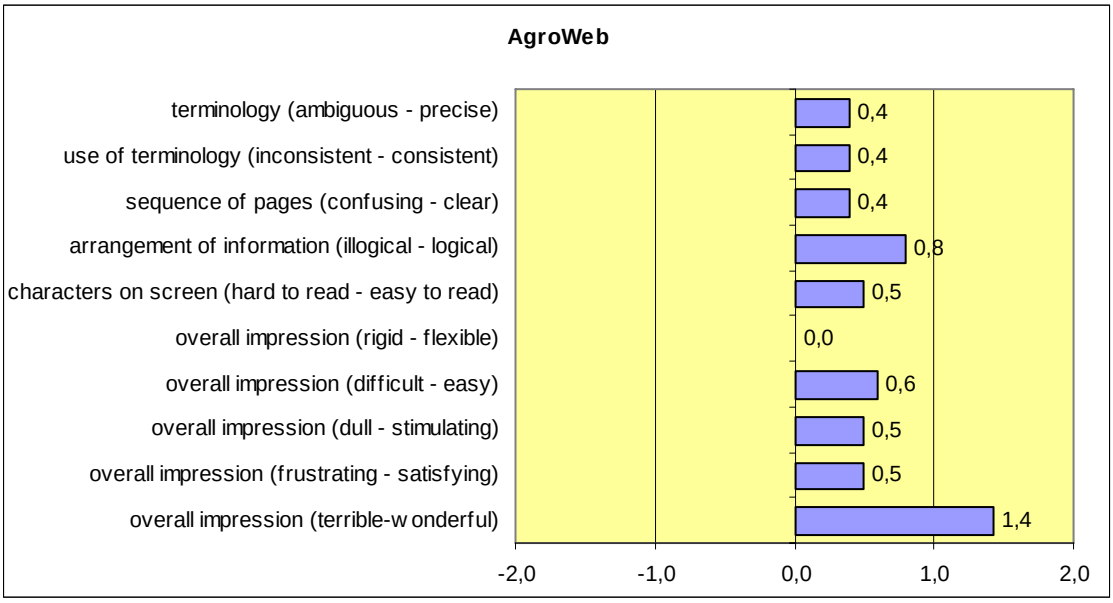
Although the usability rating for specific aspects of the RW-CAP (see diagram 18) is more positive than the overall impression (diagram 17), user comments filled in as free text in the questionnaire suggest that satisfaction with the RW-CAP could be improved. While two users state that they prefer search engines like google to the RW-CAP and that they don't find links or information in the RW-CAP that is of special interest for them, others suggest general improvement (1 user), find the structure confusing ("finding the applications is hard and not clear", "in the beginning almost everything is confusing"), encountered "too many dead/blank links" or suggest improvements in design ("I would suggest to improve the design of the portal to make it more compact and pleasant"), terminology ("Certaines améliorations sont à porter sur la terminologie.") or translation to their local language (Romania). From a Cypriot pilot site feedback was given on a piano learning program that is linked from the RW-CAP. The user mentioned that the application was not useful for Greek students because all notes were in English and that there was more advanced software available that connected computer and piano and allowed more direct sound feedback.

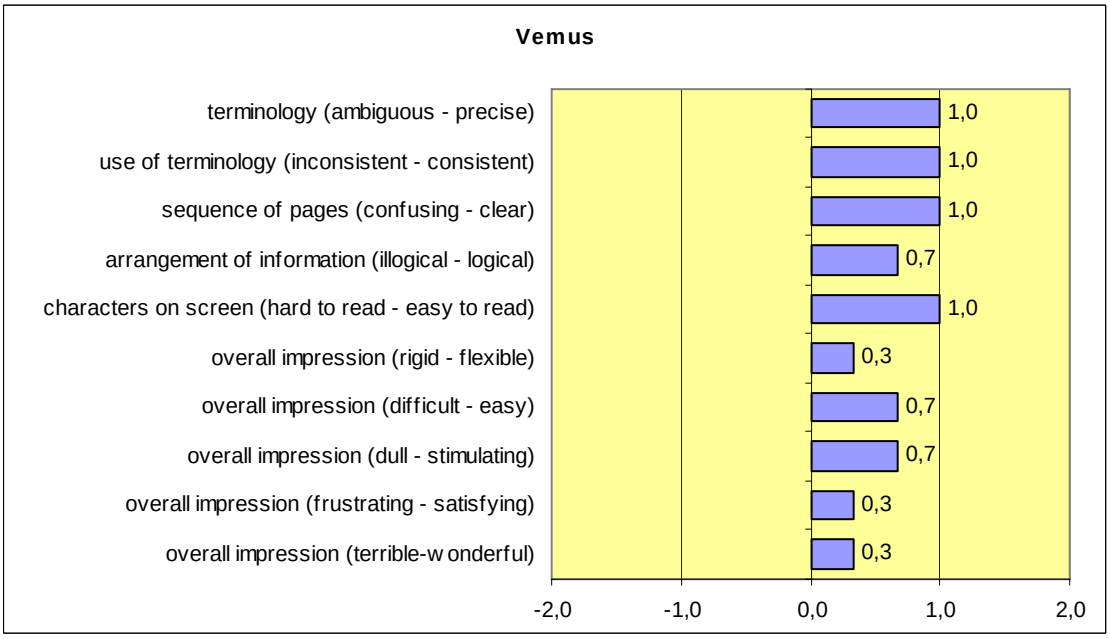
As no other application or comment option in the questionnaire led to such an amount of diverse feedback, the improvement of the RW-CAP seems to be of high relevance for the end users.

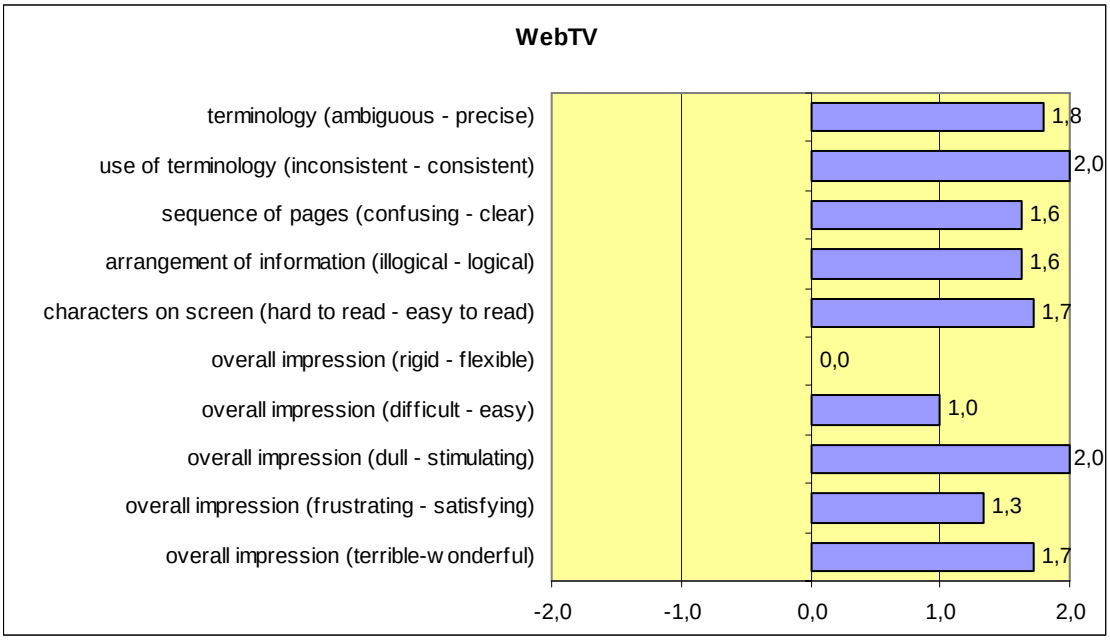


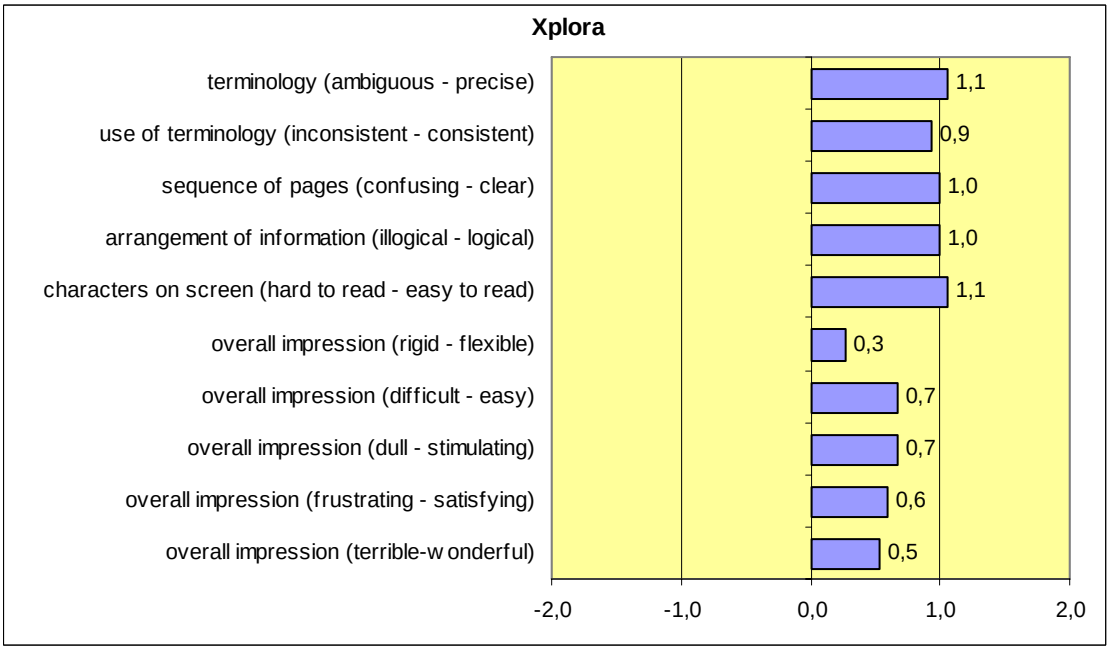
4.2.6 Usability of Rural Wings applications

The following diagrams show the usability rating for the RW applications that were rated individually by the end users on a scale with five grades. A loop option was implemented in the questionnaire that allowed presenting only those applications for the usability rating that the individual user had used during the test runs.


AgroWeb
terminology (ambiguous - precise)
use of terminology (inconsistent - consistent)
sequence of pages (confusing - clear)
arrangement of information (illogical - logical)
characters on screen (hard to read - easy to read)
overall impression (rigid - flexible)
overall impression (difficult - easy)
overall impression (dull - stimulating)
overall impression (frustrating - satisfying)
overall impression (terrible-w onderful)
0,4
0,4
0,4
0,8
0,5
0,0
0,6
0,5
0,5
1,4
-2,0
-1,0
0,0
1,0
2,0


Vemus
terminology (ambiguous - precise)
use of terminology (inconsistent - consistent)
sequence of pages (confusing - clear)
arrangement of information (illogical - logical)
characters on screen (hard to read - easy to read)
overall impression (rigid - flexible)
overall impression (difficult - easy)
overall impression (dull - stimulating)
overall impression (frustrating - satisfying)
overall impression (terrible-w onderful)
1,0
1,0
1,0
0,7
1,0
0,3
0,7
0,7
0,3
0,3
-2,0
-1,0
0,0
1,0
2,0


WebTV
terminology (ambiguous - precise)
use of terminology (inconsistent - consistent)
sequence of pages (confusing - clear)
arrangement of information (illogical - logical)
characters on screen (hard to read - easy to read)
overall impression (rigid - flexible)
overall impression (difficult - easy)
overall impression (dull - stimulating)
overall impression (frustrating - satisfying)
overall impression (terrible-w onderful)
1,8
2,0
1,6
1,6
1,7
0,0
1,0
2,0
1,3
1,7
-2,0
-1,0
0,0
1,0
2,0


Xplora
terminology (ambiguous - precise)
use of terminology (inconsistent - consistent)
sequence of pages (confusing - clear)
arrangement of information (illogical - logical)
characters on screen (hard to read - easy to read)
overall impression (rigid - flexible)
overall impression (difficult - easy)
overall impression (dull - stimulating)
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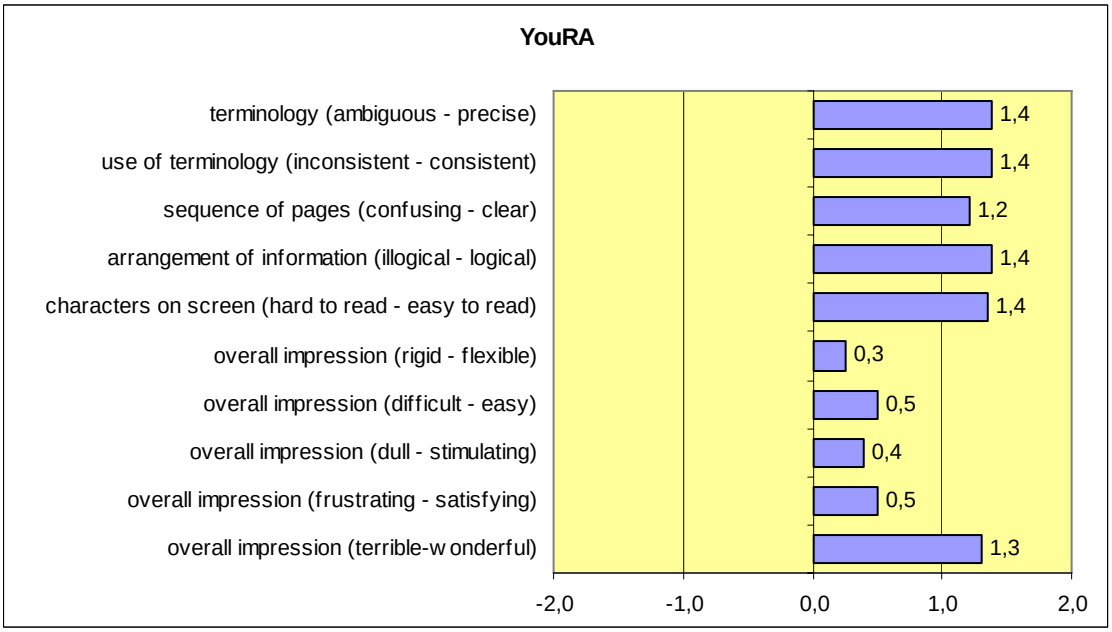
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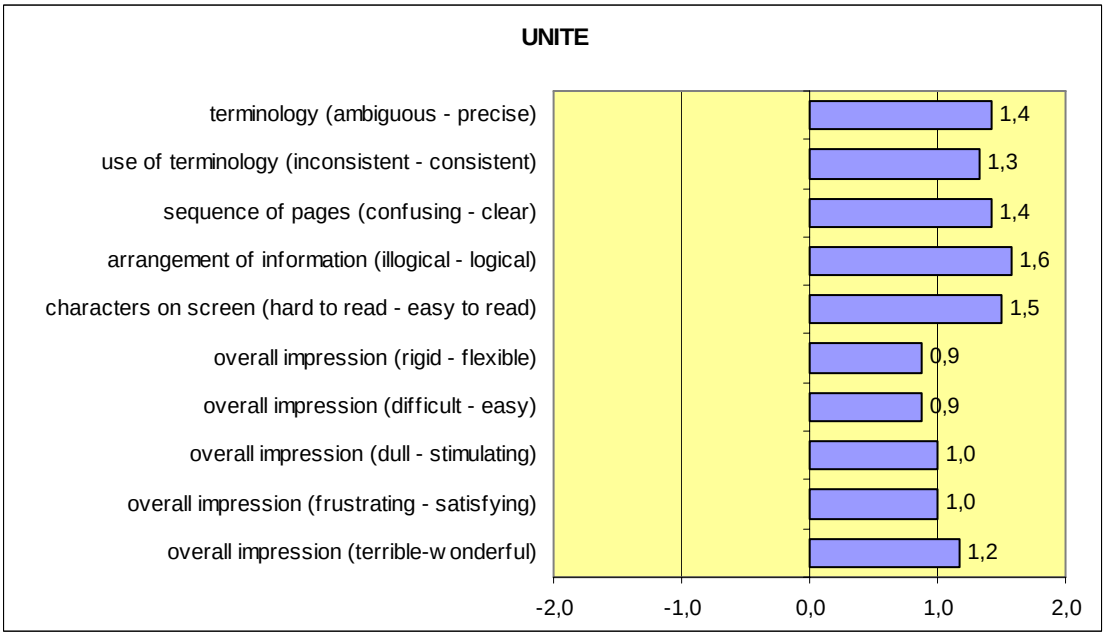
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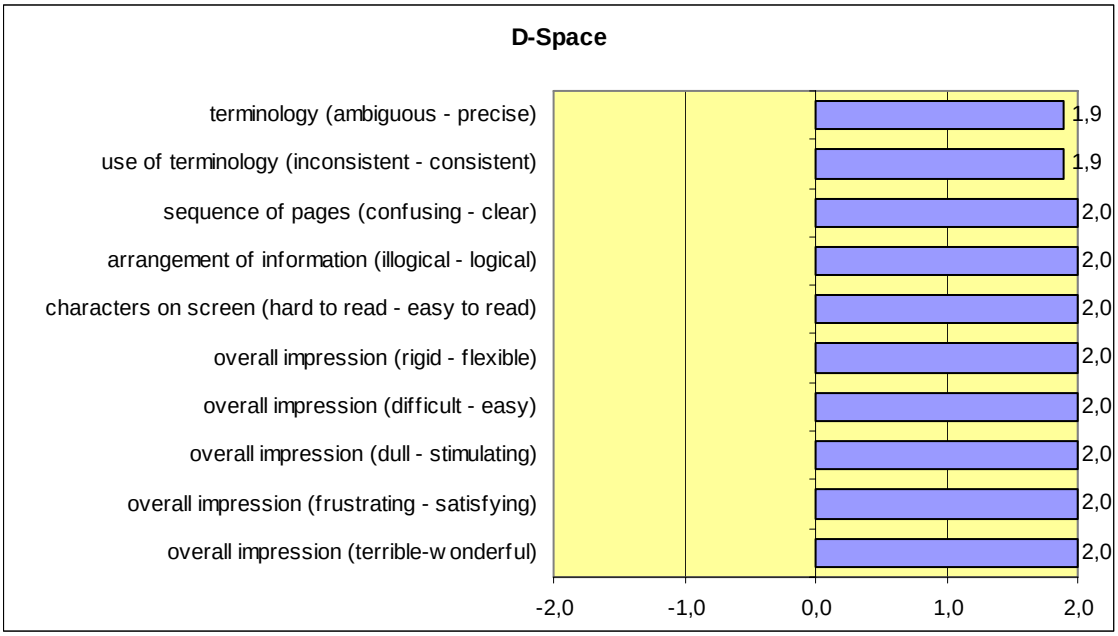
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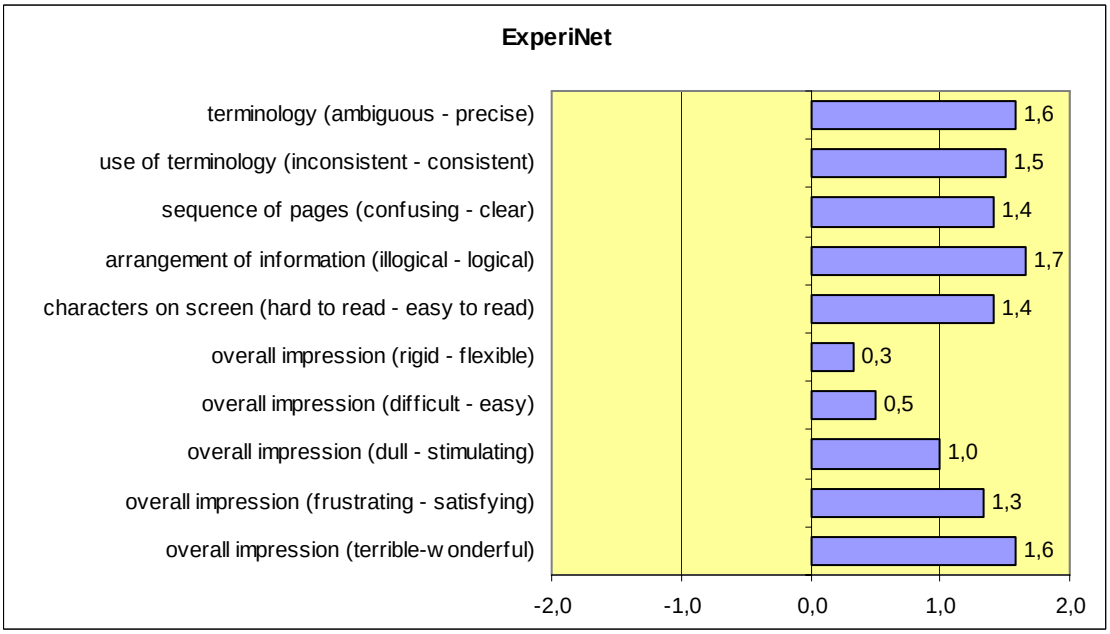
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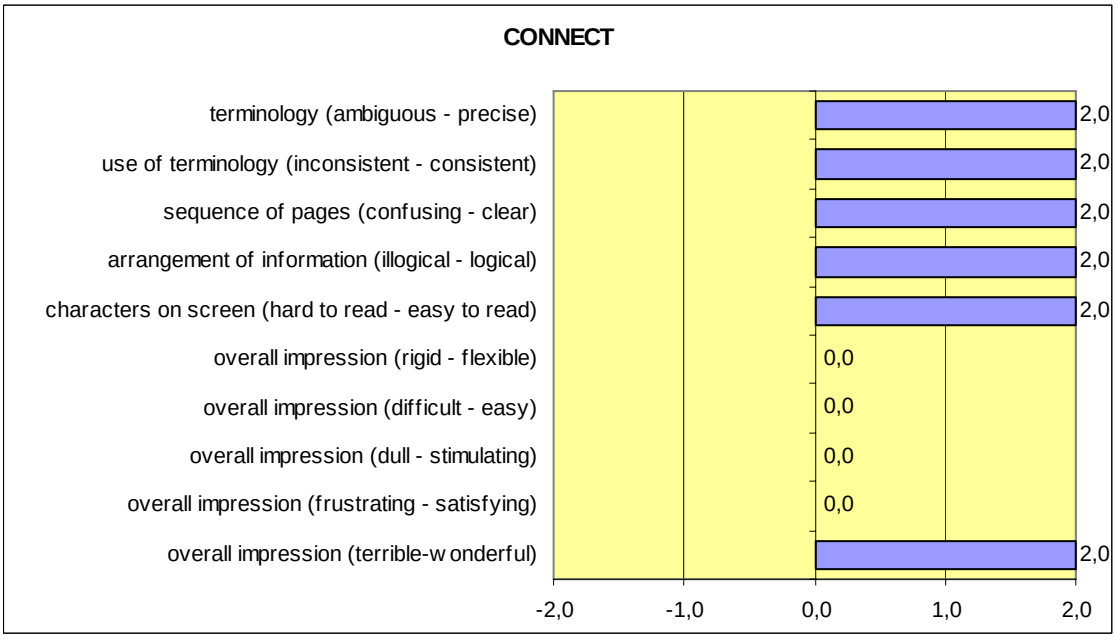
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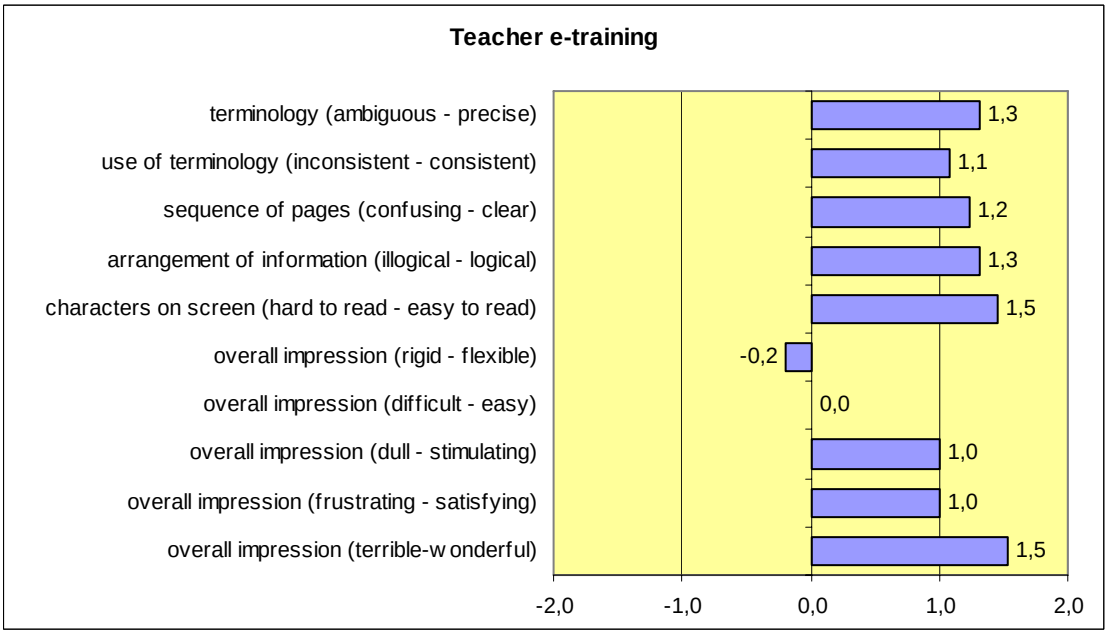
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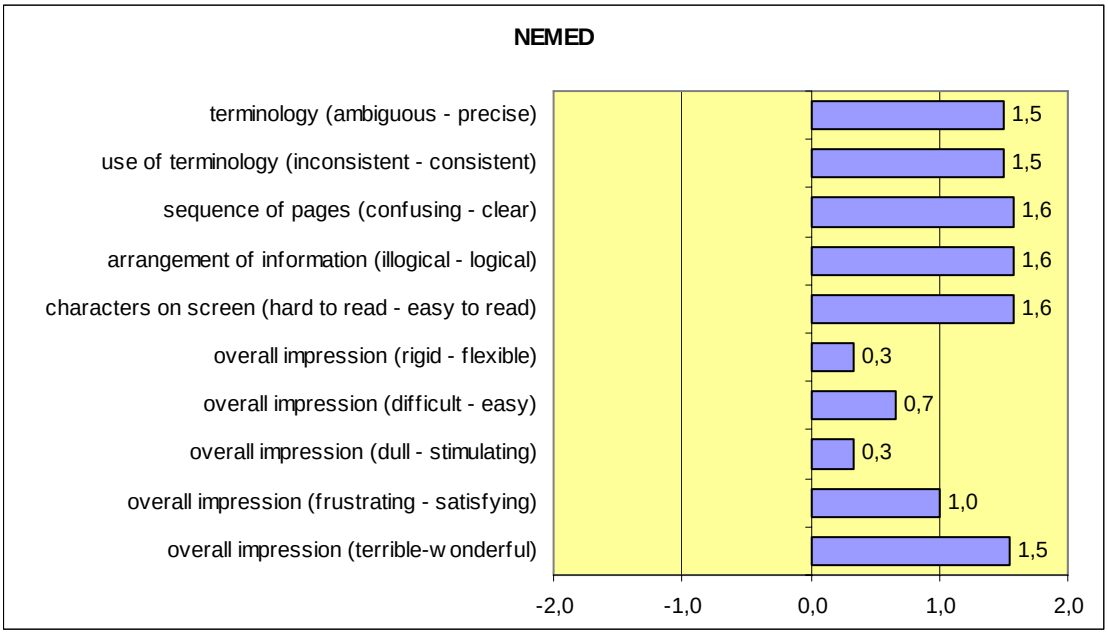
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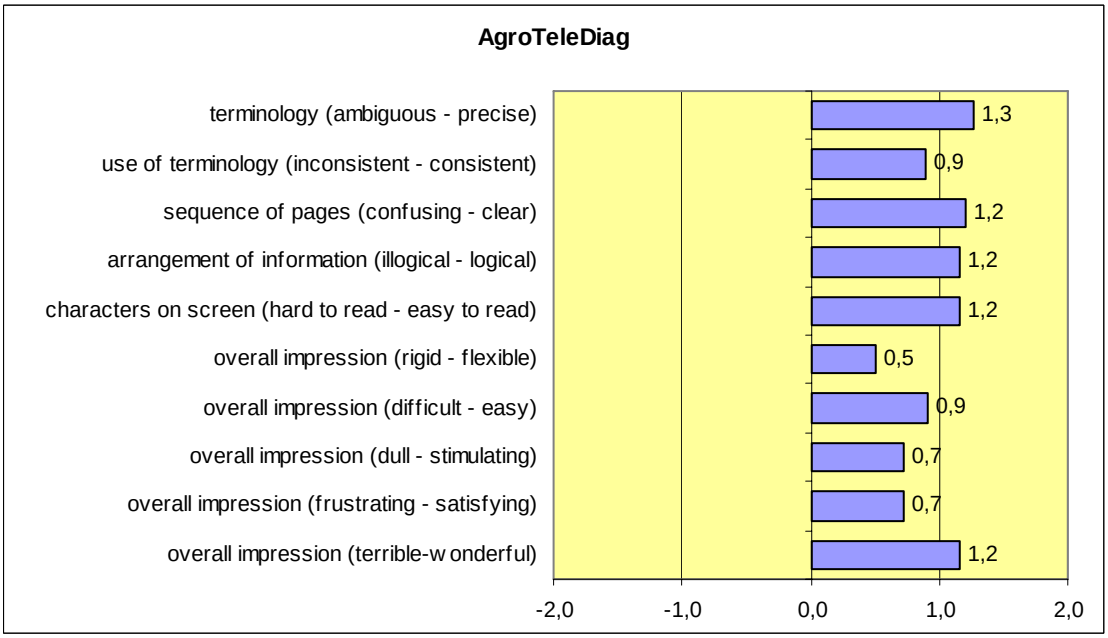
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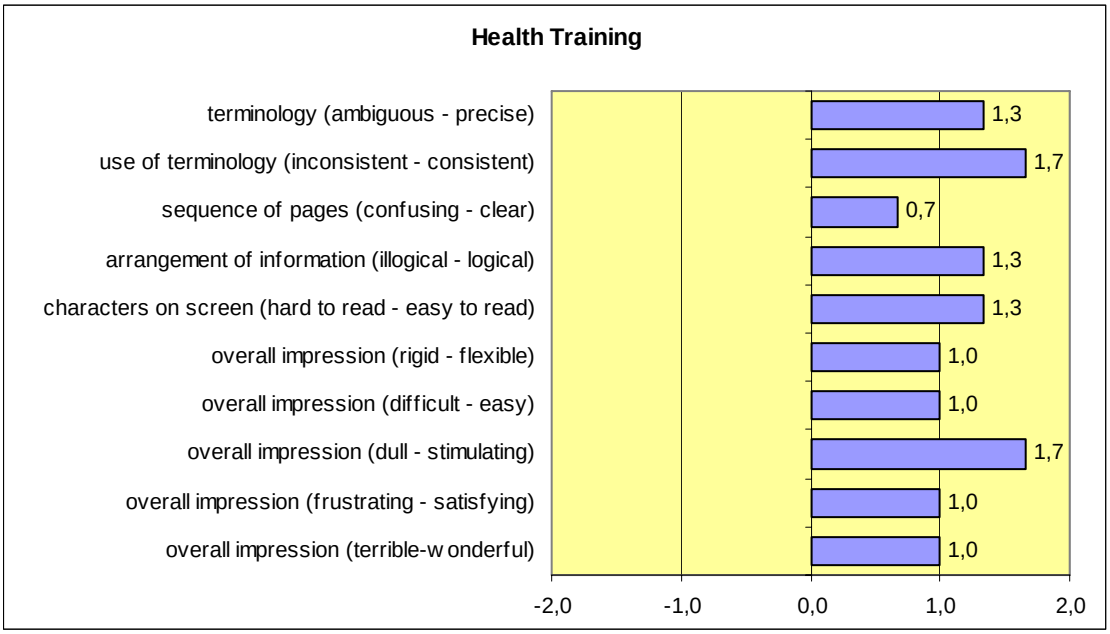
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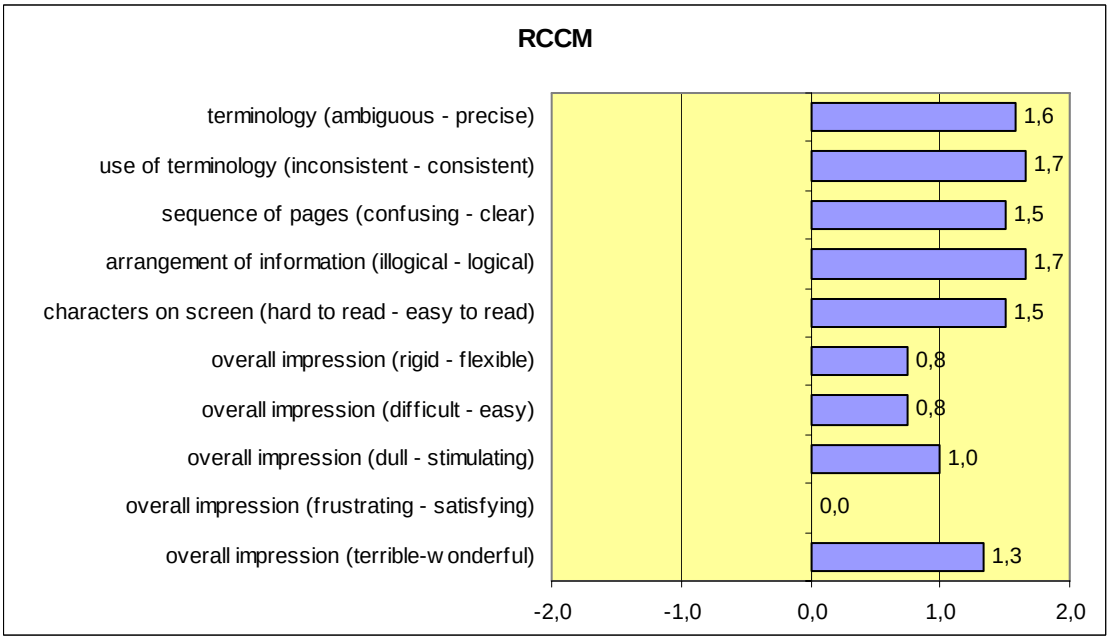
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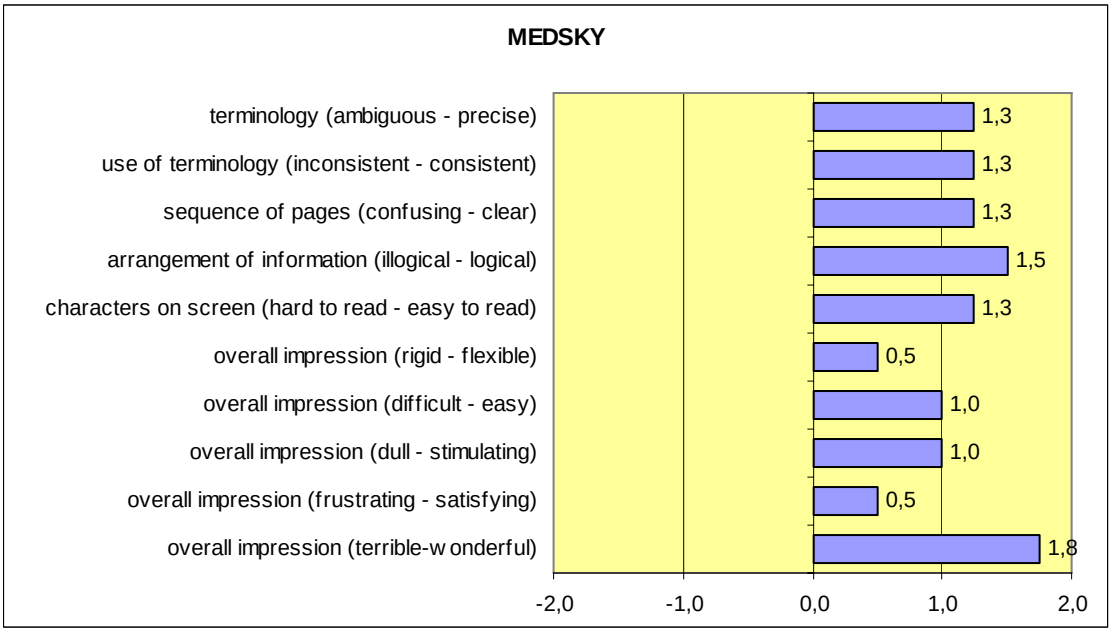
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5. Network usage analysis

5.1 Description of Rural Wings network usage monitoring system

5.1.1 Introduction

As explained in reference document D7.1.1 First Test Run period network activity has been monitored from the hub level using the Satellite Service Providers supervision tools.

The RP2 efforts for the RW network usage analysis were focused on the implementation of a homogeneous Network Usage monitoring system and procedures for the three Rural Wings SSPs (Avanti, Hellas Sat and TTSA/Eutelsat) coordinated by Astrium. The key achievement has been the setting up of a common statistic framework given the numerous differences on the SSP system architectures and equipments that enables us now to compare RW traffic information for all Pilot Sites using the same language and elements no matter the type of satellite access deployed.

Several meetings and teleconferences were organized between the SSPs and Astrium starting from the middle of 2007. The agreed network metrics to be monitored comprise:

- **Traffic Volume**: this includes the total consumed bandwidth.
- **Applications & Protocols**: this information represents the volume distribution between the different applications or protocols used: web browsing (http, https), file transfers (FTP, FTPS), mailing (POP3, SMTP), Videoconference (Skype, Marratech, ...), online streaming (RTSP, Msplayer, ...), Peer to Peer (E-donkey, Ares, ...), etc.
- **Data rate**: this metric tries to reflect an instant measure of the throughput. Depending on the SSP monitoring equipments available, the time sampling will be different. The shorter the sampling time, the more representative the value will be. The measure of this metric is the most complicated one.

Given the traditional asymmetry of the Internet traffic and Internet access, for each metric we will differentiate both traffic directions: Upload (outgoing) and Download (incoming).

These parameters are crucial for the network usage evaluation. Secondary metrics such as the number of simultaneously opened TCP/UDP connections or the number and duration of sessions might be also interesting for the network monitoring. However the definition of such metrics

depends on the satellite hub equipments and thus makes it very difficult to compare results SSPs. Hence they are not included in the common network analysis framework.

The technical evaluation of the system usability includes also the analysis of the system reliability, ie the study of the network anomalies registered. For this purpose, we have identified the key information that will be useful in order to asses this part of the Pilot Sites operation during the Test Run periods. The main points concerning the anomaly tickets are mentioned hereafter:

- **Time evolution of anomalies**: Number of anomalies per month.
- Mechanisms of **incident notification**: Hotline, mail, online form, monitoring system alarms ...
- **Concerned element** by the incident: Satellite modem, antenna, router,...
- **Type of incident**: hardware, software, manipulation, ...
- **Solution applied**: Replacement, Reboot, Re-configuration ...
- **Intervention**: whether the solution has been applied remotely or locally by an on-site team.
- **Resolution time**: the time required for solving the incident.

Once all this raw data is collected (network usage and anomalies), simple additional treatment enables to obtain interesting synthesis figures and charts.

5.1.2 Rural Wings network usage statistics methodology and procedures

In this section we will present the agreed statistical graphs.

i. First hypothesis and recommendations

The temporal unit for the data treatment is the month however additional graphs can be created in order to gather information for the whole time period of the test run. The definition of the "Test Run period" is done by ICCS.

From previous network analysis done in other EC projects like TWISTER, Astrium suggests paying special attention to:

- Traffic base units: clarify if raw data is based on **bits** or **Bytes (octets)** and keep always the same base unit so as to avoid misunderstandings.
- Revise the scale of the statistics: big numbers are difficult to follow and too small ones are no better.
  - if too much traffic use **Giga(Bytes)** instead of **Mega(Bytes)**.
  - if too much data rate use **Mega(bps)** instead of **kilo(bps)**.
- If a pilot site is much more active than the others, it is recommended to make a zoom on the small sites by **limiting the scale** (reduce de max scale to be shown). Unless special situation (too much traffic obscuring activity from other sites), we will not suppress these active sites from the graphs.

ii. Deadlines and roles

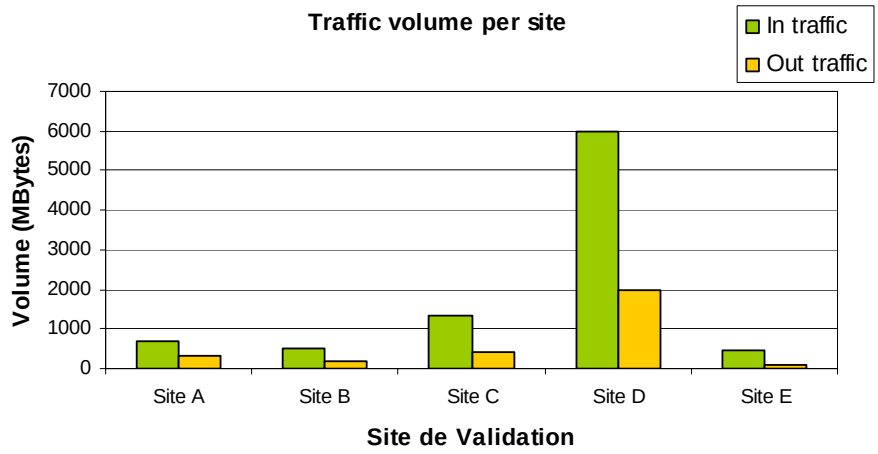
After discussion between the concerned partners, it has been agreed that:

- Raw data collection and first level treatment is done by the Rural Wings SSPs.
- According to the defined format, SSPs will send the statistics graphs, the source excel file and any additional information on the deployed sites behaviour to Astrium for its interpretation.
- The statistics will be sent on a monthly basis for the network usage data and on a three monthly basis for the reliability information.
- Graphs for each month will be submitted to Astrium no later than the 15th day of the following month.

- Some of the graphs will represent data for one single month while other graphs will also include the cumulated data of the previous months.
- SSPs might eventually be requested to complete Astrium analysis of some graphs.

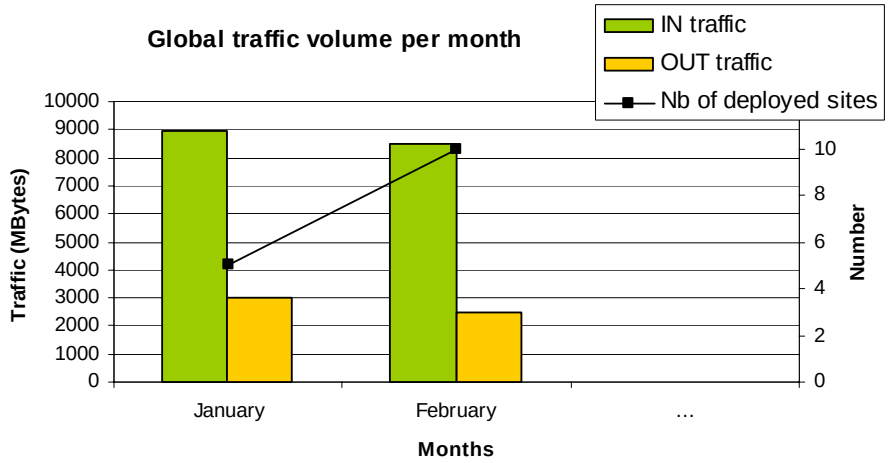
iii. Agreed network traffic statistics

1A Traffic volume per site



This graph includes the monthly traffic volume generated per site. In and Out traffic is in two separate columns.

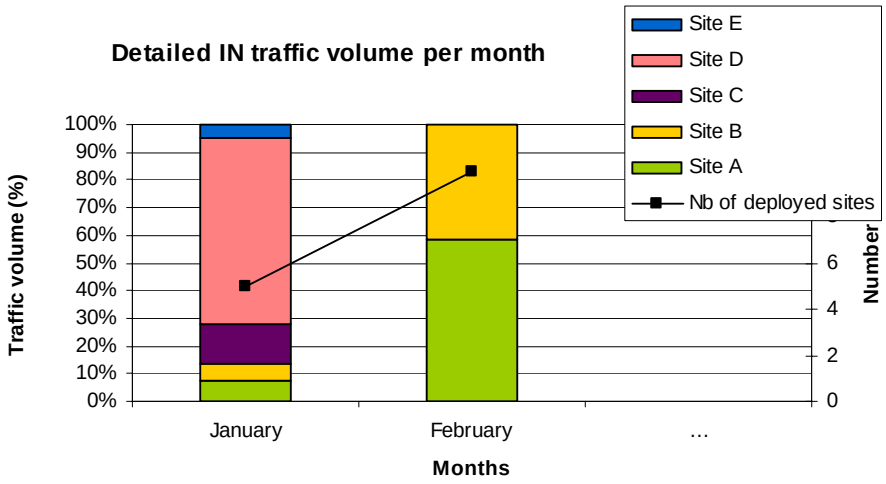
2A Global traffic volume per month



This graph includes the cumulated traffic per month for each SSP. To correctly interpret the data, we add information on the number of the deployed sites per month. Here again In and Out traffic are presented in two separated columns.

The graph keeps the history record of previous months (even for previous Trials Periods) enabling to evaluate the evolution of the Rural Wings site behaviour.

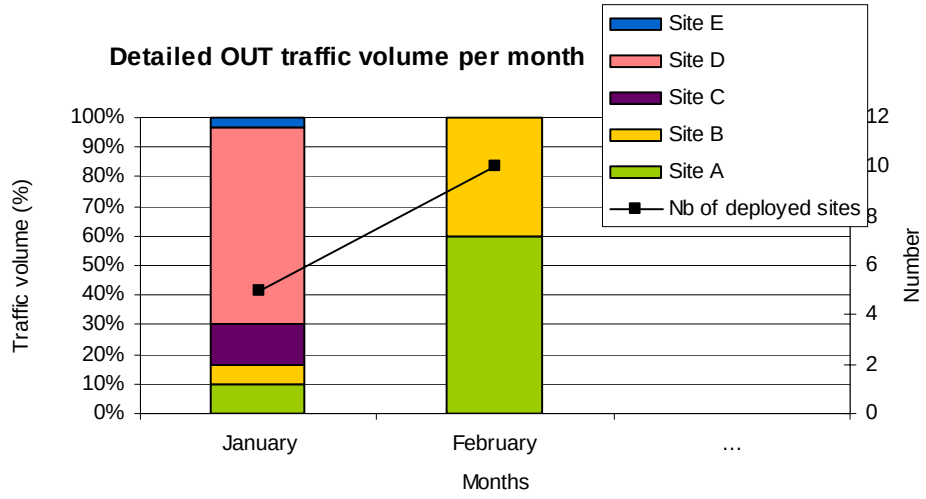
3A Detailed IN traffic volume per month



This graph represents the relative weight of each site per month for the cumulated Inbound (download) traffic volume for each SSP. For interpretation purposes, we add information on the number of the deployed sites per month.

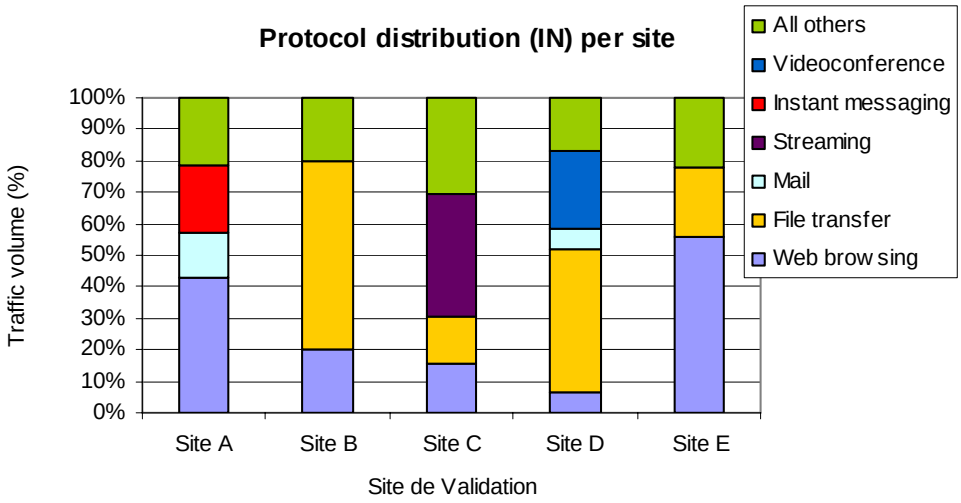
The graph keeps the history record of previous months (even for previous Trials Periods) enabling to understand the evolution of the Rural Wings site behaviour.

4A Detailed OUT traffic volume per month



This is a similar graph to the previous one but describing the Outbound (Upload) traffic.

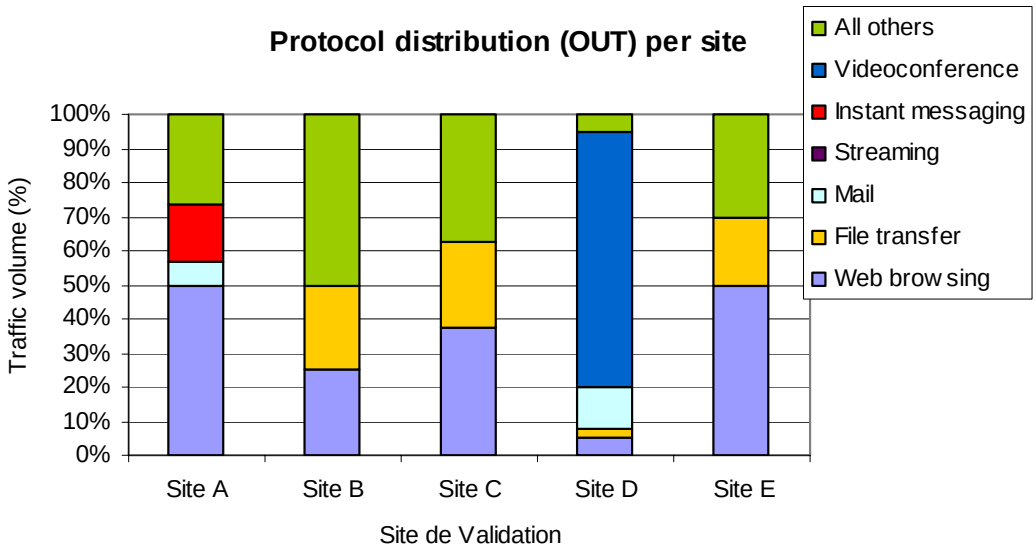
5A Inbound Protocols distribution per site



This graph represents the monthly protocols distribution for the Inbound traffic per site. It will enable comparison of the traffic profile between pilot sites.

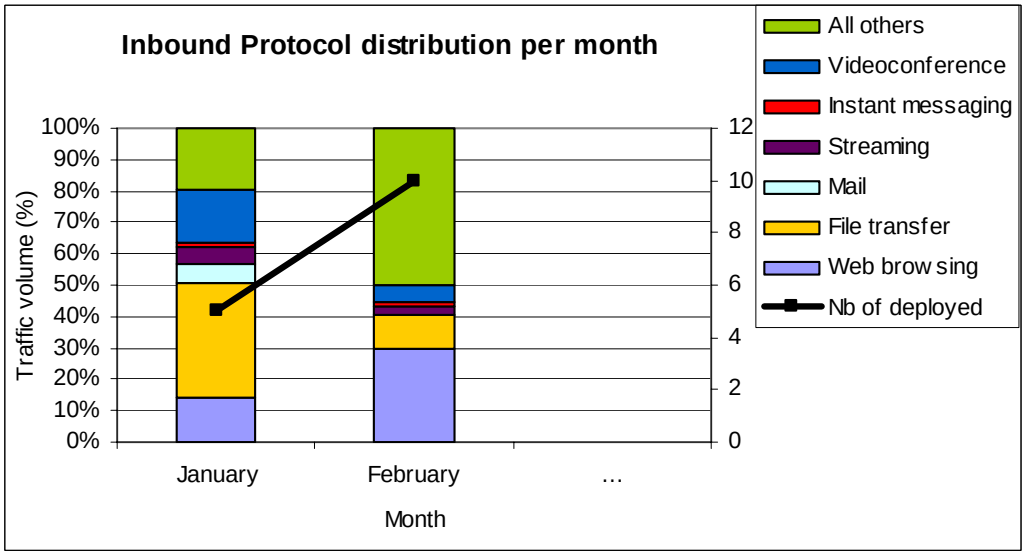
We have identified the most important types of protocols present in the network: web browsing (http, https, ssh, etc), file transfer (FTP, FTPS, ...) etc. The last category "All others" is used to include all the rest of the activity, in general it is includes mostly Peer to Peer traffic.

6A Outbound Protocols distribution per site



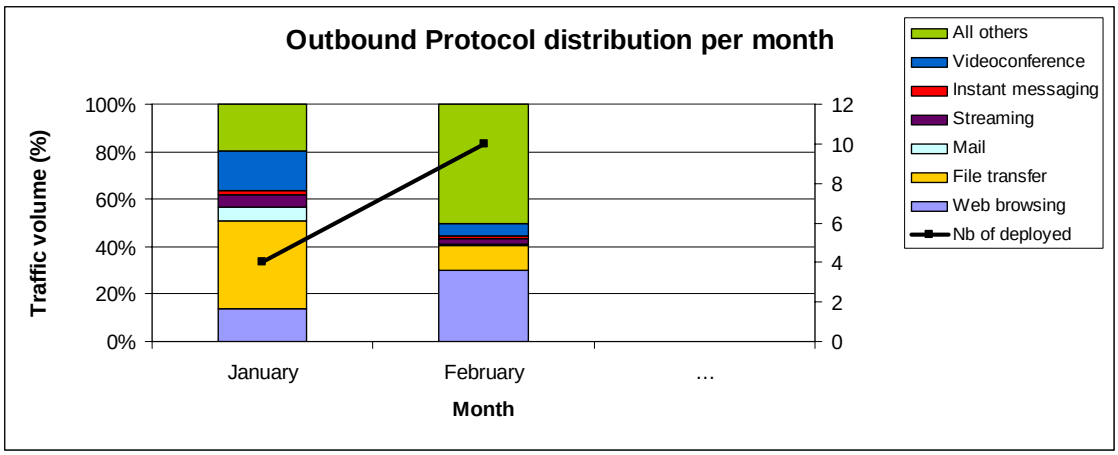
This is a similar graph to the previous one but describing the Outbound (Upload) traffic.

7A Inbound protocol distribution per month



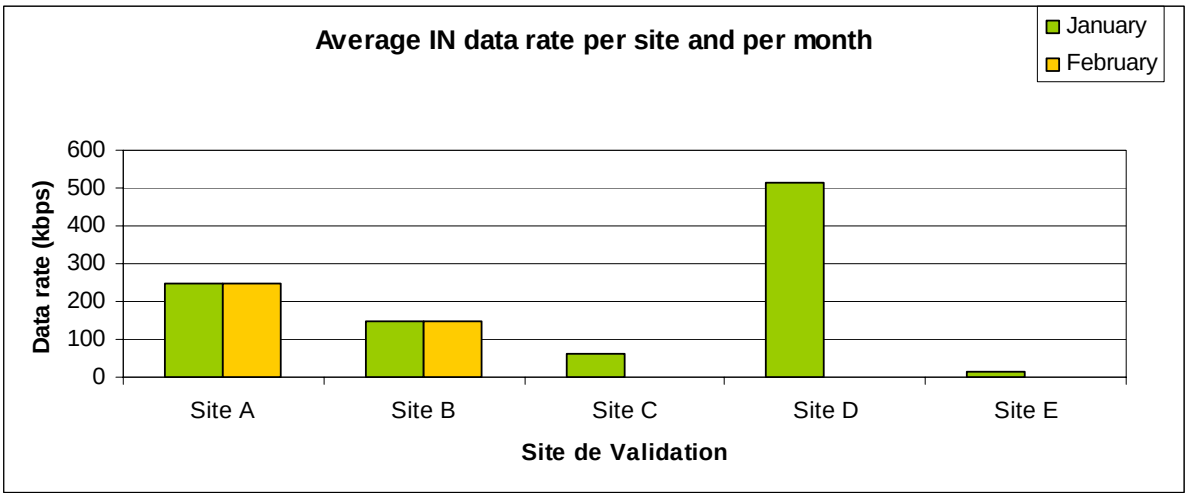
This graph represents the Inbound protocol distribution per month for a given SSP over the total registered traffic. We added information on the number of deployed sites so as to facilitate the graph interpretation. The figure keeps the history record of previous months (even for previous Trials Periods) enabling to evaluate the Rural Wings site behaviour evolution.

8A Outbound protocol distribution per month



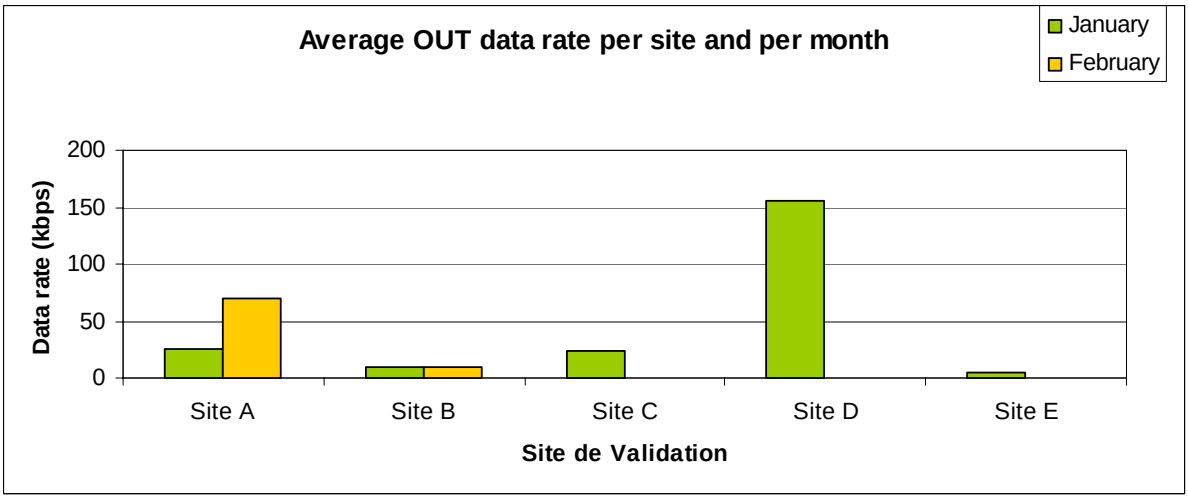
This is a similar graph to the previous one but describing the Outbound (Upload) traffic.

9A Average IN Data rate per site and per month



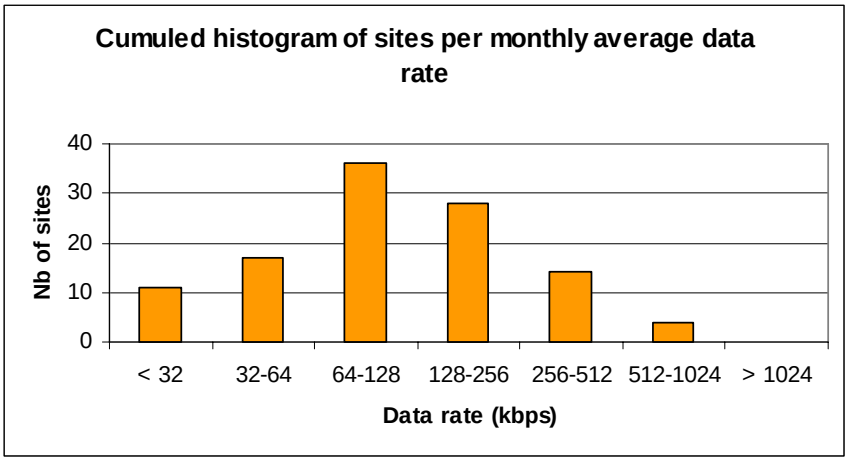
This graph represents the average Inbound data rate per site and per month.

10A Average OUT Data rate per site and per month



This graph is similar to the previous one but concerning the outbound data rate.

11A Histogram of sites per average data rate



This histogram intends to show the statistics distribution of the monthly average data rate. Two graphs will be provided in order to treat the Inbound and Outbound traffic separately. Input for this graph comes from the previous two figures: 9A and 10A.

iv. Reliability statistics

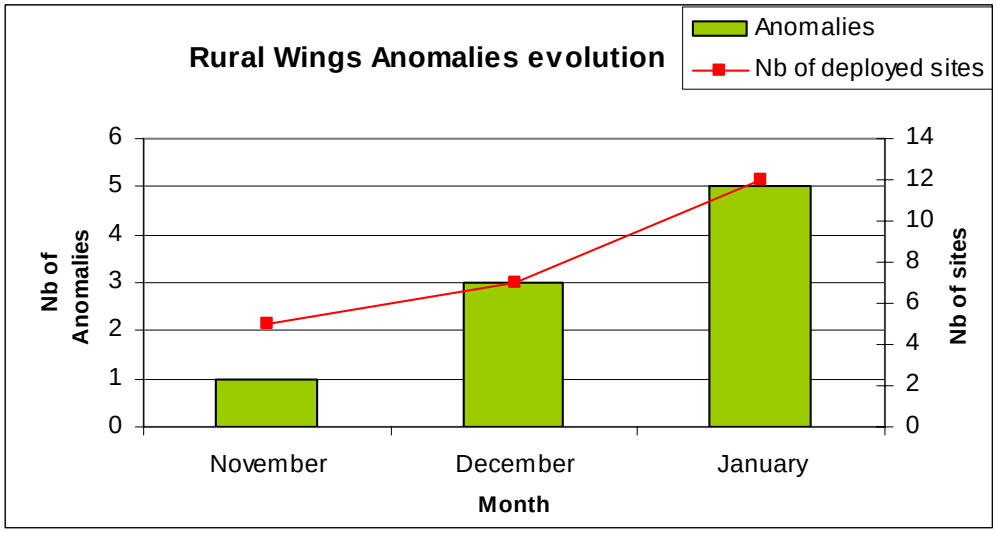
In order to keep a similar incident record trace for all Rural Wings Pilot Sites, Astrium has proposed the RW Anomaly Report Ticket template that is shown in the image below. It has been agreed by all SSPs. The template consists on an *.htm* file that enables quick filling-up, eventually it could be published on line at the SSPs customer care website.

Anomaly Report Reference (1):	RUW.INC.NC.0000X.AAA
Title (2):	Site B: problem with the satellite link
Location (3):	UB - Teo
Status (4):	☐ Open ☑ Closed
Notification (5):	EMAIL
Network Component:	Segment (6) SATELLITE Element (7) SAT MODEM
Failure Type (8):	SOFTWARE
Downtime estimation (9):	1-5 HOURS
Solution:	Type of intervention(10) ON-SITE Intervention carried out by(11) USER Task performed(12) REBOOT

Figure 1. Example of an Anomaly Report record

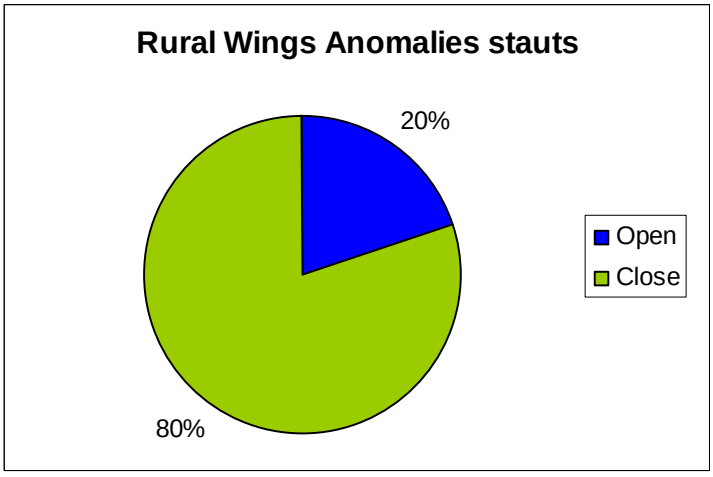
The following graphs can be provided from the treatment of the different parameters reflected on the Anomaly Reports template.

1B Evolution of anomalies



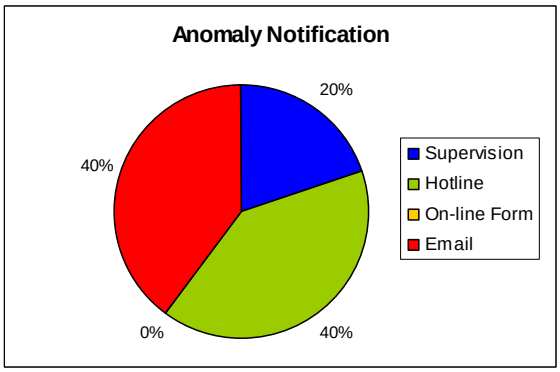
This graph includes information on the number and evolution of anomalies per month for the whole studied period. It is interesting to correlate this information with the number of deployed sites per month.

2B Distribution of incidents per current status



This pie chart represents the distribution of the open or on-going anomalies versus the closed incidents at the time of the reliability assessment evaluation.

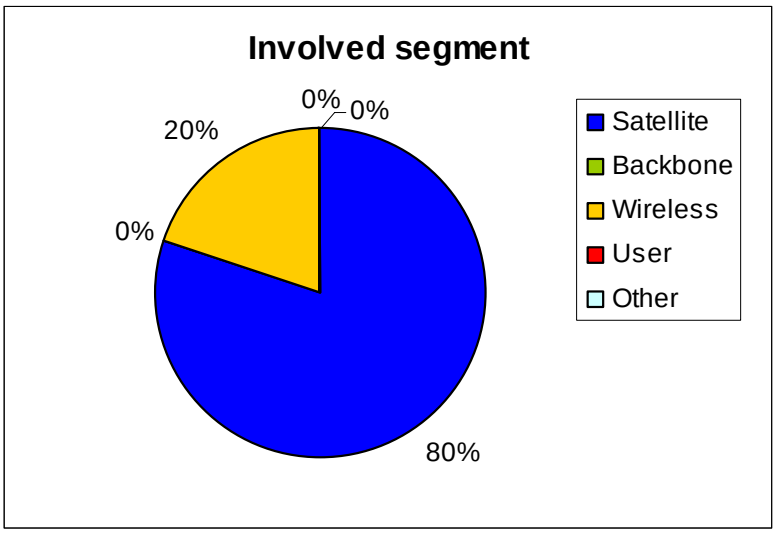
3B Distribution of incidents per type of notification



This graph is used to represent the different ways the incidents have been notified.

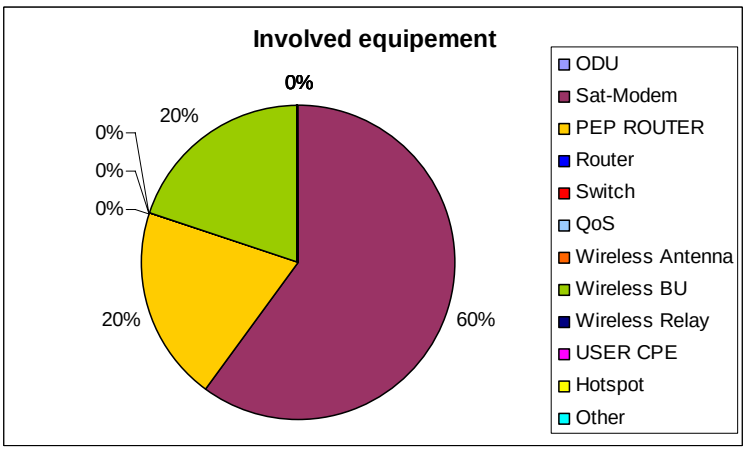
- **Supervision:** The problem has been detected directly by the Rural Wings' partner supervision system.
- **Hotline:** The problem has been notified through the partner Hotline.
- **On-line form:** The problem has been notified through an on-line form.
- **Email:** The problem has been notified by mail to the partner hotline email.

4B Anomaly reports per involved segment



This image represents the distribution of anomalies per network segment.

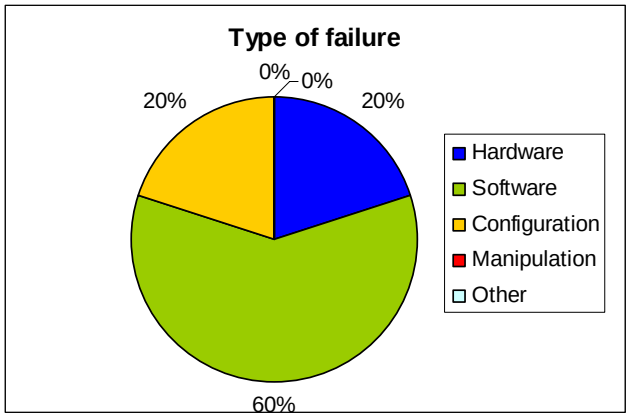
5B Distribution of incidents per equipment



This graph represents the distribution of the anomalies per concerned equipment.

- The Satellite segment includes the following equipments:
  - ODU or SAT-MODEM or PEP ROUTER for Avanti and Hellasat terminals;
  - ODU, SAT-MODEM for TTSA terminals
- For the backbone segment the possible failure equipments are:
  - ROUTER or QOS.
- For the wireless segment the problem can be found at the following equipments:
  - WIRELESS ANTENNA, WIRELESS BU, WIRELESS RELAY, USER CPE or HOTSPOT (if it is a Rural Wings Hotspot).
- For the user segment, failures can take place on the following equipments belonging to the user:
  - HOTSPOT (end-user Hotspot), SWITCH/ROUTER (switch or router at the user premises) ot PC.
- Any other equipment not described before will belong to the Other category. For instance UPS equipment or cabling elements.

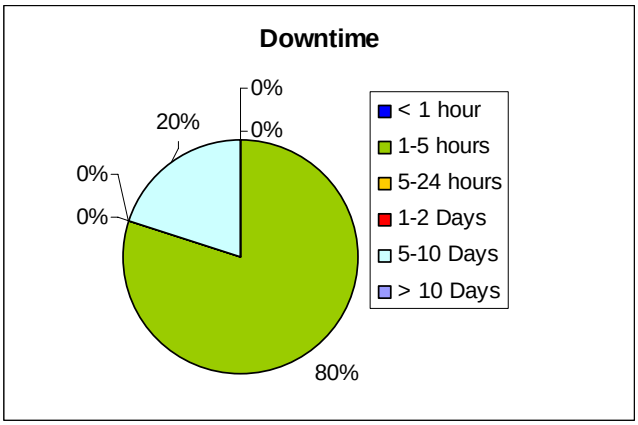
6B Distribution of anomalies per type of failure



This image represents the distribution of anomalies per type of failure. The different breakdown causes that we can find are presented below:

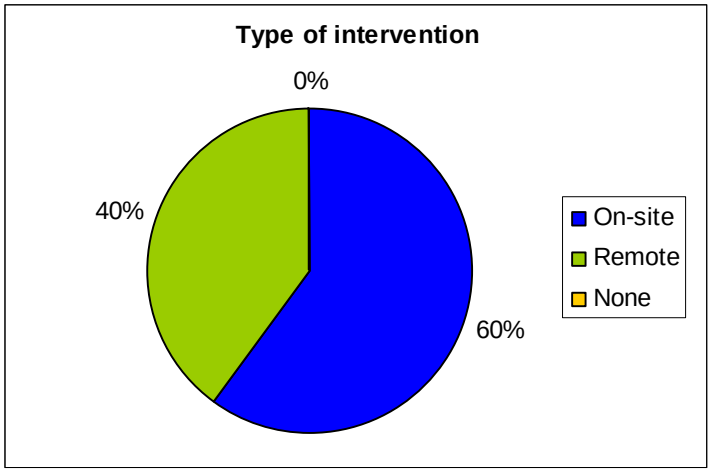
- **Hardware:** the equipment (or any of its components, such as power supply) is damaged and must be repaired or replaced.
- **Software:** the equipment crashes or loses its configuration and it is necessary to reboot it. If the anomaly is related to a firmware change/upgrade, this is the option to be selected.
- **Configuration:** failures related to a configuration error (wrong IP address, wrong value for a particular parameter, a particular option has not been activated, etc).
- **Manipulation:** in this case the anomaly appears following a manipulation performed by User, Site Administrator or Site Coordinator.
- **Other:** example of other causes of failure to consider are electric network instability in the building, bad weather conditions (storms…), supervision software failure, service down during a maintenance test, humidity at the backbone location, etc.

7B Distribution of incidents per downtime



In this image we try to estimate the downtime period until the problem has been resolved.

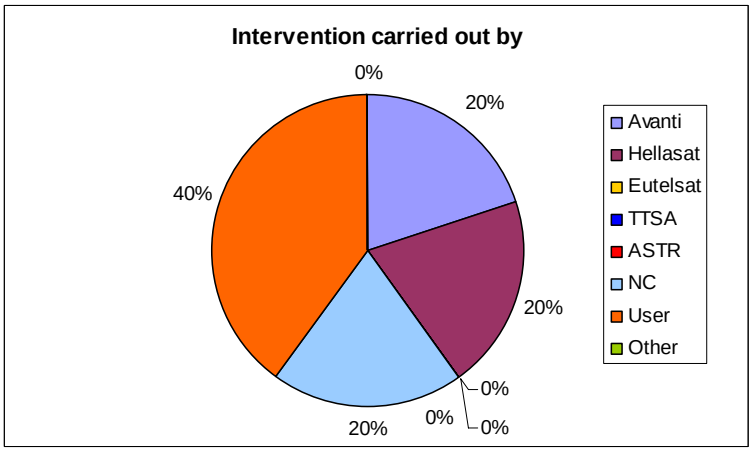
8B Distribution of anomalies per type of intervention



The objective of this graph is to present how was carried out the intervention to solve the problem:

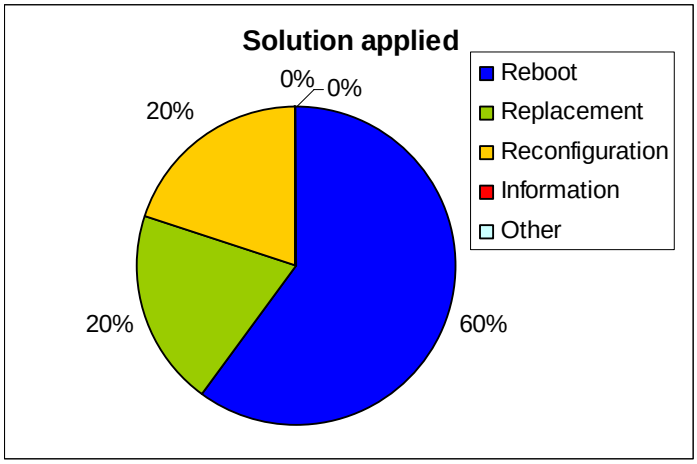
- **On-site:** intervention was performed on-site either by a technical team sent to the site, by the National Coordinator or by a local user.
- **Remote:** intervention was performed remotely by the Rural Wings support team.
- **None:** no intervention has been required to solve the problem; it was solved by itself.

9B Distribution of intervention per participant



The aim of this figure is to show which Rural Wings actor carried out the intervention.

10B Distribution of incidents per type of solution applied



This graph represents the distribution of the registered anomalies depending on the task performed in order to solve the incidence:

- **Reboot:** Solution usually applied for software failures.
- **Replacement:** Solution usually applied for hardware failures.
- **Reconfiguration:** Solution usually applied for configuration or manipulation failures.
- **Information:** Solution usually applied for manipulation failures.
- **Other:** Other solutions that could be applied, such as the pointing adjustment or correction for outdoor antennas, etc.

5.1.3 Rural Wings SSP monitoring system implementation tools

In order to be able to produce the complete Rural Wings network assessment as described in the previous sections, the three Satellite Service Provides have dedicated important efforts in RP2 to adapt and/or implement (depending on the cases) their network monitoring and reporting systems. Description of these implementation works and the final system configuration is provided in this present section.

v. Avanti Traffic Monitoring platform

Description of the monitoring system (hardware + software)

Avanti has developed a proprietary software, called **the Operational Support System** (OSS) for managing DVB-RCS systems that has already been explained in deliverable document D5.1 (issue 2).

The main tool used for gathering usage and performance statistics is a hardware/software device about the size of a DVD player (see **Fehler! Verweisquelle konnte nicht gefunden werden.**) called Netenforcer/NetExplorer. It provides ISPs with:

- bandwidth management, and
- network performance statistics

Figure 2. Netenforcer

The Avanti Netenforcer is located at the satellite hub between the customer terminal and the Internet as shown hereafter by the following scheme (**Fehler! Verweisquelle konnte nicht gefunden werden.**)

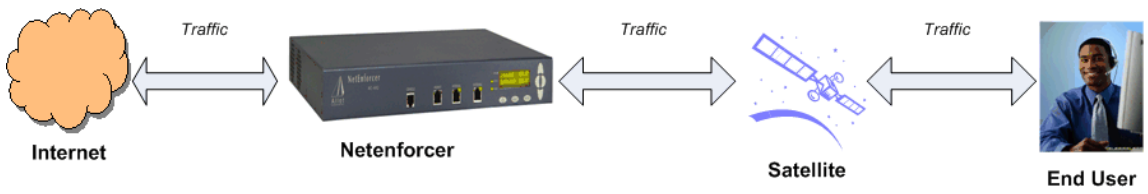


Figure 3. Architecture

All traffic passing between the end user and the Internet, via the satellite, flows through the Netenforcer. The Netenforcer can examine every IP packet and take an appropriate action. There are several models of Netenforcer suitable for all sizes of operation, from SME to Enterprise. Avanti has a mid-range device that can handle traffic up to a maximum symmetrical throughput of 256 Mbps.

Main monitoring features of the supervision system and equipments

The Netenforcer can be passive thus taking no action on the packets and allow data to flow as if the device was not present. But the power of the device lies in its ability to take actions defined by the ISP in support of its business model and operations policy (control of killer applications, prioritization of access between different classes of users and implicit access control).

The operator interacts with the device through rules. The use of Netenforcer as a traffic shaping and QoS management devices has been addressed in deliverable documents D2.2/D5.1 and D5.4.

The Netenforcer also collects statistics for a later display and analysis, either by using the NetExplorer software (dedicated software used to monitor and configure several Netenforcers and at the same time adding extra accounting functionalities) or by exporting traffic information to a statistical data package.

Most common statistics are:

- Bandwidth consumption
- Most active hosts
- Most active protocols
- Most active 'pipes' (groups of users)

Monitoring system configuration for the Rural Wings network usage analysis

Avanti collects traffic information uninterruptedly for each terminal and stores them on a monthly basis. These statistics are available in .csv form.

For the Rural Wings statistics treatment, Avanti currently:

1. Reads the .csv files, using macros, into one consolidated spreadsheet

2. Processes the statistics using macros, for example to identify the sites and to map protocols to the groups required by Rural Wings
3. Aggregates the statistics using various techniques, such as Pivot tables, into the format required by Rural Wings. Astrium has provided an example spreadsheet to be used in order to provide homogeneous graphs. We have transcribed the data to the spreadsheet provided by Astrium.

Example of "raw data" extracted from the monitoring system

Two examples of 'raw data' are presented in the images below:

	A	B	C	D	E	F	G	H	I	J	K
1	From	To	Pipe	Total Banc	In Bandwi	Out Bandv	In Packets	Out Packe	New Conr	Dropped Connections	
2	Jan 01 200	Jan 01 200	01-00033 (	0.192	0.135	0.056	404455	395789	12811	0	
3	Jan 02 200	Jan 02 200	01-00033 (	0.113	0.078	0.035	345344	344014	11872	0	
4	Jan 03 200	Jan 03 200	01-00033 (	0.179	0.088	0.091	391729	409237	14300	0	
5	Jan 04 200	Jan 04 200	01-00033 (	0.594	0.489	0.104	705300	686255	20218	0	
6	Jan 05 200	Jan 05 200	01-00033 (	1.257	1.169	0.089	1140890	976046	16570	0	
7	Jan 06 200	Jan 06 200	01-00033 (	0.171	0.143	0.028	351246	275213	16010	0	
8	Jan 07 200	Jan 07 200	01-00033 (	0.241	0.195	0.046	472966	485972	17854	0	
9	Jan 08 200	Jan 08 200	01-00033 (	0.698	0.623	0.075	807610	666523	17885	0	
10	Jan 09 200	Jan 09 200	01-00033 (	0.281	0.244	0.037	477261	408896	11614	0	
11	Jan 10 200	Jan 10 200	01-00033 (	0.204	0.171	0.033	428301	375739	9355	0	

1-33-January_total_volume

Figure 4. Avanti Data volume raw data

	A	B	C	D	E	F	G	H	I
1	From	To	Protocol	Total Banc	% Total Ba	In Bandwi	Out Bandwidth (Kbps)		
2	Nov 01 20(	Nov 29 20(	HTTP	7.6	66.3	6.7	0.9		
3	Nov 01 20(	Nov 29 20(	All Others	2.6	23.2	2.1	0.5		
4	Nov 01 20(	Nov 29 20(	FTP	0.4	3.8	0	0.4		
5	Nov 01 20(	Nov 29 20(	[IP/UDP:12035]	0.4	3.3	0.4	0		
6	Nov 01 20(	Nov 29 20(	MS Player	0.2	1.8	0.2	0		
7	Nov 01 20(	Nov 29 20(	SSL	0.2	1.7	0.1	0.1		
8									
9									

1-145_November_protocols

Ready

Figure 5. Avanti Protocols distribution raw data

vi. TTSA Traffic Monitoring platform

Description of the monitoring system (hardware + software)

TTSA monitoring system has been implemented during the last quarter of 2007. It is also based on the Allot Traffic Shaping and Accounting products including an Allot Netenforcer already deployed at the Skylogic satellite NOC in Turin and a Allot NetXplorer server in TTSA Secure Hosting Platform in Paris.

Monitoring system configuration for the Rural Wings network usage analysis

The following diagram illustrates the overall Telemedicine Technologies network infrastructure and highlights the equipment which plays a role in monitoring traffic usage over the satellite network:

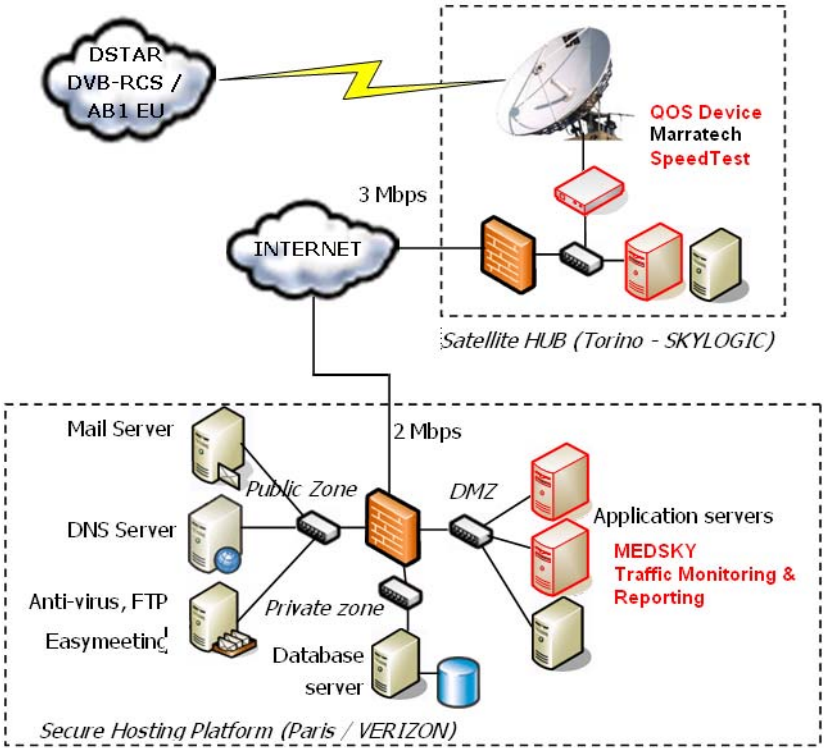


Figure 6. Telemedicine Technologies Network Infrastructure

The ALLOT NetEnforcer traffic shaping device (QoS Device in the figure) is placed behind the satellite network, effectively controlling all transmissions from satellite terminals to the hosted application servers or the Internet and vice-versa. This device records all inbound and outbound traffic but it has an extremely limited storage capacity and so we have deployed an ALLOT NetXplorer server within the Telemedicine Technologies production platform in Paris.

Traffic data processing flow and tools

The NetXplorer server extracts the monitoring data from the NetEnforcer device at 30 second intervals and stores this information in its internal database. However the data thus collected is progressively summarised over time so as to limit storage requirements. In order to preserve the 30 second resolution, we have created a number of automated reports which are generated on an hourly basis by the NetXplorer server. Once generated, the reports are transferred to the MedSky platform by the MedSky Monitoring Agent. There, the information is received by the MedSky Monitoring Gateway which processes the reports and adds the extracted information to the MedSky Database via the MedSky Persistence Layer. Note that all the Medsky modules of the Figure 7 as well as the Speedtest server are TTSA in-house developments.

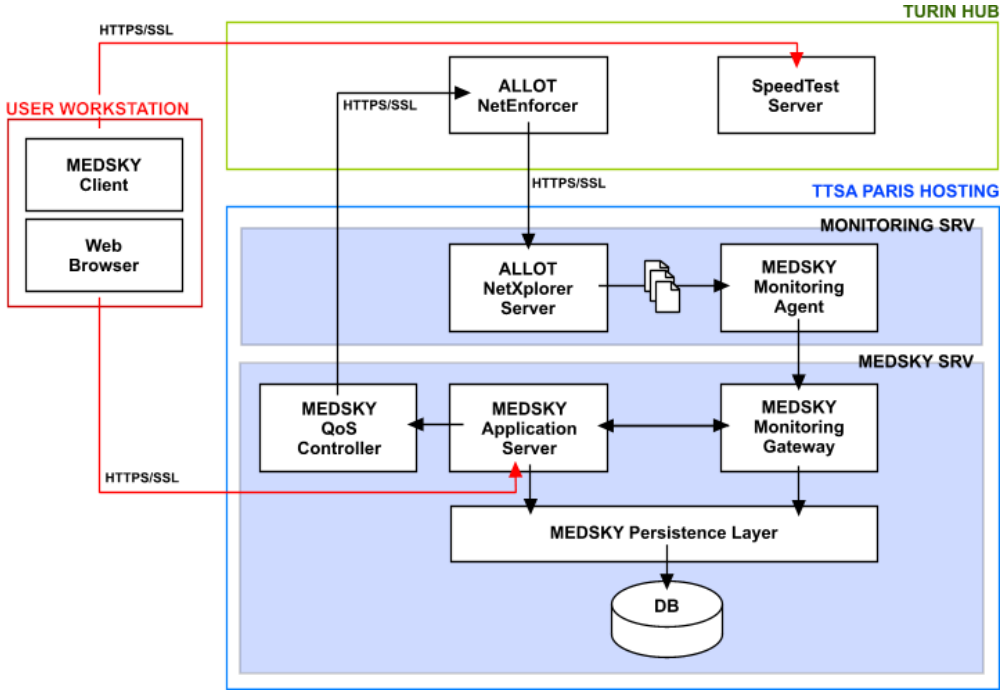


Figure 7. Logical depiction of the monitoring data flow

Once archived in the MedSky database, we are free to access and manipulate the traffic usage data. For instance, in order to enable satellite users to perform self regulation, traffic curves have been made available to users via the MedSky client application (Figure 8). Users with the appropriate access profile can consult the charts related to their terminal or the group of terminals which they manage and export the underlying monitoring data in CSV format (currently this is restricted to Rural Wings national coordinators). This is a recent addition to the MedSky client and is continuously being enhanced and extended.

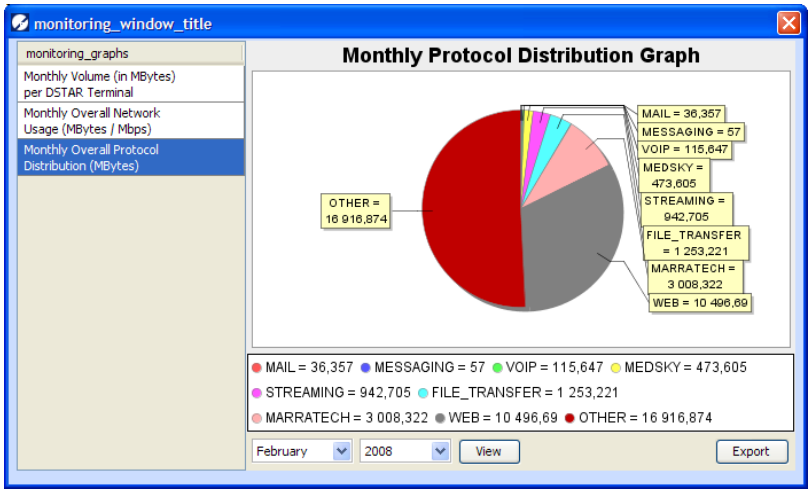


Figure 8. The current state of traffic monitoring within the MedSky client

vii. Hellas Sat Traffic Monitoring platform

Description of the monitoring system (hardware + software)

Hellas Sat is using a Packeteer PacketShaper 1700 (max. throughput 45 Mbps) as monitoring equipment deployed at satellite hub level in order to provide the specific traffic analysis statistical data for the Rural Wings project. The firmware version of the equipment is the v8.2.2g1. This equipment is used to monitor 24/7/365 the traffic IN and OUT of the RW Pilot Sites in order to gather the network usage statistics.

Main monitoring features of the supervision system and equipments

Detailed presentation of the equipment can be found in the Packeteer website:

- http://www.packeteer.com/products/packetshaper/

The next image presents the Hellas Sat monitoring device.

Figure 9.The PacketShaper from Packeteerused for HELLAS SAT monitoring

The Hellas Sat QoS Management Device offers performance statistics, threshold monitoring, high-level problem indicators, and performance graphs.

Current and historical performance data can be seen in intuitive tables and graphs, in a MIB (Management Information Base), via an XML API, or as raw data (CSV file) (see).

The event facility can alert network operator by emails, SNMP traps, and/or Syslog message, when conditions of interest occur.

But the QoS Management device doesn't simply collect data. It also organizes findings, synthesizes conclusions, and flags problems early to help managing performance more effectively.

The traffic measurement allows differentiation of the traffic with regard to the network layer (IP, ICMP, IPSec or other), transport layer (TCP or UDP) and application layer (SNMP, HTTP, FTP) based on the network with Layer 7 Plus technology.

The accounting is based on the IP address and network address of each terminal or a group of terminals.

The QoS Management Device is a GUI web application and it uses the HTTPS protocol.

Monitoring system configuration for the Rural Wings network usage analysis

The Hellas Sat system has been configured in the following way:

- The outbound and inbound traffic is defined depending upon its direction with destination the Internet or the satellite terminals correspondingly. Thus as outgoing traffic is defined the one that is required from the satellite terminal and as incoming the one that is forwarded from the satellite host to its destination via the Internet. Consequently there are two massive groups the Outbound and Inbound ones.
- The entire host subnets that are required to be monitored and analysed are discriminated based in their network topology. Particularly, the 14 RW remote sites are classified in 14 discrete groups.
- The traffic that flows through the traffic analyser is filtered based upon the subnet IP. When the IP matches with the criteria defined within the specific group, then the system captures all the packets which are analysed and measured with a high sampling rate. The whole procedure is done for both the outgoing and incoming traffic packets.

Example of "raw data" extracted from the monitoring system

An example of raw data for a period of five days on one day sample is provided in the next images.

time	/Outbound-avg-bps	/Outbound/Localhost-avg-bps	/Outbound/RW_27_in-avg-bps	/Outbound/RW_27_in/ActiveX-avg-bps	/Outbound/RW_27_in/BITS-avg-bps	/Outbound/RW_27_in/FlashVideo-avg-bps	/Outbound/RW_27_in/FTP-avg-bps	/Outbound/RW_27_in/GoogleEarth-avg-bps	/Outbound/RW_27_in/GoogleVideo-avg-bps	...
03-Feb-2008 13:00:00	2890044	0	8892	12	0	1662	2	0	2	...
02-Feb-2008 13:00:00	2845170	0	7386	1	208	1604	1	203	6	...
01-Feb-2008 13:00:00	3180159	0	11577	7	28	2084	1	0	5	...
31/01/2008 13:00	2735977	0	8293	5	48	1439	0	0	8	...
30/01/2008 13:00	3198027	0	6511	0	117	1208	1	0	1	...

Table 1. Partial Raw data gathered for the INBOUND traffic of a Hellas Sat RW Terminal

time	/Inbound-avg-bps	/Inbound/Localhost-avg-bps	/Inbound/RW_27_out-avg-bps	/Inbound/RW_27_out/ActiveX-avg-bps	/Inbound/RW_27_out/BITS-avg-bps	/Inbound/RW_27_out/FlashVideo-avg-bps	/Inbound/RW_27_out/FTP-avg-bps	/Inbound/RW_27_out/GoogleEarth-avg-bps	/Inbound/RW_27_out/GoogleVideo-avg-bps	...
03-Feb-2008 13:00:00	8309332	0	106717	295	0	51323	3	0	1	...
02-Feb-2008 13:00:00	8889326	0	102621	1	5467	49728	1	2114	3	...
01-Feb-2008 13:00:00	9183480	0	205601	148	591	64788	1	0	3	...
31/01/2008 13:00	9406261	0	101800	147	1077	43967	0	0	106	...
30/01/2008 13:00	9361454	0	84583	0	2298	36826	1	0	1	...

Table 2. Partial Raw data gathered for the OUTBOUND traffic of a Hellas Sat RW Terminal

The traffic analyzer is running the routines that are matching the filtering requirements approximately every 1 minute. Then it stores internally to its HW disk all the measurements and traffic analysis in terms of packets characteristics.

A central database server is directly connected to the inner interface of the Packet Shaper By using scheduled procedures all the data are forwarded and stored in .csv format.

Later Excel treatment enables to synthesize this information in the agreed RW network monitoring format.

5.2 Presentation of first Test Run period results

This paragraph will present the network assessment results issued from the first Test Run period.

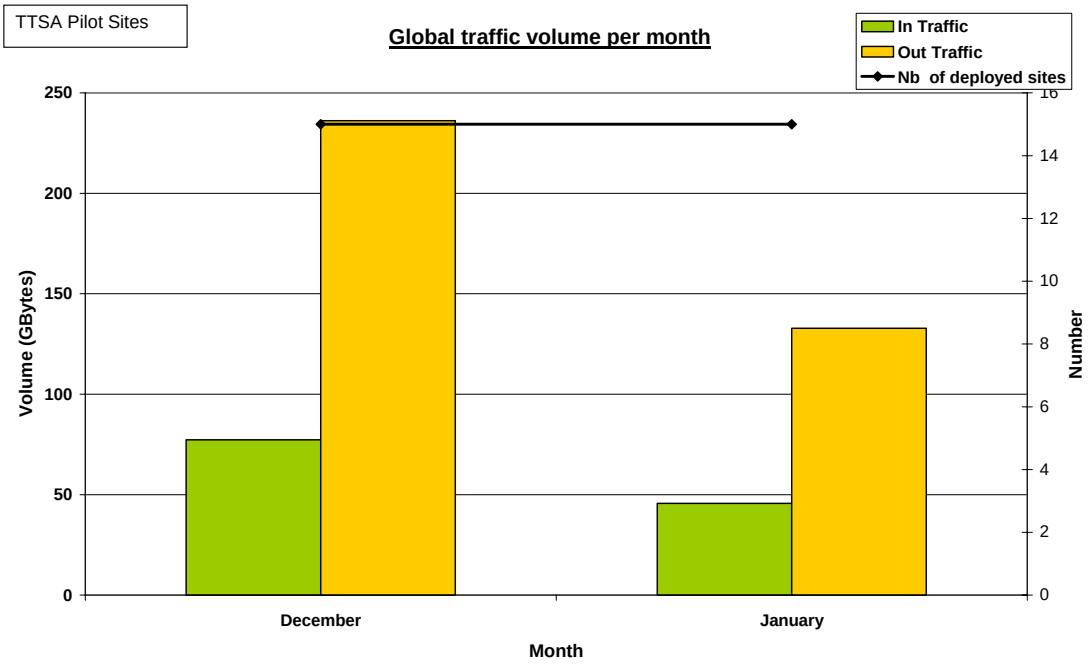
5.2.1 Network usage

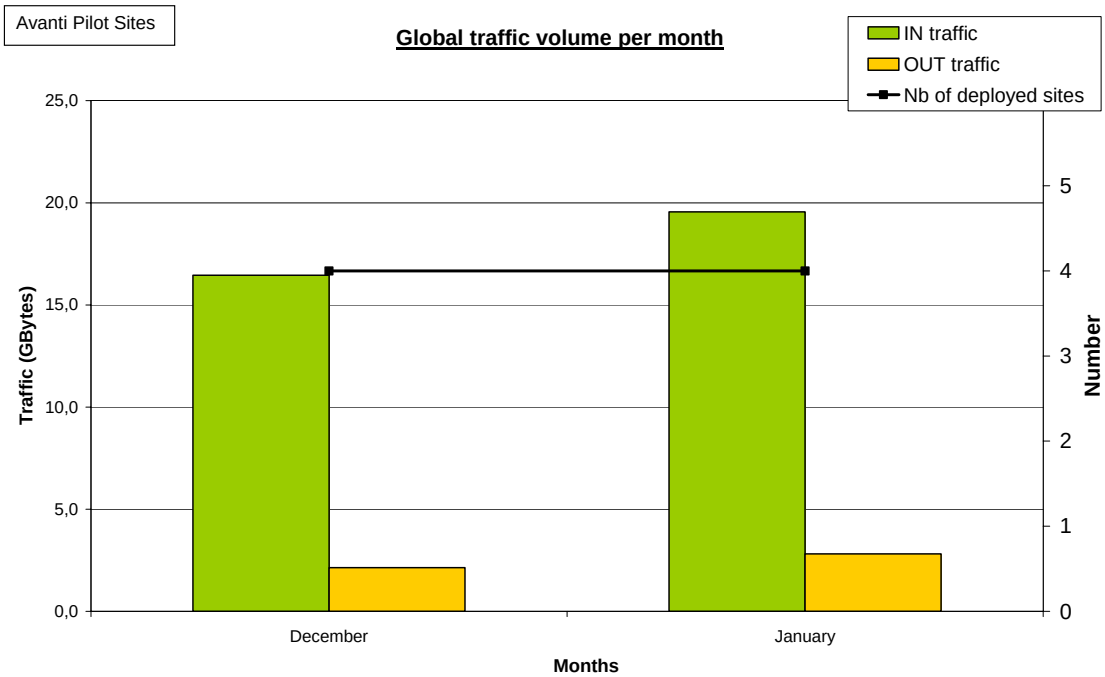
Since the implementation of the monitoring system and procedures have taken longer than initially planned, data has been collected from the 1st December 2007 until 31st January 2008 for Avanti and TTSA Pilot Sites and for the last week of January only for the Hellas Sat sites.

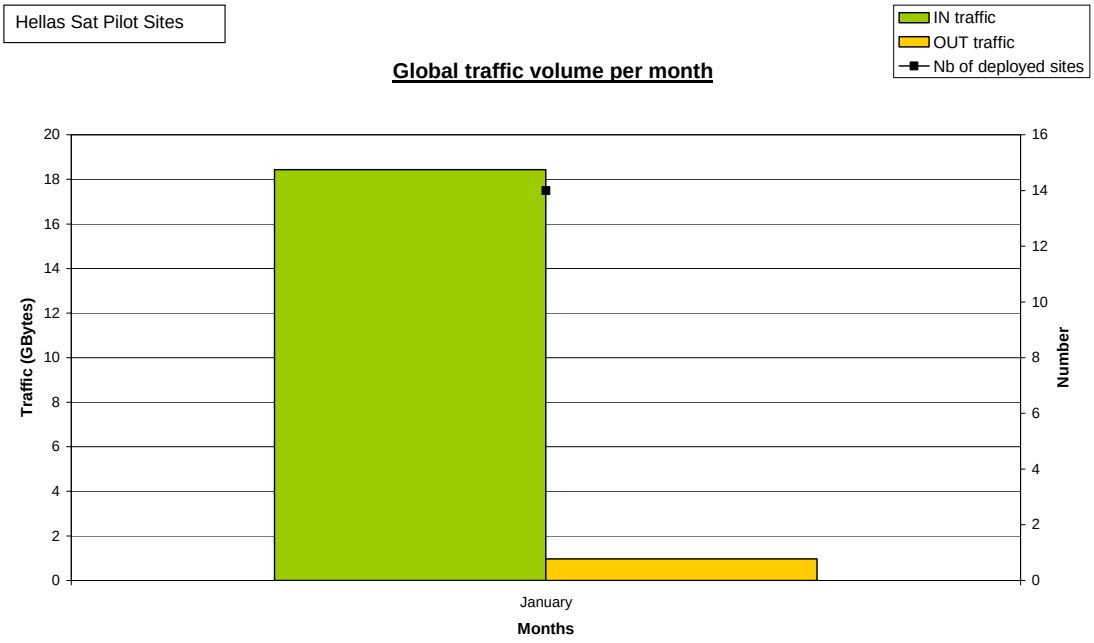
The fact that this monitored period is not very large is not an important issue in RP2 since for these first months of Pilot Site operation the main point was to activate and validate the monitoring system and the corresponding eporting procedure. We will use the next Test Run periods to enlarge the network statistics data base with more complete and pertinent results.

For the data analysis here below, we have modified the order in which the statistics already presented in iii are analysed starting from the most general information to the detailed one. Thus we will present first the network traffic evolution per month and then we will enter in the detail of the information per site. This order the opposite from the one followed for the data collection process, information is first collected per site and then gathered per group of pilot sites depending on their satellite access solution.

2A Global traffic volume per month


TTSA Pilot Sites
Global traffic volume per month
In Traffic
Out Traffic
Nb of deployed sites
Volume (GBytes)
Number
250
200
150
100
50
0
16
14
12
10
8
6
4
2
0
December
January
Month


Avanti Pilot Sites
Global traffic volume per month
IN traffic
OUT traffic
Nb of deployed sites
Traffic (GBytes)
Number
25,0
20,0
15,0
10,0
5,0
0,0
5
4
3
2
1
0
December
January
Months



These graphs help us to follow the activity evolution of the in&out traffic of the pilot sites during the test run period.

For TTSA sites we can appreciate a diminution on the activity between December and January. This decrease, as it will be explained later, is caused by a traffic diminution of the Dezna site in January since this site is by far the most active one in the studied period for TTSA (and even for the whole RW Pilot sites). The activity of this site is also responsible for the unbalance of the ration between In&Out. From the total graph we see that the Outbound traffic is much bigger than the Inbound one. This is not a typical behaviour for the Internet activity. Next graphs will help us to justify this traffic activity. If we exclude this site from our analyse, we can see that the general trend shows an increase on the activity at the Pilot Sites as the time went by and that the download volume is more important than the upload one.

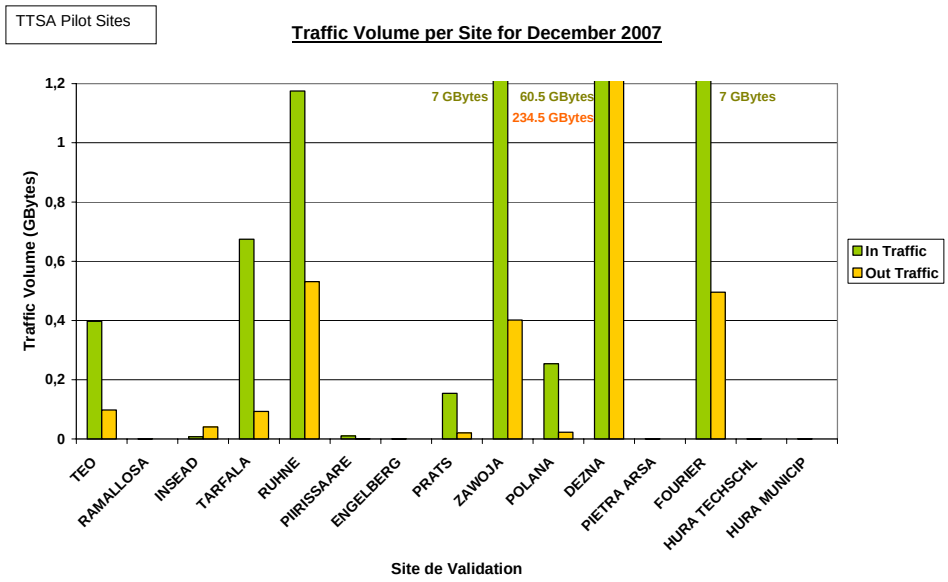
For the Avanti Pilot sites we can also confirm an increase in the total volume with the time for the same number of deployed sites and a more important download activity than upload.

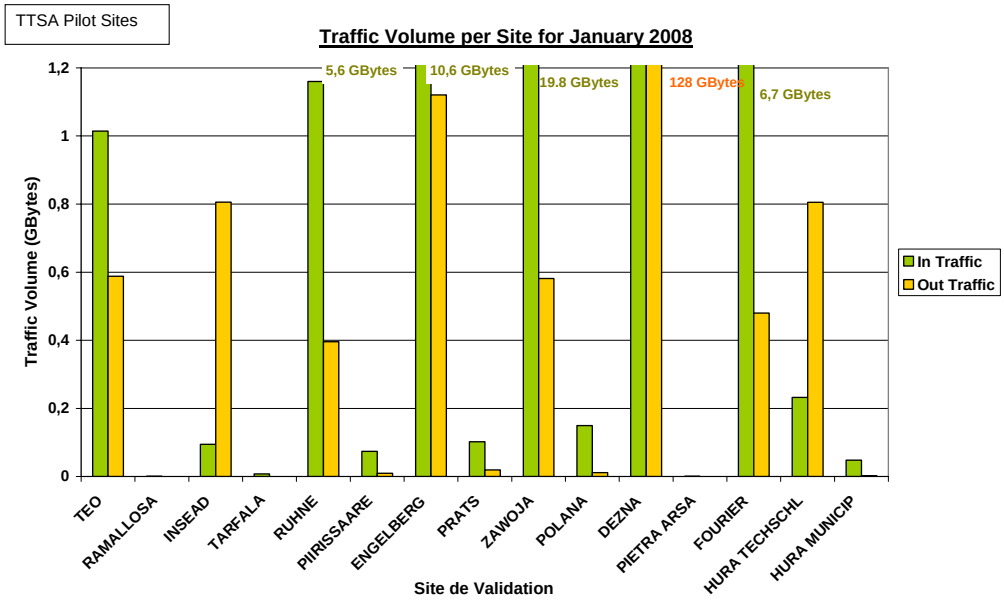
For Hellas Sat, given the limited data available, we cannot conclude a trend yet, we will have to wait for next month's information. Much more volume has been generated on the inbound traffic

that the outbound, talking in terms of cumulated traffic volume, the download traffic is up to 18 times the upload traffic.

This increasing trend is very positive and logical since it shows that Rural Wings Pilot Sites become more and more active with the time. This is also the consequence of the evolution and maturity process of RW applications and of the NC efforts on Pilot Site animation.

1A Traffic volume per site



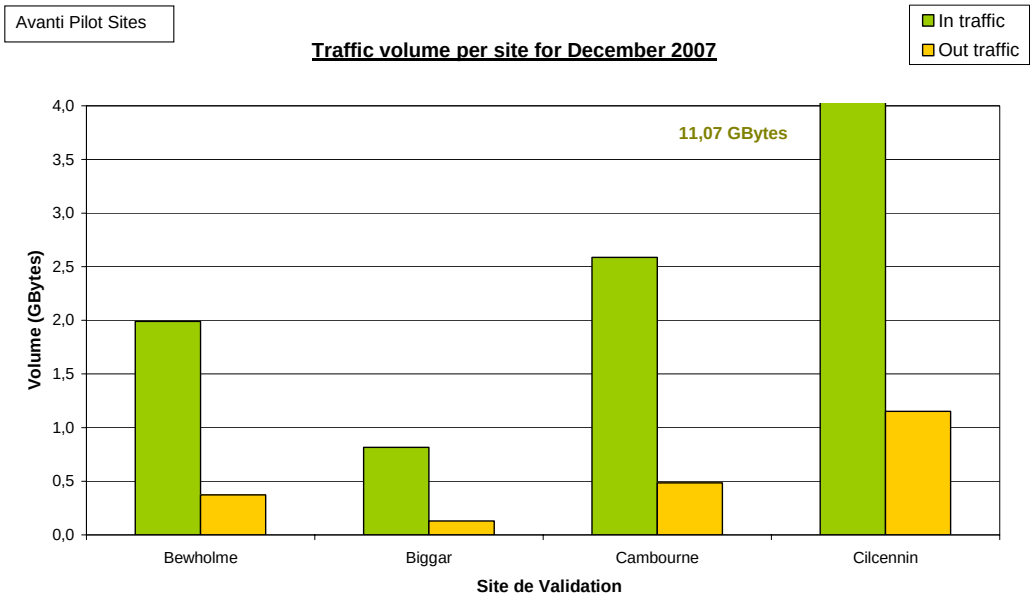


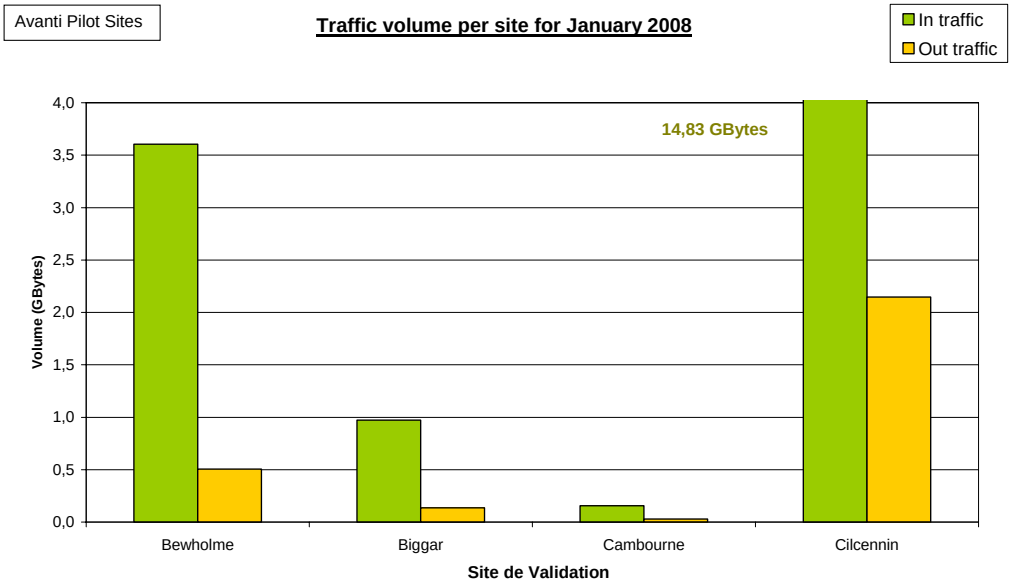
As it can be seen in these TTSA graphs the activity registered for the Pilot Sites can be quite different. When talking about total traffic volume we can distinguish three main groups for TTSA pilot sites:

- Pilot sites generating light traffic volume such as Prats, Pietra Arsa, Polana or Hura
- Medium volume generating sites such as Ruhne
- Very heavy volume sites like Zawoja or Fourier and as already mentionned Dezna.

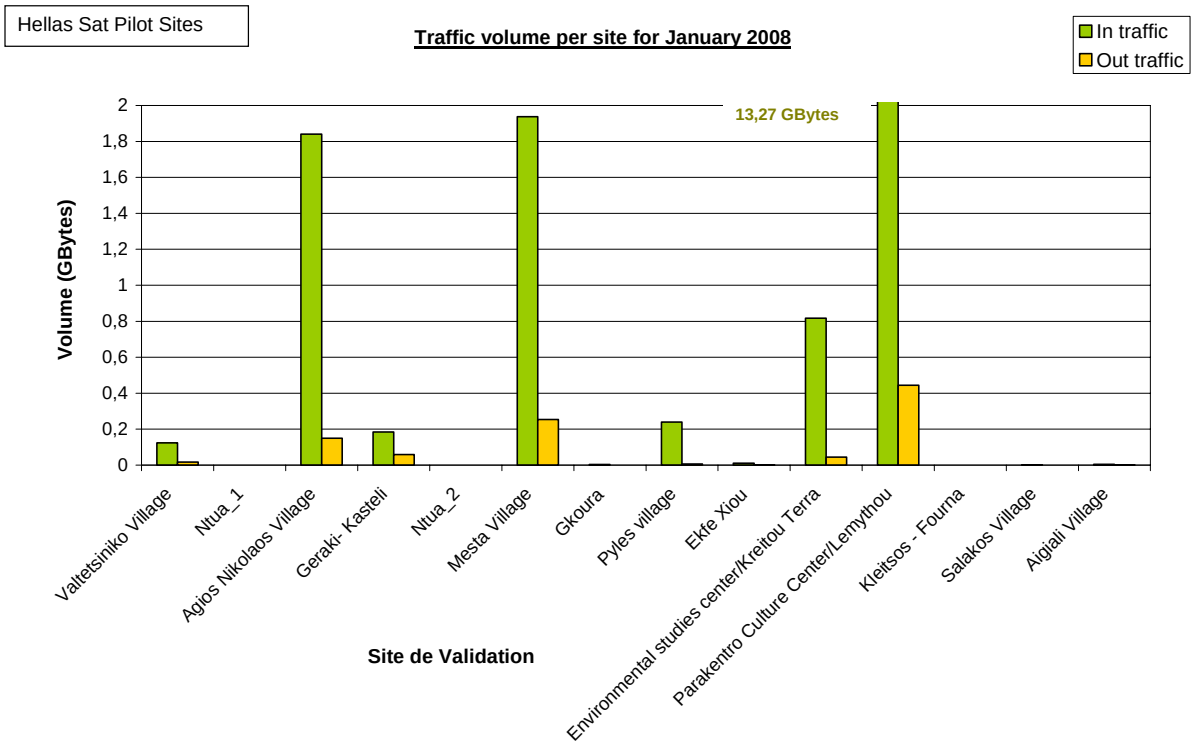
The behaviour of the Dezna site is very particular since it has been more than 90% of the total TTSA traffic volume. As confirmed by the following graphs, we will see that this huge consumption is due to the intensive usage of Peer to Peer traffic. We can confirm here the already mentioned diminution on the Dezna activity from December to January, since TTSA took specific actions to limit Peer to Peer in order to control these aggressive applications and ensure a fair access to the bandwidth for the other terminals.

General trend for TTSA sites shows that the inbound traffic (ie download activity) is more important than the upload one in an average ratio of 10/1. This trend is applicable to all sites except Insead and Dezna. Especially for the last one, the upload traffic is much more important (234 GBytes vs 60 GBytes in December). We could justify this by the fact that when using Peer to Peer application user does not only download files but also external users come to the network to recover files from our user, Dezna uploads more files than those that it downloads.





Concerning the Avanti Pilot sites generated traffic volume; we can see that Cilcennin is the most active site with a monthly download traffic volume bigger than 10 GBytes. The classical Internet asymmetric traffic can also be found for the Avanti Pilot sites, the download traffic is more important than the upload one on ratios that goes from 5/1 to 10/1.



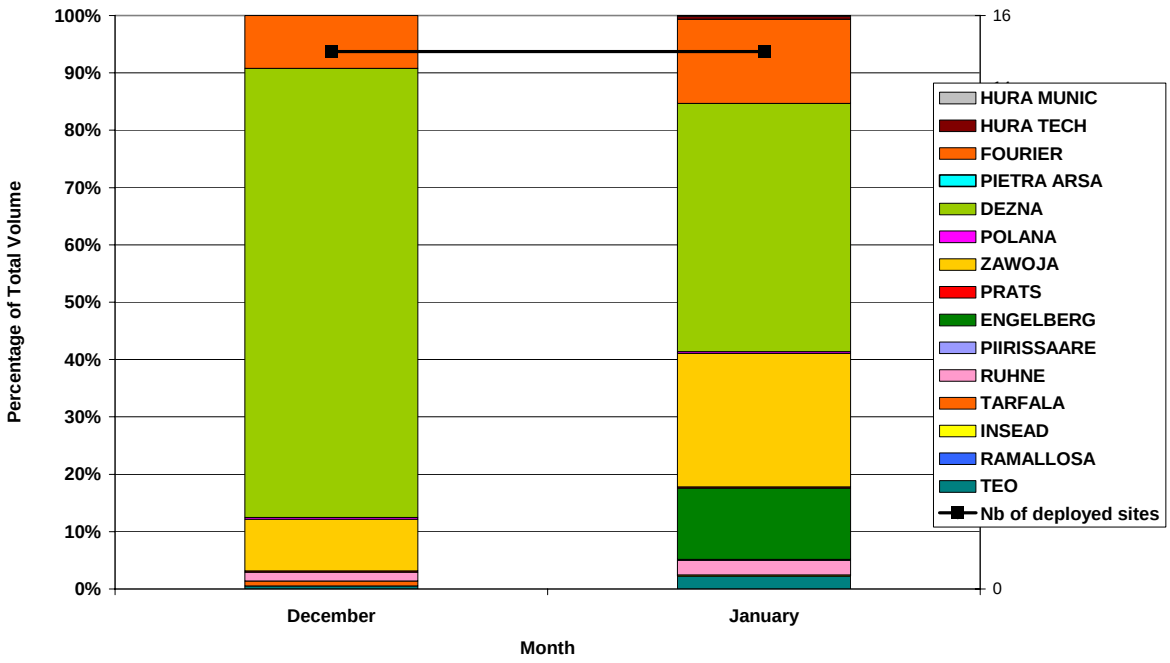
Information for Hellas Sat pilot sites in the last days of January shows us that there is a very active site, the Parakentro Culture Centre. Next graphs will enable to understand this network usage that reaches up to 13 GBytes in only 5 days.

For all Hellas Sat pilot sites, the ratio between the download and upload traffic is mostly around 6/1 with some exceptions like for Geraki (3/1) and Plyles village (46/1).

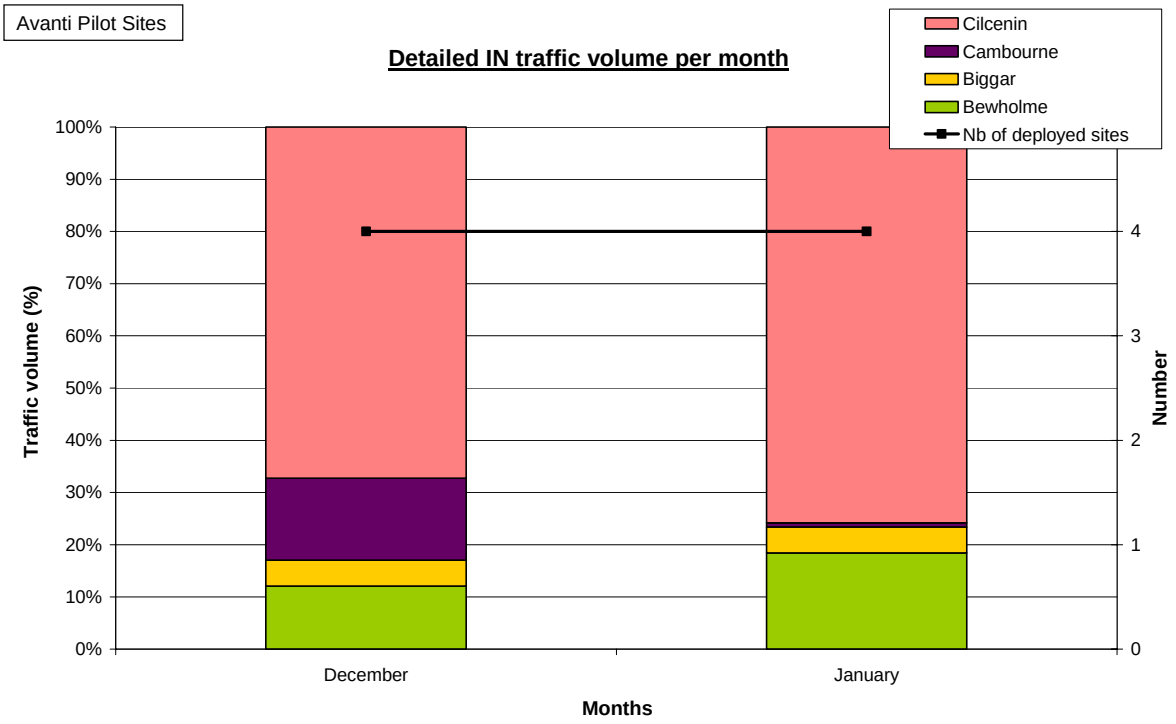
Talking in global terms for the Rural Wings pilot sites during the first test run months, the most active site has been Dezna with cumulated 80,36 GBytes downloaded and 462,5 GBytes uploaded. The gathered data also shows that the download traffic (IN) is much important than the upload traffic (OUT) except on the case of Insead and Dezna.

3A Detailed IN traffic volume per month

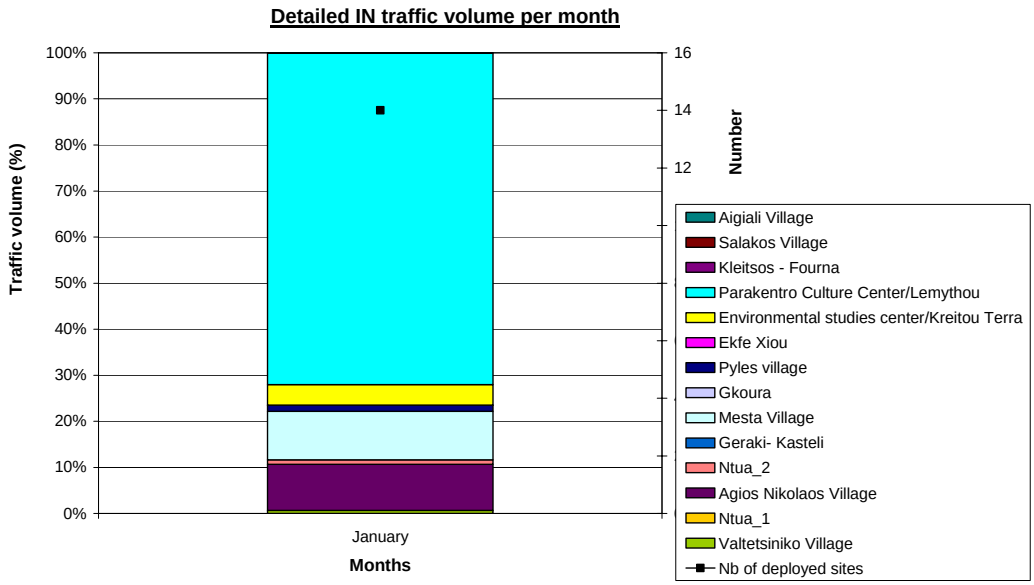
TTSA Pilot Sites



Avanti Pilot Sites



Hellas Sat Pilot Sites

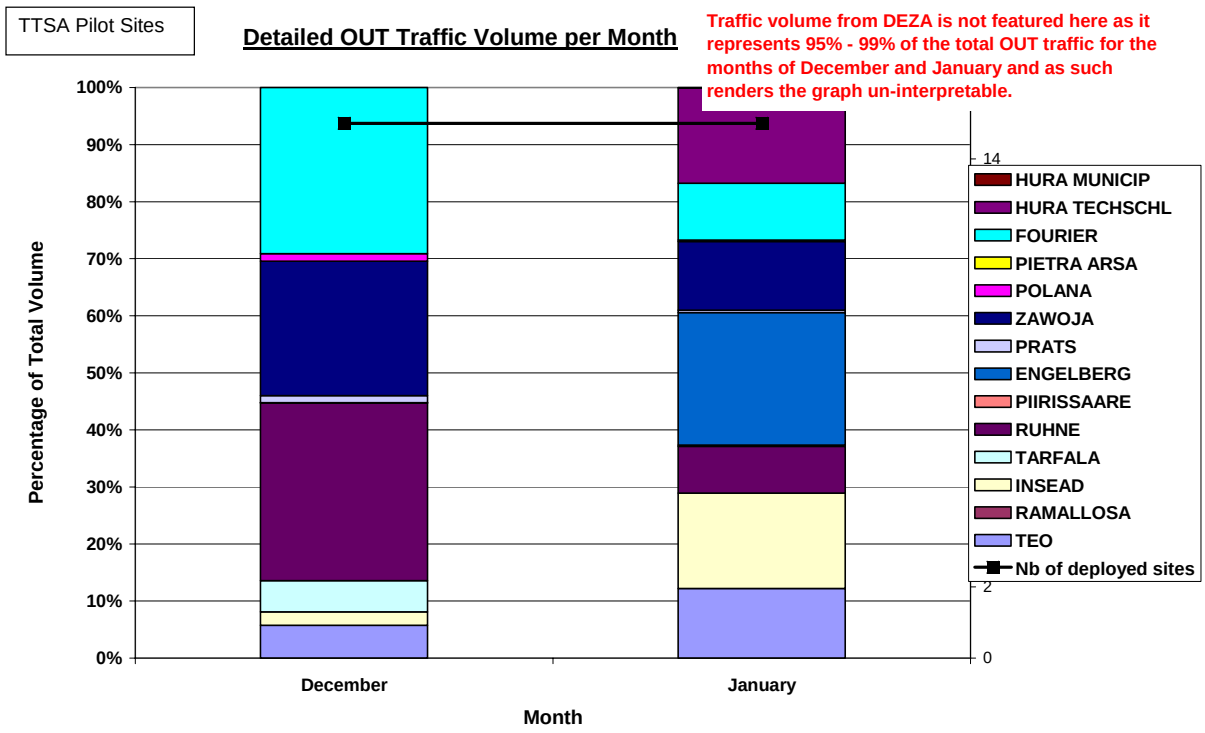


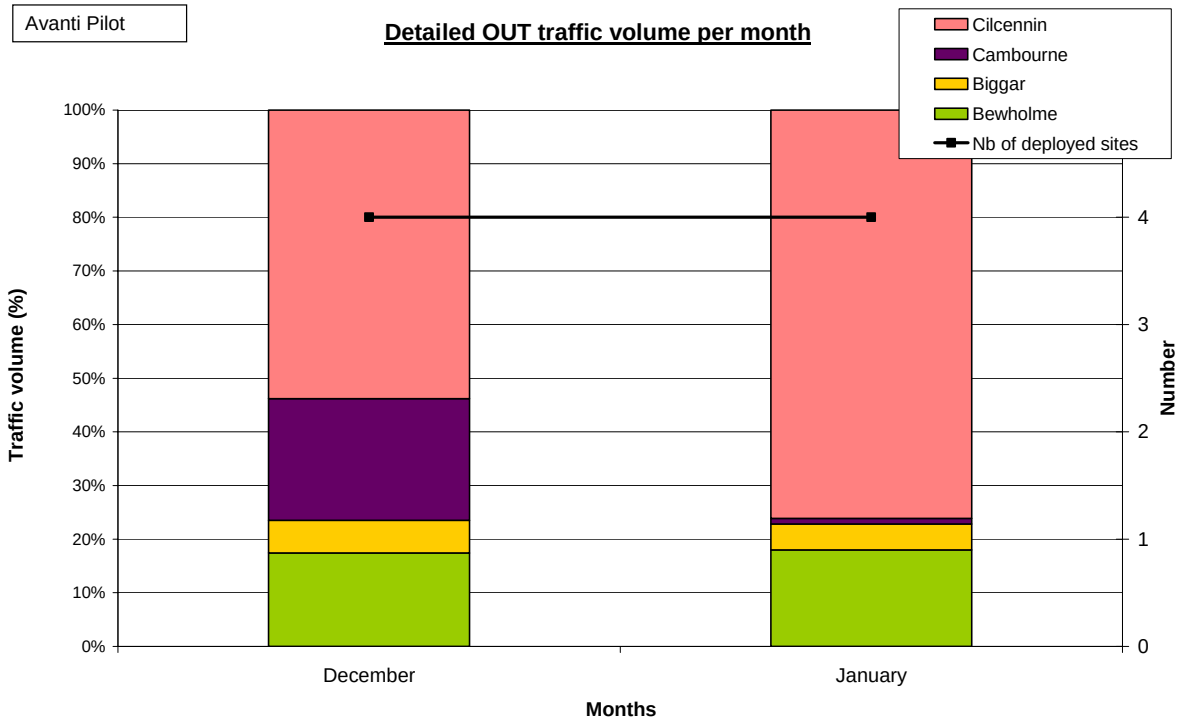
For TTSA pilot sites, most of the IN (download) traffic has been generated by the Pilot sites of Dezna, Fourier and Zawoja. Statistics graphs about the protocols distribution for this traffic direction will enable us to justify this higher volume consumption.

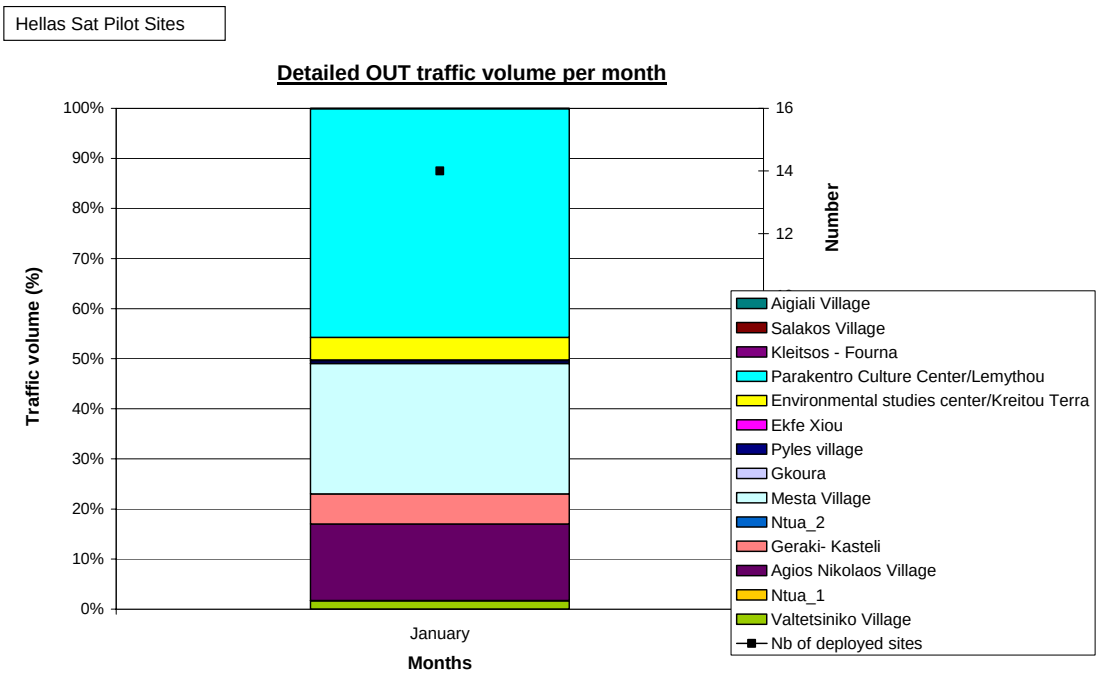
For Avanti Pilot sites, as already anticipated in 1A graphs, most of the download traffic has been generated in Cilcennin followed by Bewholme et Cambourne. Biggar is the Avanti less active site for the download.

For the Hellas Sat sites, most of the download activity has been generated by the culture centre in Parakentro, Mesta and Agios Nikolaos.

4A Detailed OUT traffic volume per month







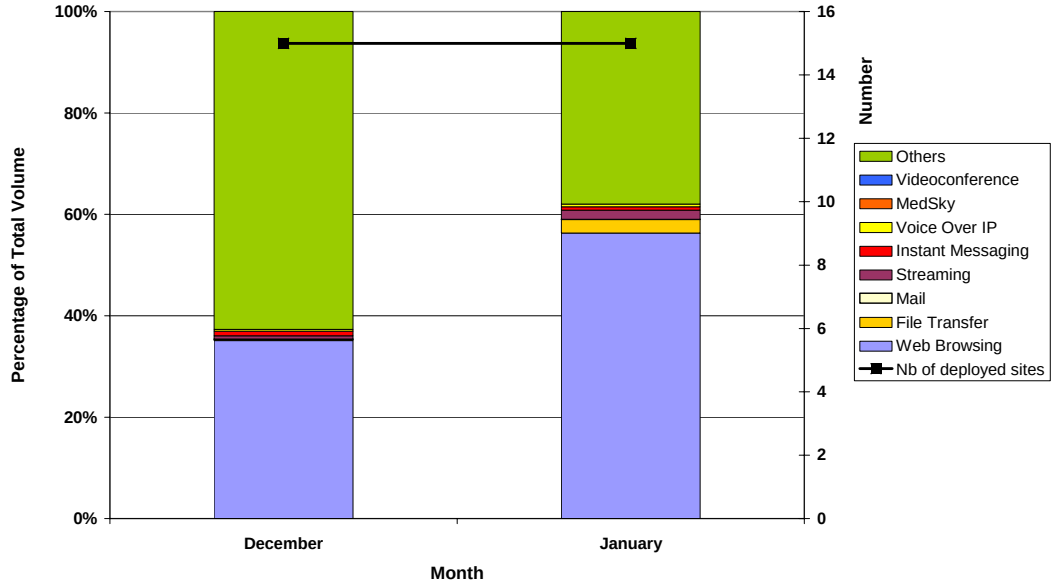
In the TTSA graph, we have suppressed data coming from Dezna pilot site since it represents between 95 and 99% of the total TTSA upload volume. This difficulties the analyse of the activity coming from the rest of the sites. On the new graph, we can appreciate that the most active sites for the upload link vary from month to month, in December they were: Fourier, Zawoja and Ruhne while in January the most active ones were Hura Technical School, Engelberg Insead and Teo. We will match this behaviour with the protocol analyse performed in 6A graphs.

Concerning Avanti pilot sites, Cilcennin is still the most active one in terms of generated traffic volume. Bewholme keeps a similar behaviour during the two months while Cambourne seemed quite active in December but almost disappeared in January.

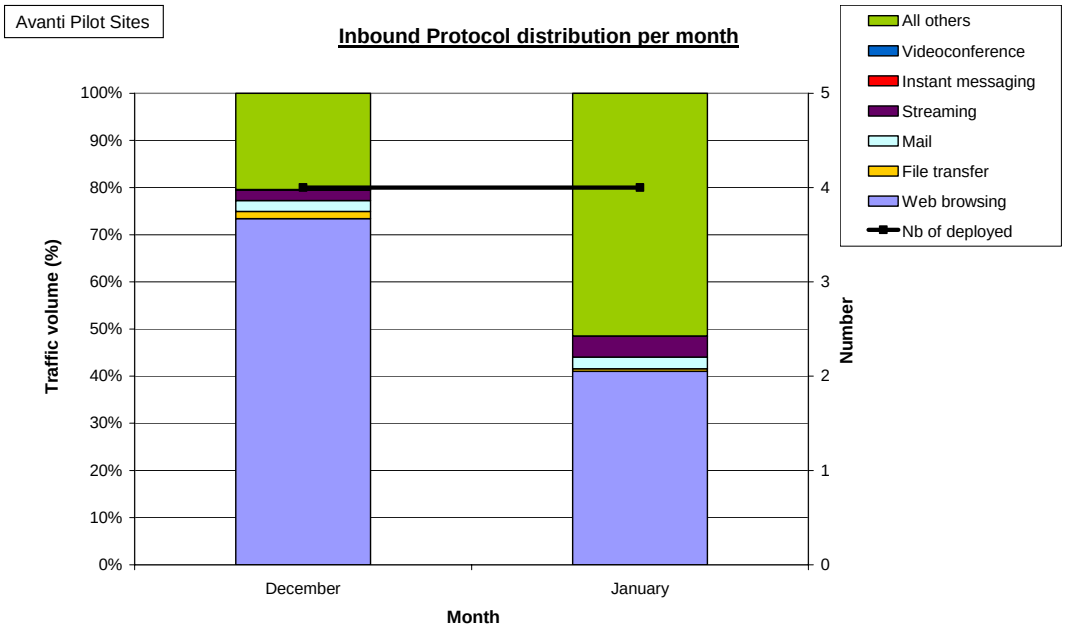
Statistic graph for the Hellas Sat shows a similar result that the one found for graph 3A: most of the upload traffic has been generated at the Parakentro Cultural Centre, Mesta and Agios Nikolaos.

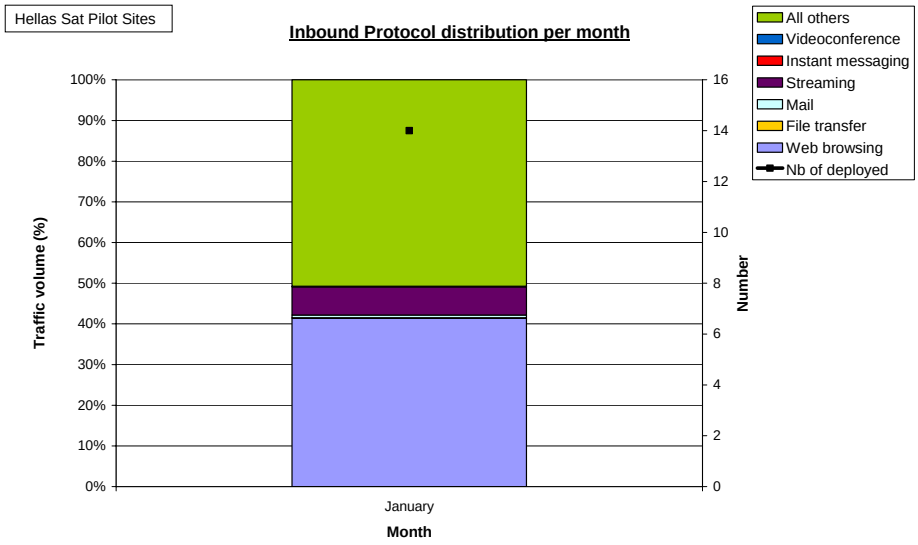
7A Inbound protocol distribution per month

TTSA Pilot Sites



Avanti Pilot Sites





The protocols distribution presented here for the TTSA sites shows that most of the download traffic in December comes from Peer to Peer traffic (63% against the 38% registered in January for the "All others" category). This decrease can be justified by the Peer to Peer limiting policy that TTSA put in place to limit this highly demanding and aggressive application. However the applied rules are still quite permissive and will require some improvement. The 48 GBytes registered in December as "All others" category were mostly coming from the Dezna site (46 GBytes).

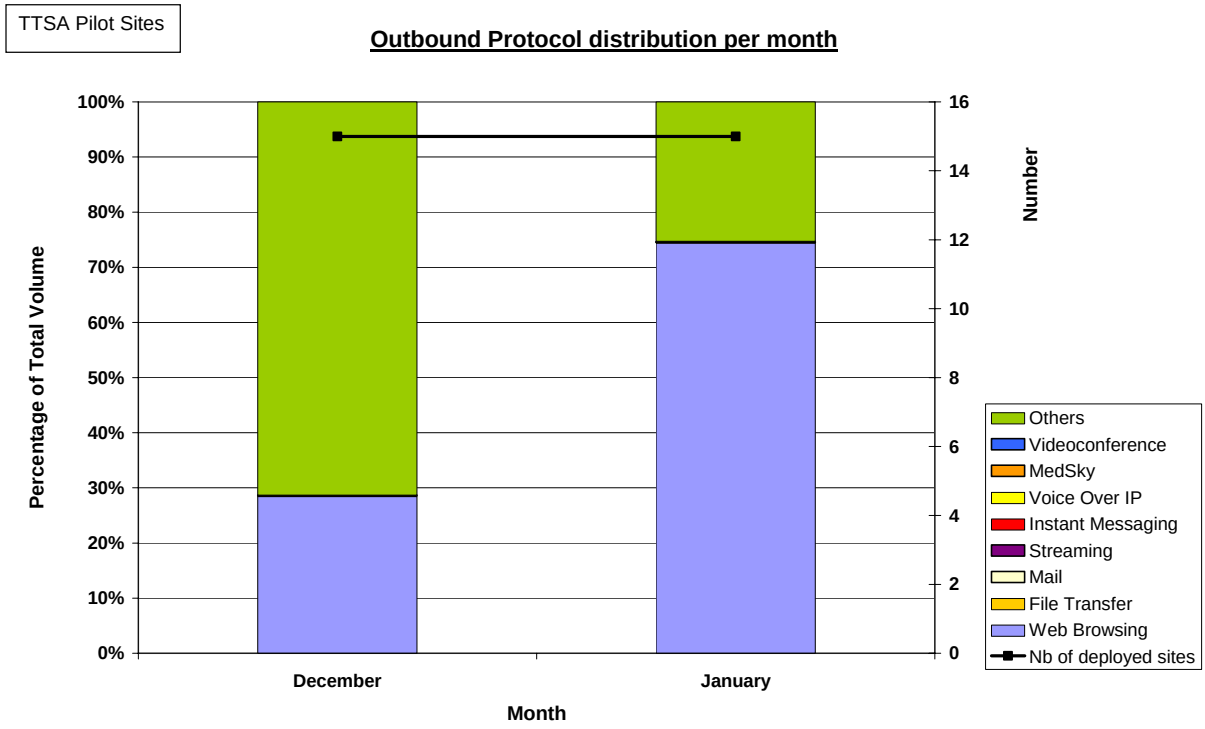
The situation for the web browsing activity is thus the opposite, it experiments an increase in volume between December and January going from 35% to 55%. From the total 25 GBytes of web browsing traffic generated in January only 7 were generated in the active site of Dezna. The next most active site in terms of web browsing is Fourier.

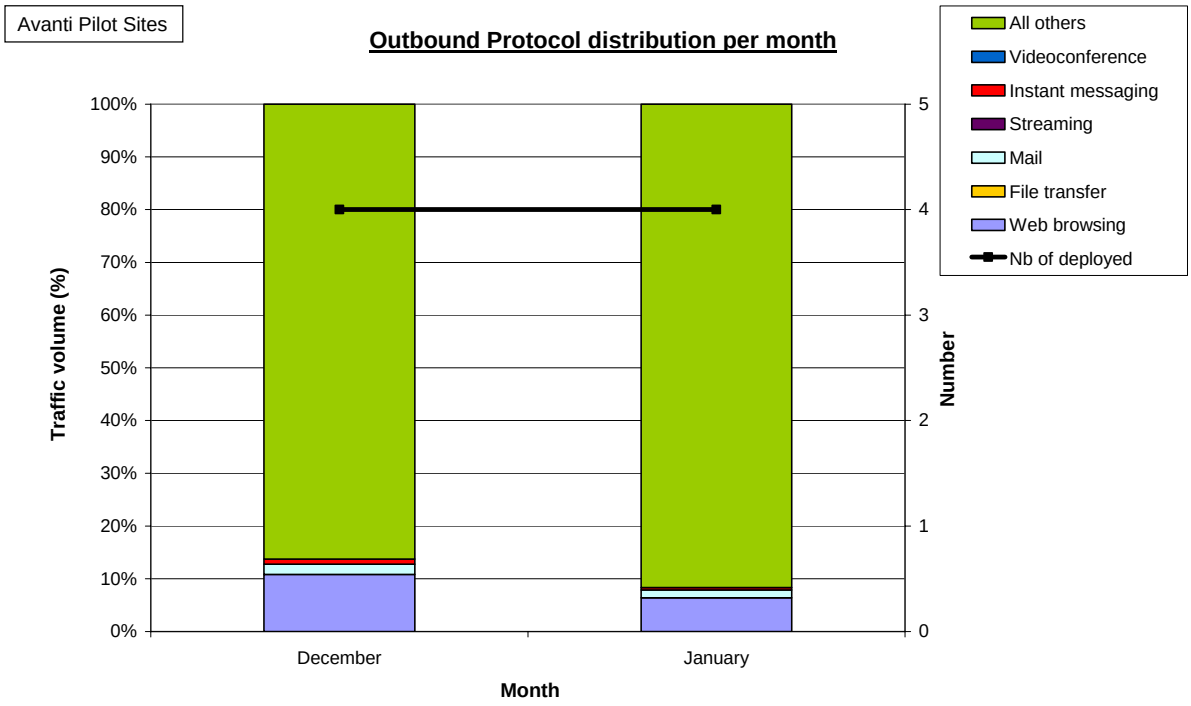
Talking about Avanti pilot sites, most of the activity is coming from web browsing (74% in December and 41% in January) closely followed by the "All others" category with 21% and 52%. 71-72% of web browsing in December and January was generated at the Avanti most active site, Cilcennin (8 and 5 GBytes respectively). In the "All others" category, the Cilcennin site is the responsible of the 54% and 80% of the total volume registered

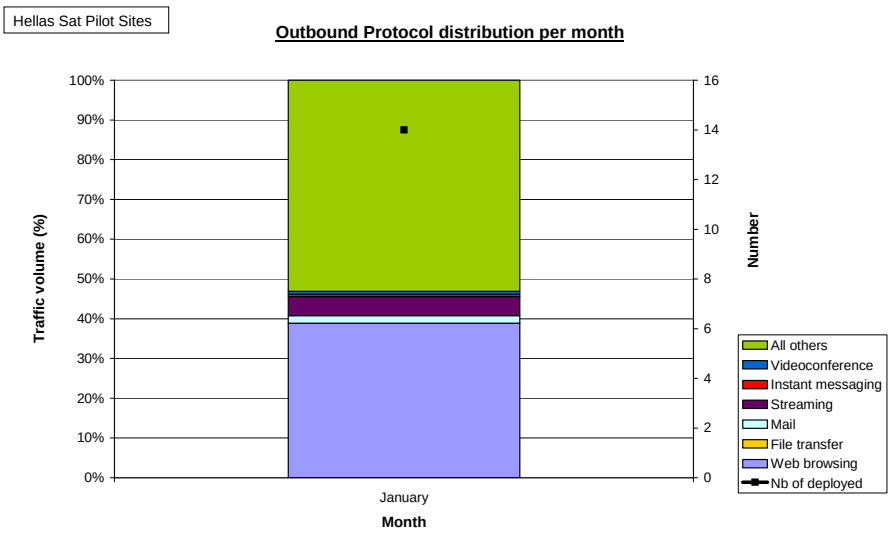
Besides we can appreciate an important increase in the "All others" traffic in January that passes from 3 to 10 GBytes. This trend is just the opposite of that observed for the TTSA pilot sites. It will be recommended to further analyse Avanti QoS rules concerning P2P restricting QoS was applied. The next applications most commonly used include Streaming, Mailing and Instant messaging in this order.

From the Hellas Sat graph we can see that the most common applications come from the "All other" category with a 51% of activity closely followed by web browsing 42% and then streaming 7%. 87% and 72% of the Web browsing and the "All others" traffic is generated at Parakentro Culture Centre representing 13,1 and 13,2 GBytes respectively.

8A Outbound protocol distribution per month







For the TTSA pilot sites most of the upload activity registered in December was coming from the Peer to Peer applications with a total of 72% over the registered volume versus a 28% of web browsing activity. The situation in January is inverted due to the Peer to Peer control policy implemented; only 25% of the total volume is due to Peer to Peer while web browsing activity

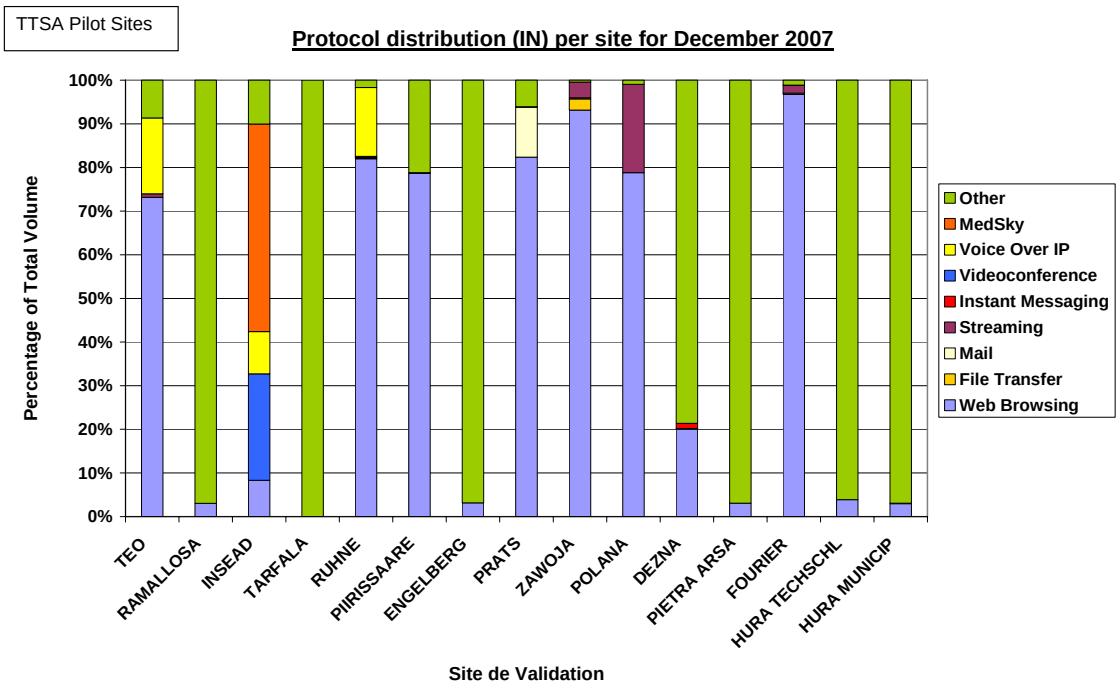
was significally incremented up to 75% (98 GBytes for the upload traffic in January for 15 sites). This figure is suspiciously too high, since more than 95 out of the total 98 GBytes come from the pilot site of Dezna. Peer to Peer traffic can be masked on to web browsing format by changing the traffic port to 80, the typical http port. This behaviour will justify these figures, thus we recommend revising the network activity of the Dezna site in coordination with the National Coordinator so as to reorientate the network usage towards the Rural Wings applications instead of the Peer to Peer ones.

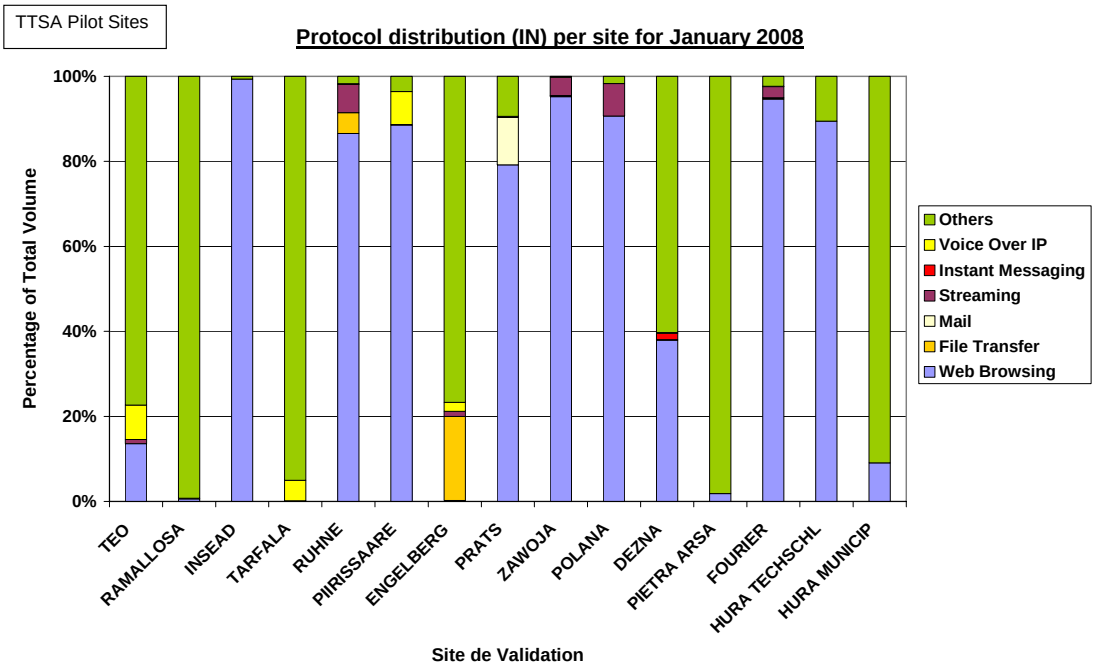
For the Avanti Pilot sites, it can be seen that mostly Outbound traffic is generated by applications falling in the “All others” category representing 86% in December and 93% in January. Increase on upload Peer to Peer volume is not as important as the one experienced in the download. Cilcennin is the responsible of 58% and 80% of the total volume of this category. The web browsing activity is reduced to a corresponding 11% and 6%. The third type of application generating traffic volume for the upload is mailing.

The protocols distribution for the Hellas Sat sites upload traffic in January presents a similar picture of that explained for the download traffic. Main activity is generated by the “All others” category (54%), followed by web browsing (39,5%), streaming(4,4%) and the new coming mailing traffic (1,8%). Parakentro is the main contributor with 45% and 61% for the two main categories: Peer to Peer and Web Browsing.

In the upload traffic for Hellas Sat and Avanti we see appear the mailing activity, this can be explained by the fact of using e-mails as a way to interchange information sending attached files such as documents or even photos.

5A Inbound Protocols distribution per site



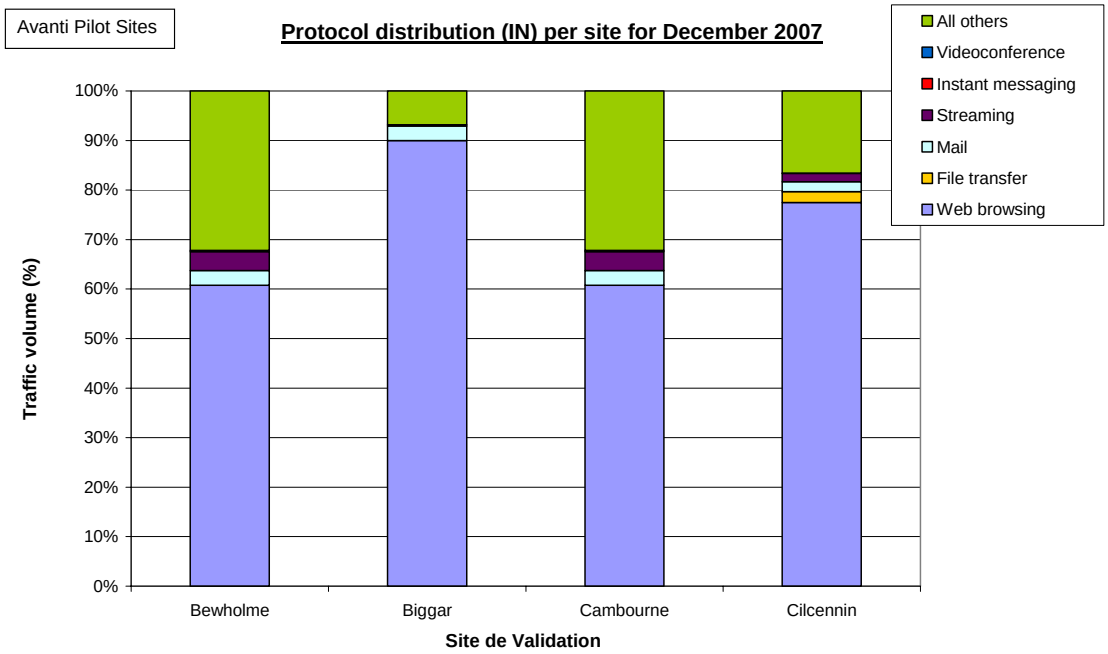


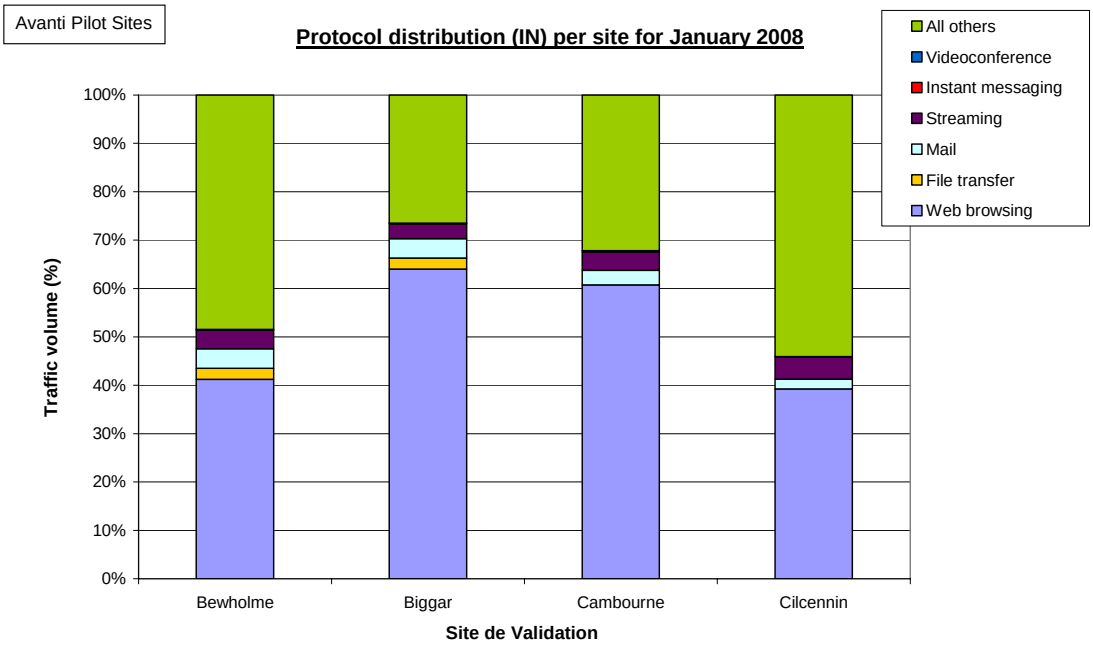
From this graph we can identify three main types of TTSA Pilot sites:

- those whose activity in December and January is mainly composed by web browsing like in Ruhne, Prats, Zawoja, Polana and Fourier.

- Pilot sites where activity is mostly coming from the “All others” category and thus mainly due to Peer to Peer applications such as: Ramallosa, Tarfala, Engelberg, Pietra Arsa and of course Dezna
- A third group of sites for which main activity migrates from Peer to Peer to web browsing from December to January like: Hura Technical School.

Sites presenting activity other than web browsing and peer to peer are Insead in December with a huge amount of Medsky, Engelberg in January with some file transfer, Prats with mailing, Teo, Ruhne and Piirissaare generate VoIP and Streaming traffic.



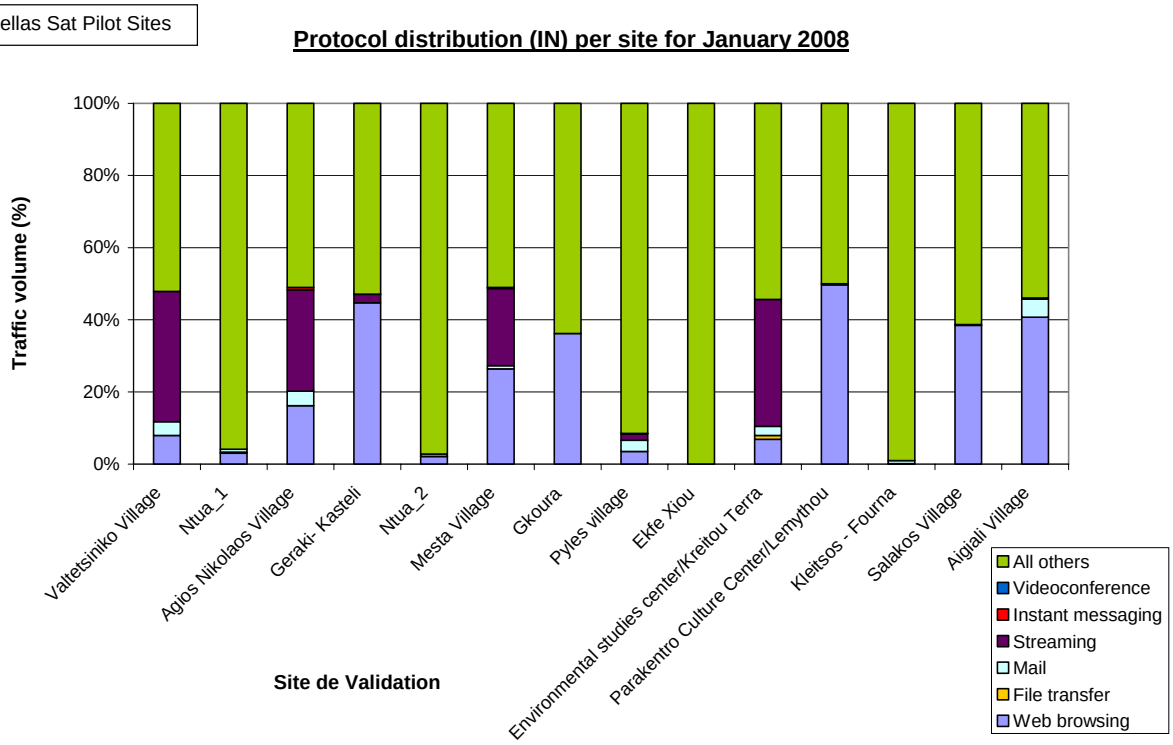


For the Avanti pilot sites, main applications are web browsing, peer to peer, streaming and mailing. As mentioned before, we can see an increase on the “All others” traffic from December to January especially for Biggar and Cilcennin sites. The Pilot site of Cilcennin as shown in 1A is the most active one for the Avanti group of sites with more than 10 GBytes download per month, this volume in December has been mostly generated by web browsing and by Peer to Peer in January. As already suggested for TTSA-Dezna, it would be recommended to follow with more detail the activity of the Cilcennin site.

Activity for Cambourne and Bewholme is keep similar for both months.

Some FTP traffic has also been generated in Cilcennin in December and in Bewholme and Biggar in January.

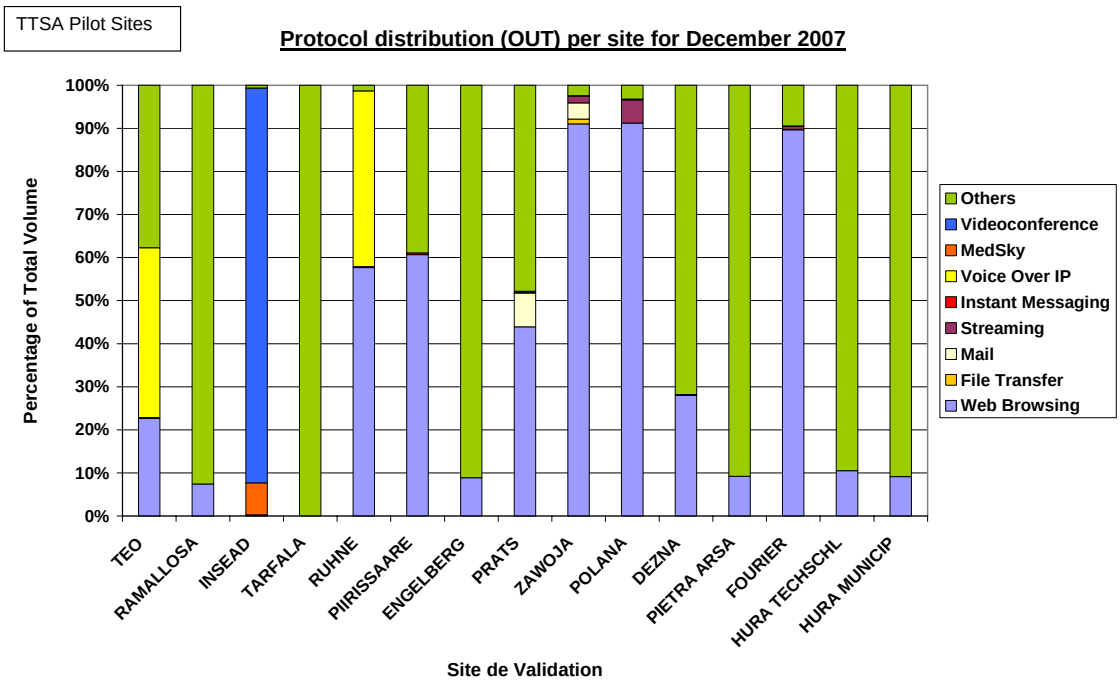
Hellas Sat Pilot Sites

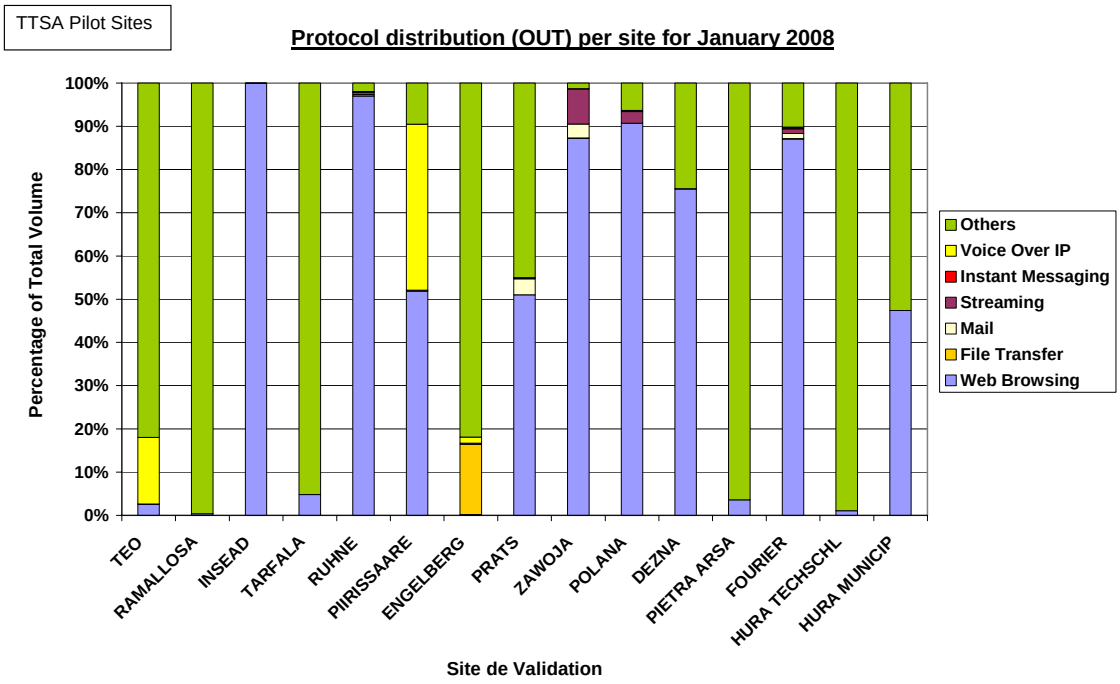


Registered activity for Hellas Sat shows that most of the download traffic in January comes from the “All others” category. Then three types of behaviour can be identify

- pilot sites that present also some web browsing activity like Geraki, Mesta, Parakentro Culture Centre, Salakos and Aigiali Village
- sites that carry on some streaming activity like Valtetsiniko, Agios Nikolaos, Kreitou Terra and again Mesta
- sites that only perform “All others” applications like Ntua (1&2), Ekfe Xiou and Kleistos. Thus for this sites it is important to remind graph 1A where we could see that the registered activity is almost zero.

6A Outbound Protocols distribution per site





For the TTSA pilot sites upload traffic we can distinguish two main groups:

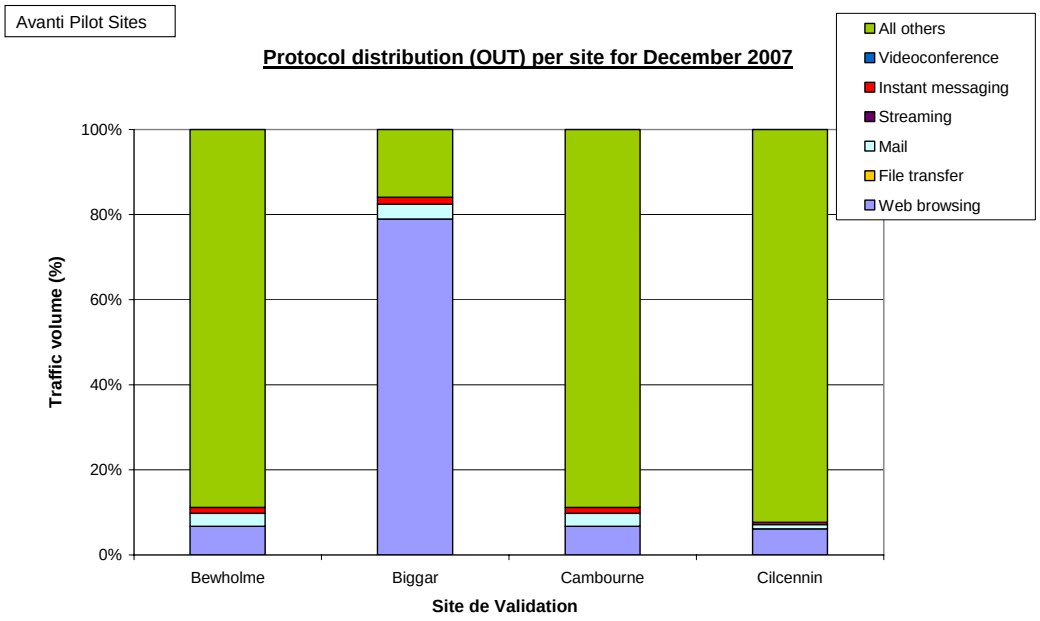
- pilot sites of mainly web browsing activity like Ruhne, Prats, Zawoja, Polana and Fourier. Similar behaviour for those sites had been found for the inbound traffic.

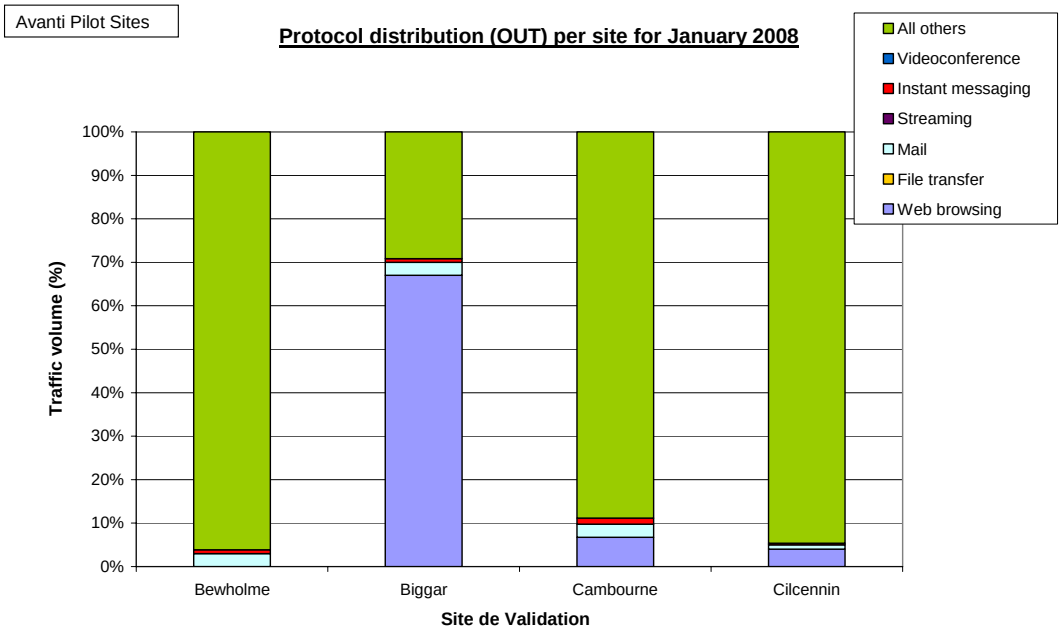
- pilot sites of mostly “All others” activity like Ramallosa, Tarfala, Engelberg, Dezna, Pietra Arsa and Hura Technical School. This fits well with the already Peer to Peer activity detected for those sites in the download direction.

Other activities also present in the upload link of TTSA pilot sites include VoIP in Teo, Piirissaare and Rhune.

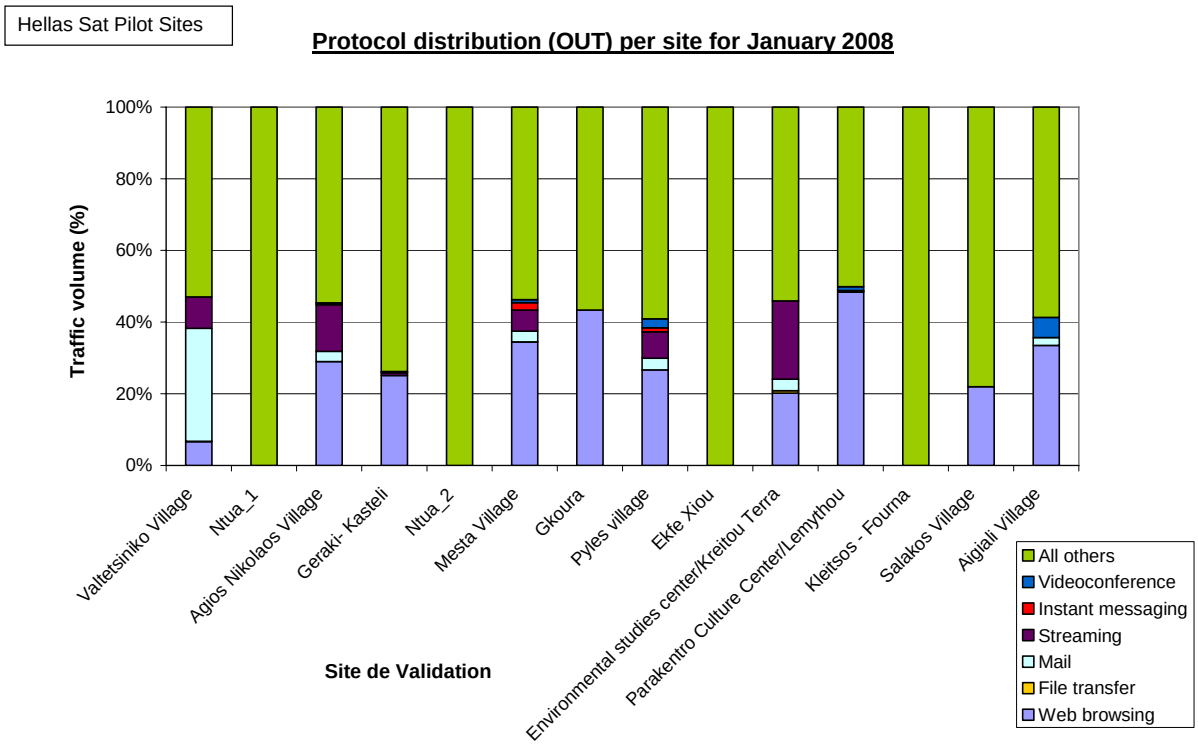
Some streaming has been carried out in Zwoja and Polana.

Satellite link deployed at Insead headquarter has been mainly used for videoconference and Medsky application.



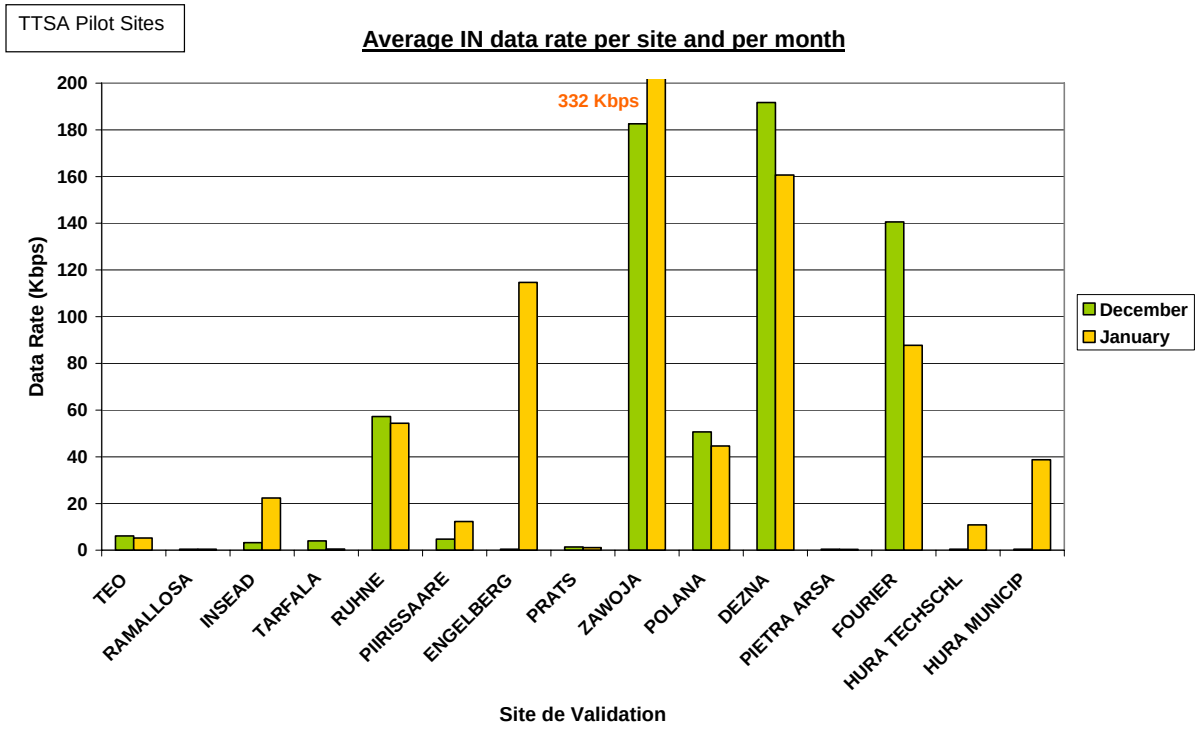


Most of the Avanti upload activity has been generated by “All others” applications except for the Pilot site of Biggar where most of the activity was coming from web browsing. Nevertheless it is important to remind that the total Avanti uploaded volume was 7 times lower than the registered volume for the Avanti download flux.

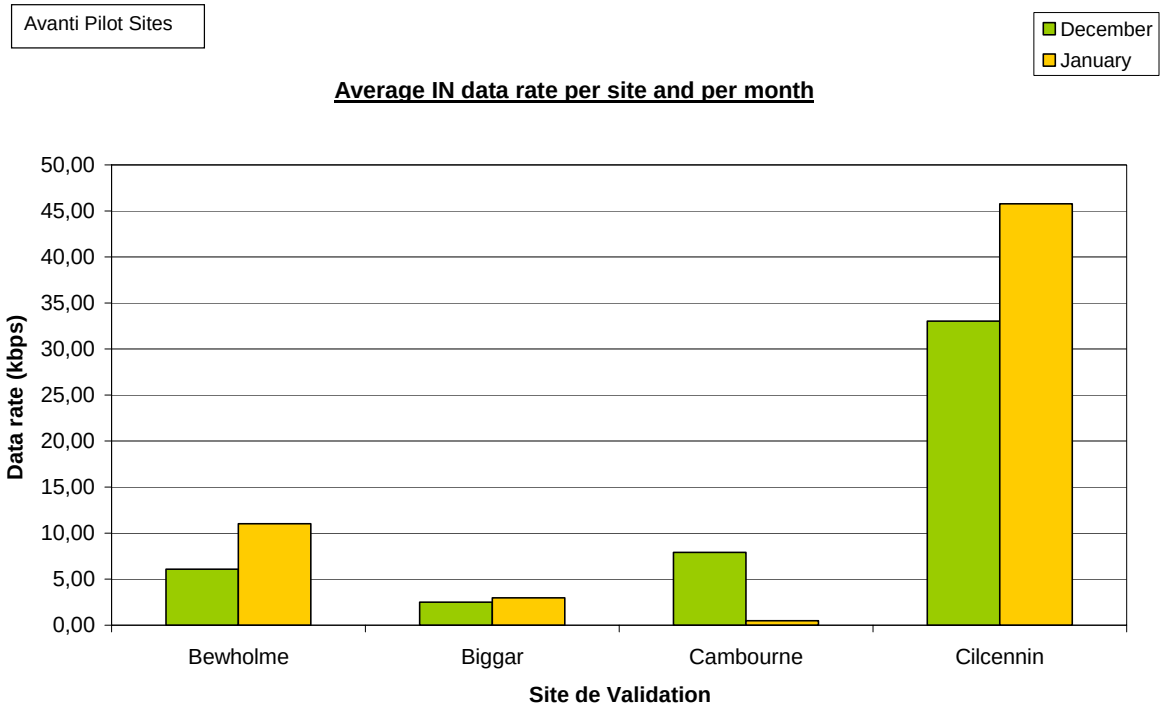


For the Hellas Sat pilot sites, most of the upload activity has been generated by “All others” protocols. But besides these applications we can also find web browsing activity at almost all sites with some significant traffic. The third most common application is streaming that is present in Agios Nikolaos, Mesta, Pyles and Kritou Terra. Mailing is also present in those sites but above all in Valtetsinkiko Village.

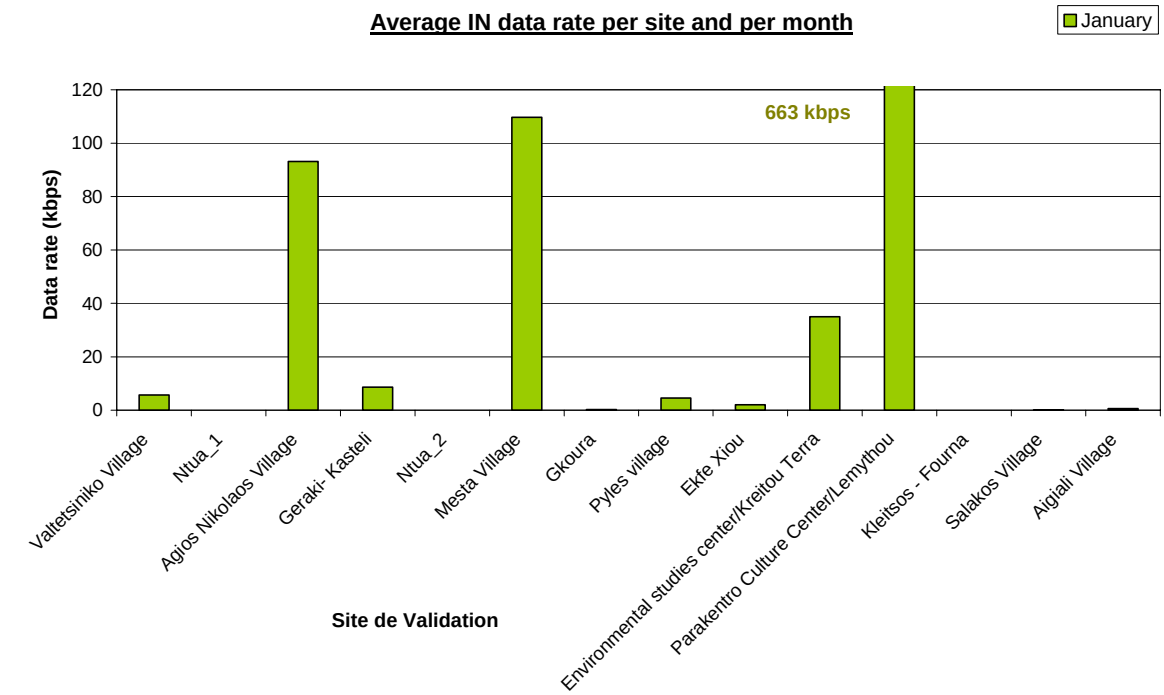
9A Average IN Data rate per site and per month



Avanti Pilot Sites



Hellas Sat Pilot Sites



These graphs and the following ones are the most difficult statistics to generate since they work on a instantaneously metric, the data rate. Today equipments are not able to give us the instant value but sampling rates are becoming smaller and smaller so getting near to the real figure. For the first test run period, these graphs were an experiment to confirm whether or not its feasibility. The values shown in the graphs have been averaged in order to provide a single value per month. This average must be done carefully only taking into account the network active time in order not to destroy the interest of the metric.

After a first glance, it is obvious that the Avanti measured values are smaller than those of TTSA and Hellas Sat. Based from the Astrium experience with the Avanti terminal, this difference in the throughput must be provoqued by the way the values have been extracted from the system since tested performances do not show such a big difference with regards to other satellite accesses (TTSA and Hellas Sat). From this thought, it would be recommended to do a new iteration with Avanti monitoring system for the collection of this metric.

Leaving this behind, if we analyse group per group, we can see that for TTSA the highest download data rate per month has been found in the Zawoja Pilot site with 332 kbps registered in January. Initially this pilot site is not one of the typical Peer to Peer sites but its main activity is web browsing. Since the total amount of download volume generated is quite important around 7 GBytes in December and more than 10 in January, we can think that the main activity of the site is http download. Another interpretation of the results may let us think that there is some Peer to Peer going on in the site masked on the port 80 to be passed as web browsing. This usage is quite sophisticated and would show a high level of computer literacy. It will be interesting to correlate these conclusions with the National Coordinator that knows better the users and their potential usage profile.

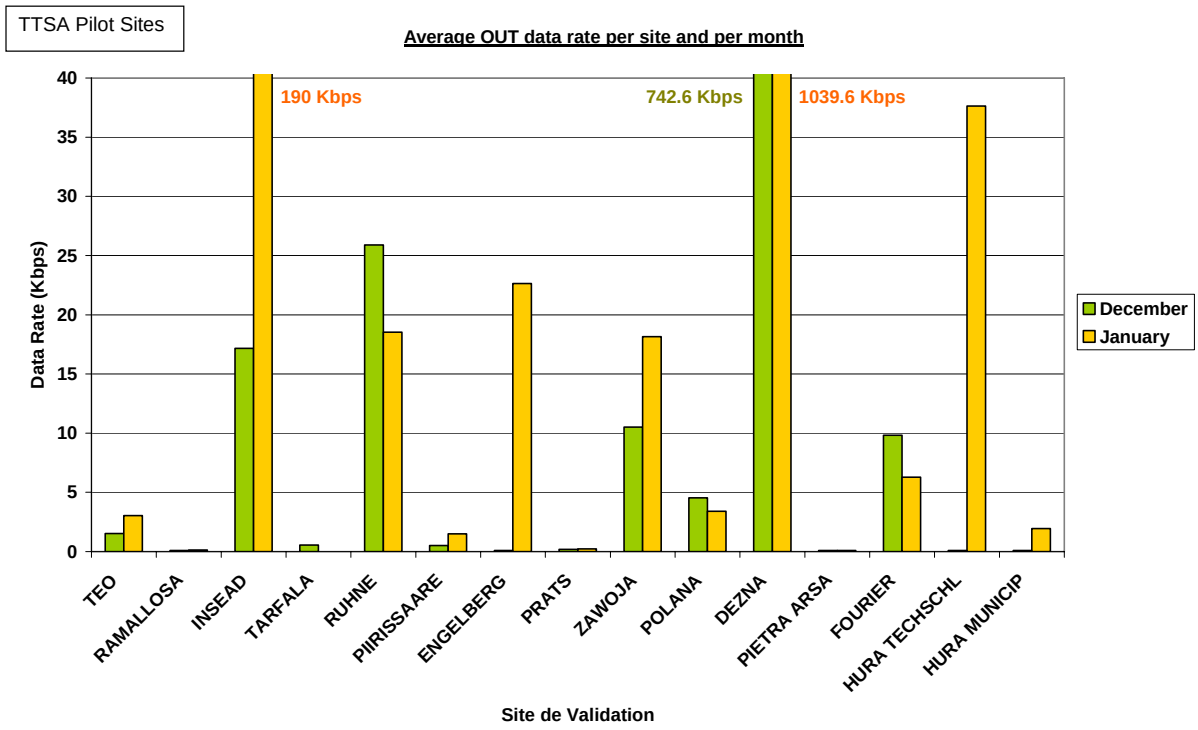
Download data rates registered for Dezna are around 160 and 200 kbps which is not a huge figure given the Peer to Peer profile of this site.

For Avanti sites, the highest download data rates have been measured for the pilot site of Cilcennin. The fact that the graph shape of the data rate per December is similar to the total volume downloaded in December, let us question once again the way this measure has been obtained. For next test run periods it will be convenient to revise it since it seems not very realistic.

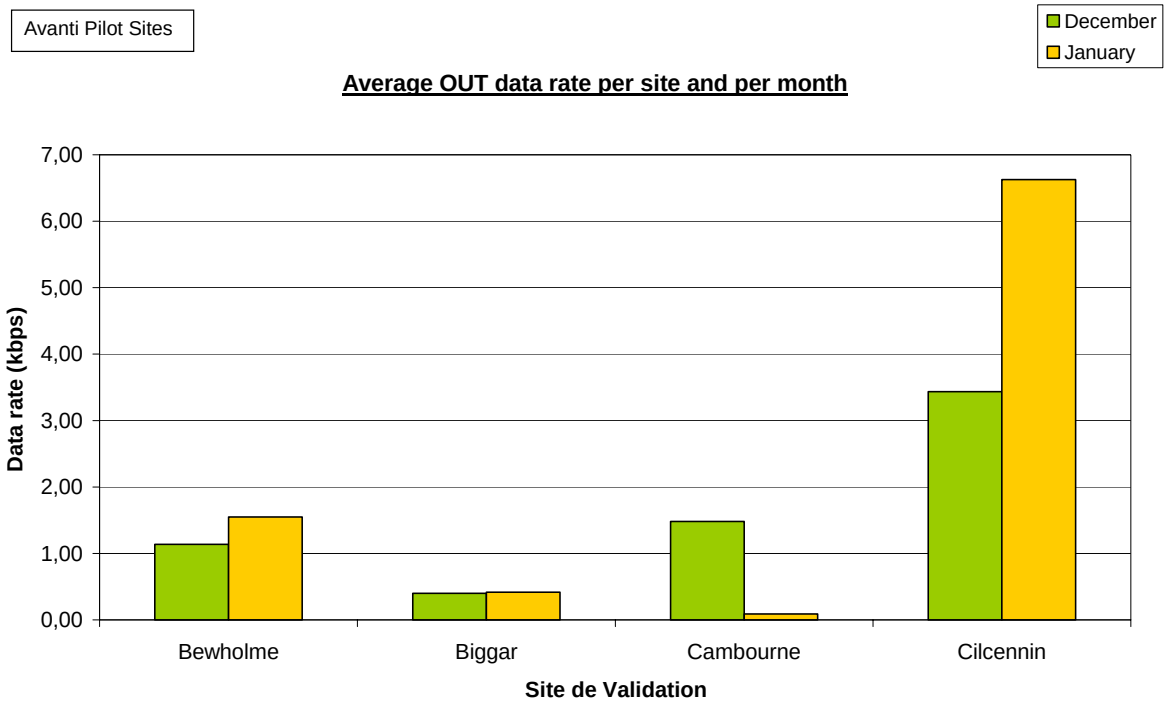
Average data rates measured for Hellas Sat shows a huge throughput for the pilot site of the Parakentro Cultural Centre. This fact combined with the almost 50%-50% protocol distribution between web browsing and peer to peer and the important cumulated volume downloaded in 5

days makes the behaviour of the site a bit suspicious. Is there other activity hided behind the web browsing traffic? This information is to be confirmed by the National Coordinators and the end-user profile.

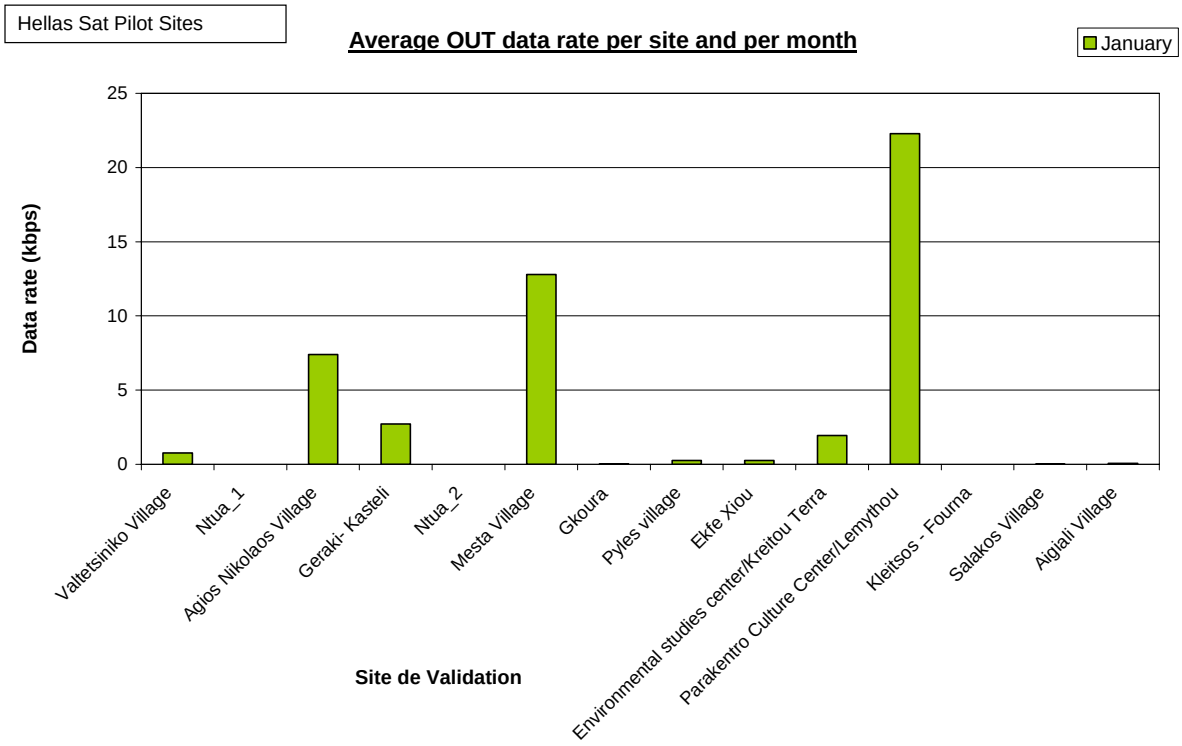
10A Average OUT Data rate per site and per month



Avanti Pilot Sites



Hellas Sat Pilot Sites



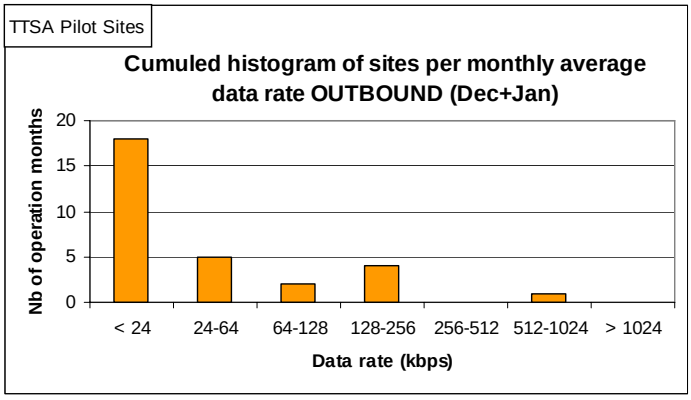
Average upload throughput registered for TTSA pilot sites are higher than the data rates registered for the download. This fact is quite surprising since typically the download bandwidth is higher than the upload one. Nevertheless, this is also supported by the particular behaviour of the Dezna pilot site. Further analysis on the data rate evolution will be required through the next Test Runs.

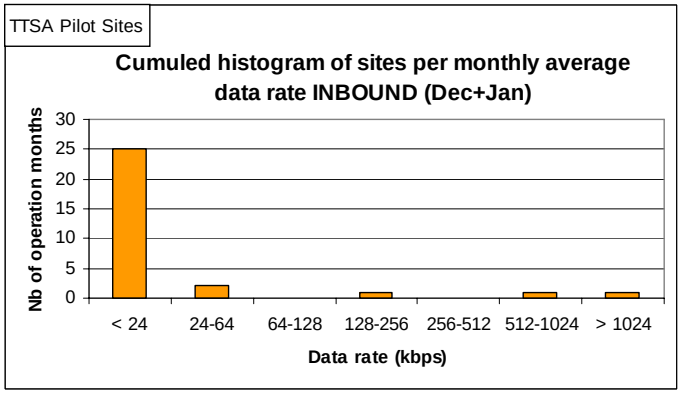
Once again, ratio between the upload data rate per site and per month is the same as the ratio calculated with the total uploaded volume per site and per month (1A). This reflects the way the average data rate has been calculated: total volume per site per month/month. This is not the correct way to obtain this measure. We recommend thus Avanti to revise its data rate calculation process.

Hellas Sat measures of the upload data rate seem more coherent with the expected results than those of TTSA, in general the upload throughput is lower than the download one. Once again the site with the highest results for the data rate is the cultural centre in Parakentro.

11A Histogram of sites per average data rate

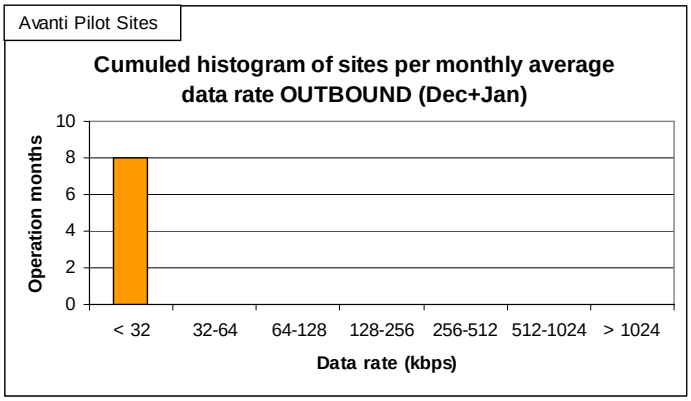
The objective of these graphs is to show the distribution and the mean of the cumulated operation months in terms of download and upload throughput. For average purposes we have inserted a point per site and per month in a total cumulated graph.

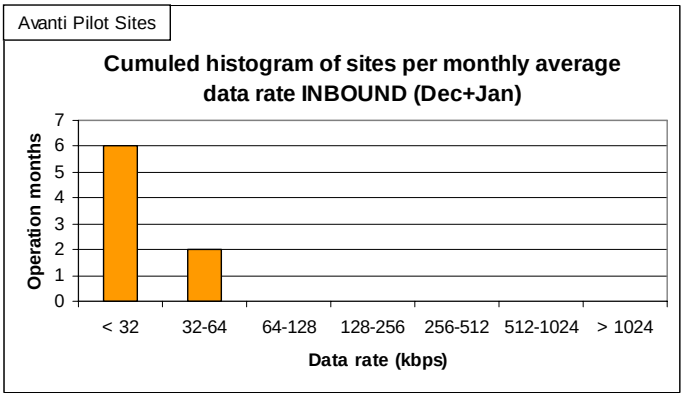




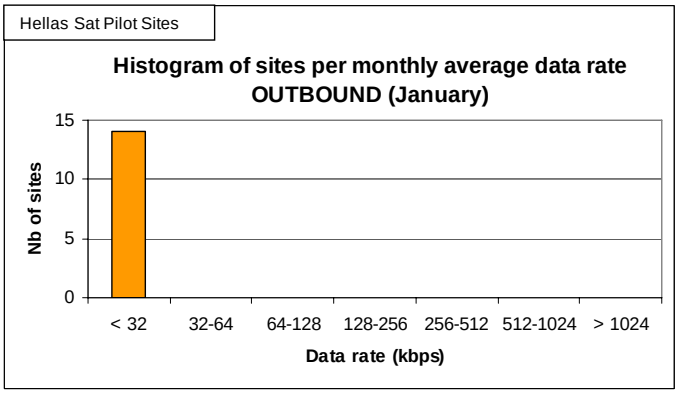
For TTSA pilot sites we see that most of the pilot sites are placed in the first data rate range below 24 kbps. Some sparsely points are then to be found in ranges 24-64, 128-256, 512-1024

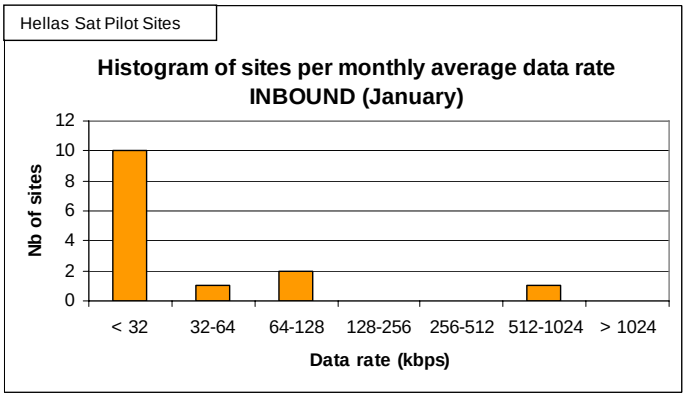
and higher than 1024. Concerning the upload, the distribution is more shared between different ranges; however the most numerous one is still the lowest category of data rates below 24 kbps.





Avanti pilot sites are to be found in the lowest range for the outbound and shared with the 32-64 categories for the download. However as already mentioned the measured values must be revised since the process used for its collection might not be the correct one.





For Hellas Sat since the provided values cover only some days in January we can directly clarify the pilot sites in the different ranges of data rate defined. Thus the “y axis” doesn’t talk about operation months but number of real pilot sites, we have just one point per site. For the outbound, all sites are place in the lower category. For the inbound data rate, we see the most of the sites are placed on the first category but 4 others appear spread between the 32-64, the 64-128 and the 512-1024 categories.

Conclusions

First traffic statistics show an increase in the RW Pilot sites activity as the time goes by. This is a very positive result since it confirms that RW Pilot sites behaviour is evolving and end-users are getting used to the Internet access provided.

It is also clear that the download (inbound) traffic represents a much more mportant volume than the upload one except in the particular case of the TTSA site of Dezna where the outbound traffic is at least twice the download.

In general, the measured volume per site varies a lot between the different pilot sites. For each SSP the top users are Dezna (TTSA), Cilcennin (Avanti) and Parakentro Cultural Centre (Hellas Sat). The RW top site in terms of generated volume is Dezna with a total of 80.3 GBytes downloaded and 362.5 GBytes uploaded. These volumes have been generated mostly by Peer to Peer traffic in December and by Web browsing in January. For Avanti, and Hellas Sat top pilot sites we have also observed a similar protocol distribution between “All other” traffic and Web browsing.

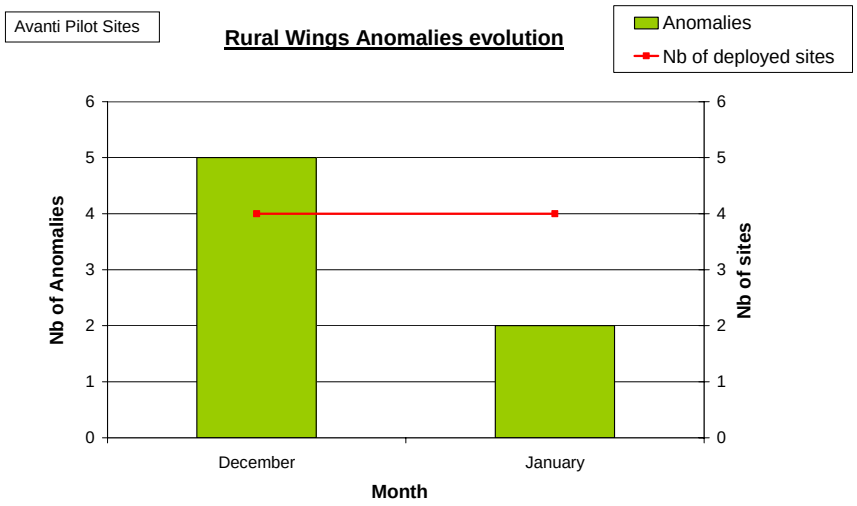
“All others” traffic seems to decrease in time for TTSA sites following the application of more Peer to Peer restricting rules while in Avanti the trend is the opposite, it increases with the time. For Hellas Sat, Peer to Peer is present in almost all sites. This situation is to be followed closely in order to be sure that this important Peer to Peer activity does not interfere with the own RW applications usage and bandwidth fair access for all sites and end-users.

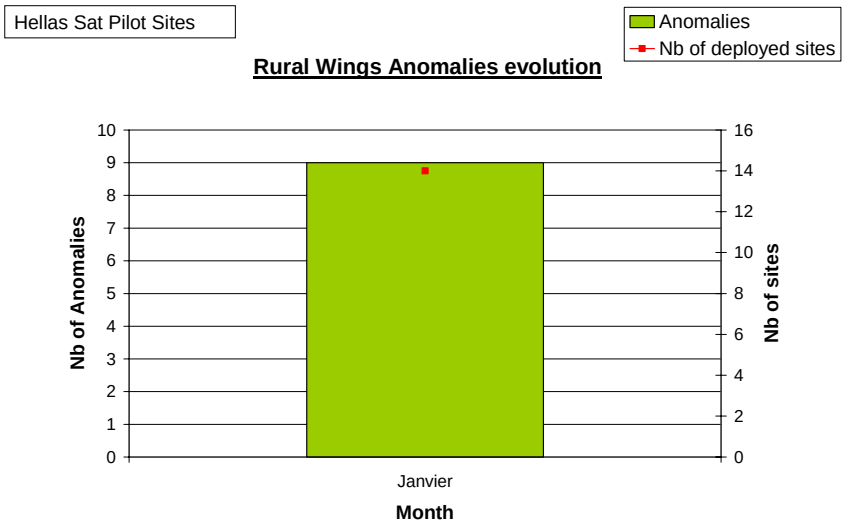
Total volume registered for web browsing is surprisingly high for the three SSPs top sites. This could be explained by an intensive http downloading or by Peer to Peer activity masked behind TCP port 80. We recommend studying closely the activity for these sites. This can be done by correlating information with the Pilot Sites National Coordinator and with end-users experience of the RW provided satellite access. In fact this suggestion of correlating information is recommended for all the Pilot sites in order to have a better picture of their usage.

The general Rural Wings network monitoring platform is validated and most of the statistics and graphs are collecting interesting information with enough precision for our analysis. However some additional work is still to be done concerning the instantaneous measure of the throughput, especially by Avanti.

5.2.2 Network reliability (anomalies)

1B Evolution of anomalies

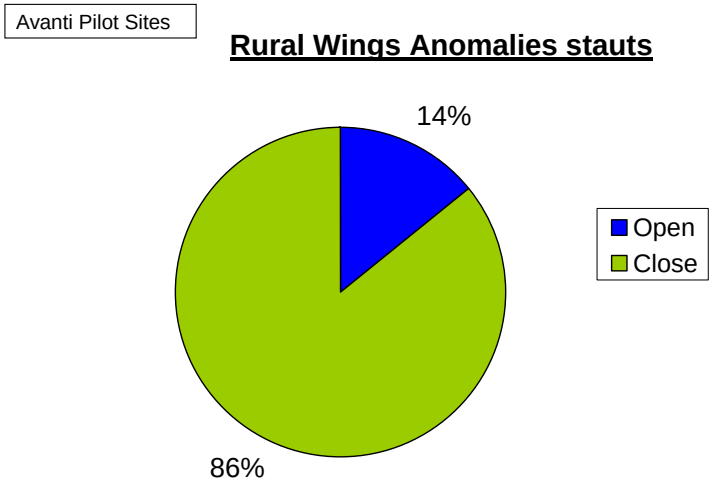


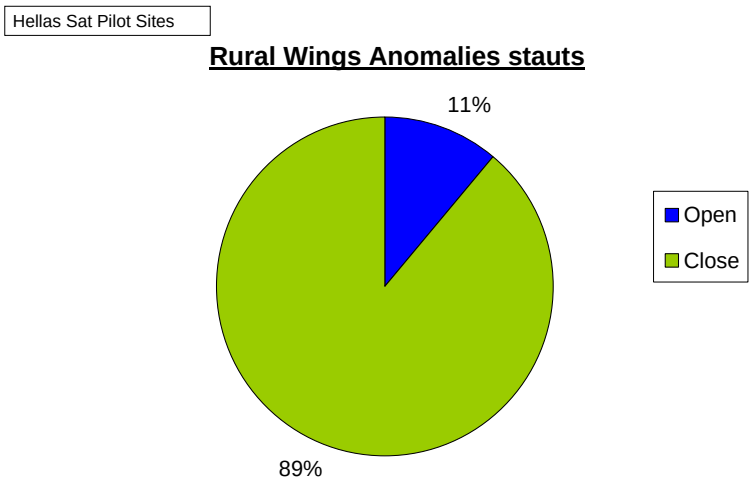


A total of 16 anomaly tickets have been registered for the Rural Wings pilot sites between December 2007 and January 2008. 7 incidents were reported to Avanti (5 in December and 2 in January) while 9 were reported to Hellas Sat. TTSA has not been notified of any incident. This is might be a surprising result, thus Astrium believes that the supporting procedures are still not very clear for these sites. We recommend the National Coordinator to keep close contact with

TTSA customer help desk and with RuralWings end-users in order to be able to detect incidents and solve them in the most efficient way.

2B Distribution of incidents per current status

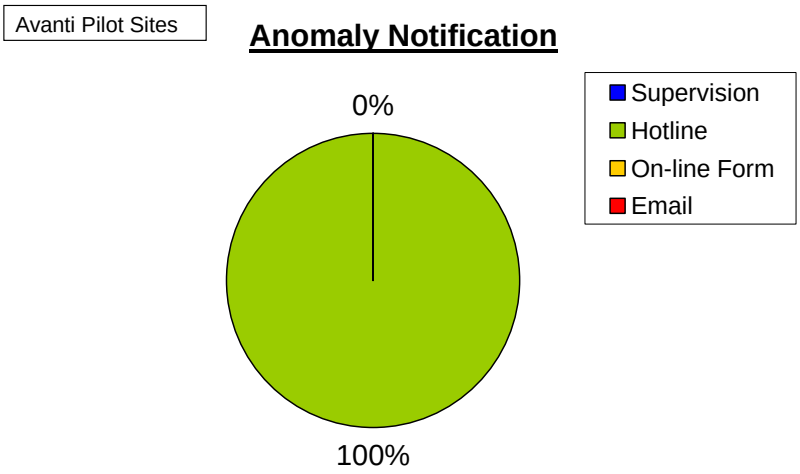


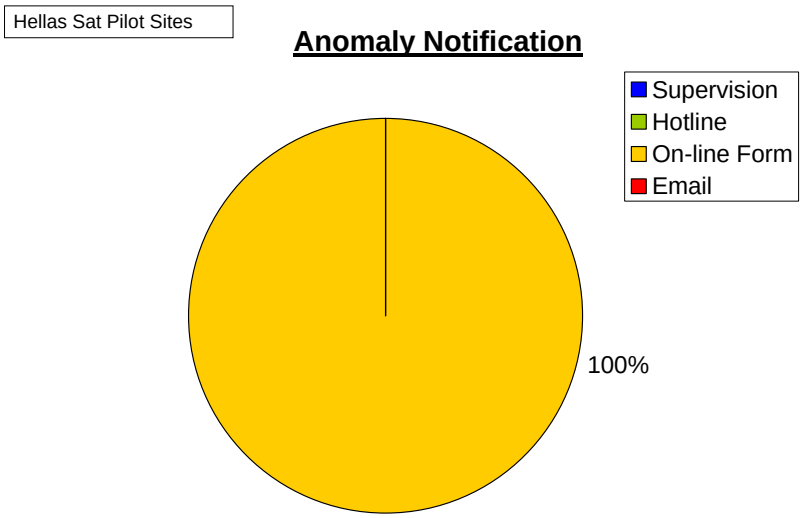


14% of Avanti tickets are still open at the time of this rapport is being written, this means that 1 ticket is under treatment currently.

One incident is being treated by Hellas Sat at the current time of this deliverable which represents 11% of the total number of incidents notified.

3B Distribution of incidents per type of notification

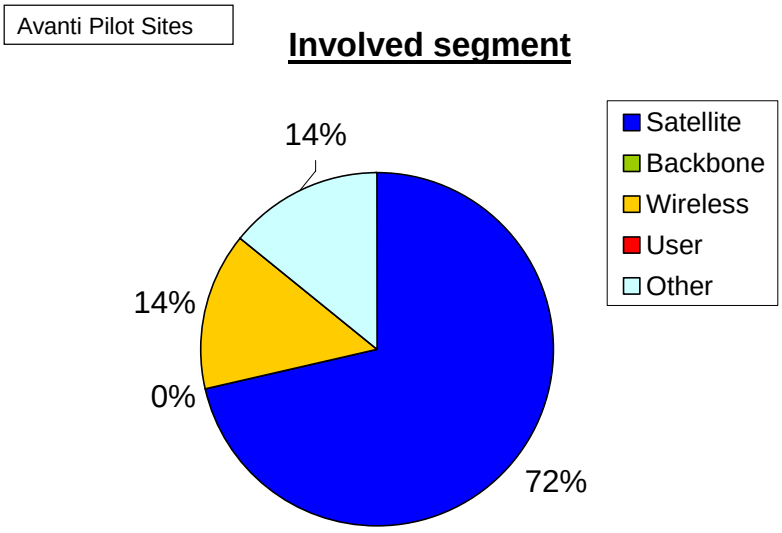


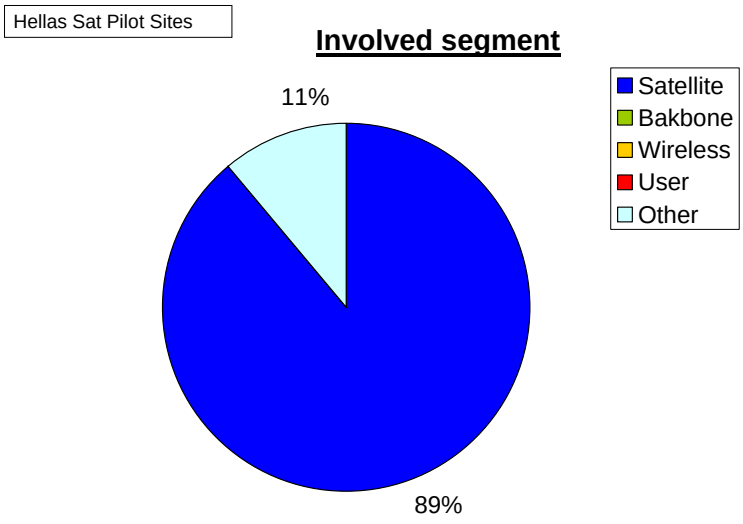


All Avanti incidents have been communicated through the Avanti hotline.

For Hellas Sat anomaly notification was done via an on-line form that users filled in directly.

4B Anomaly reports per involved segment



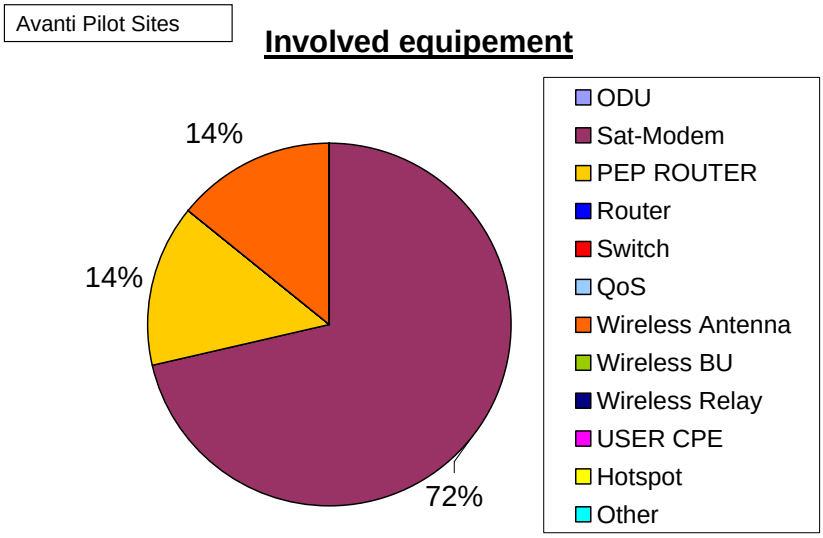


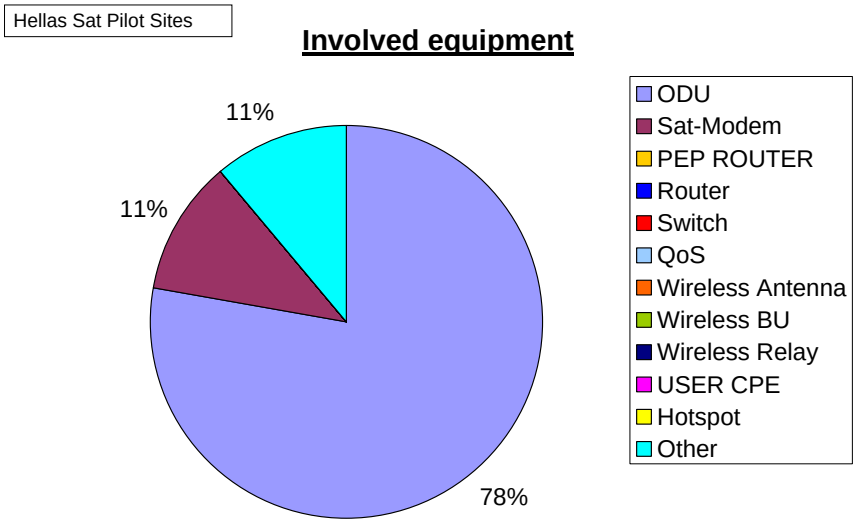
Most of the registered incidents have covered the satellite segment with a total of 72% in Avanti (5 tickets) and 89% for Hellas Sat (8 incidents).

Since Avanti acts as National Coordinator for the UK and also monitorises the wireless local loop, we know that 1 incident has been registered on the wifi segment.

1 anomaly has been classed as belonging to the “other” category for Avanti and another one for Hellas Sat.

5B Distribution of incidents per equipment

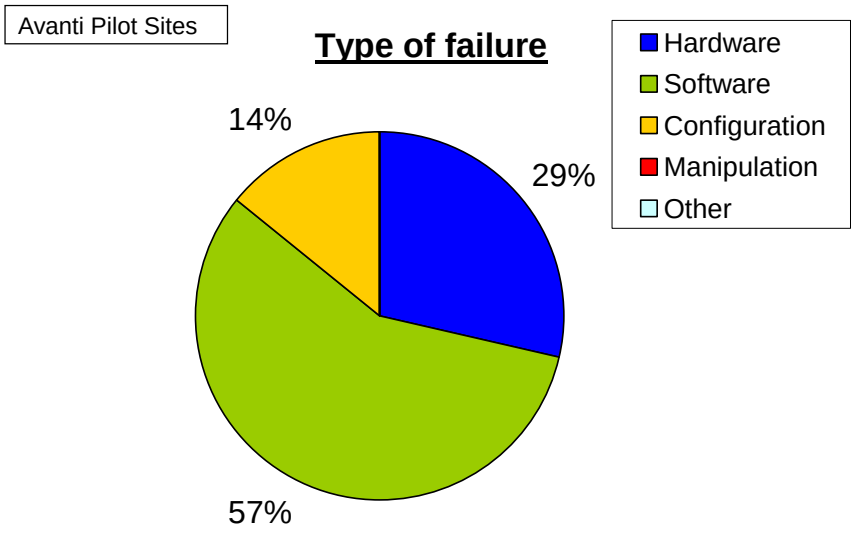


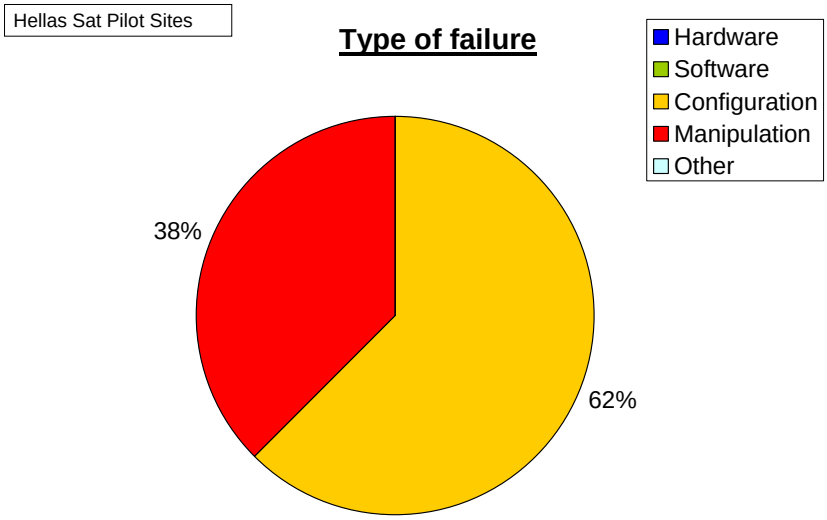


All Avanti incidents related to the satellite segment were localised at the Satellite modem level. Incident on the wireless segment concerned a wireless antenna and the problem classified as other concerned the PEP Router. This last anomaly in fact should have been classified as belonging to the satellite segment.

For Helllas Sat incidents, satellite segment problems were all related to the ODU except one that concerned the satellite modem.

6B Distribution of anomalies per type of failure

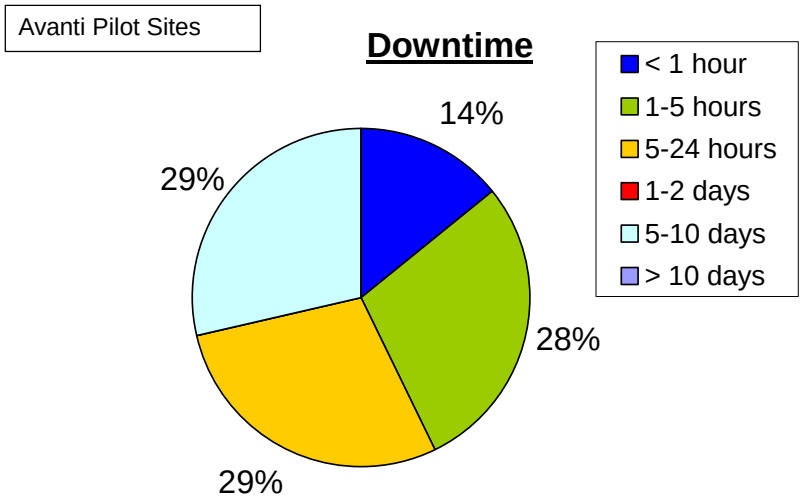


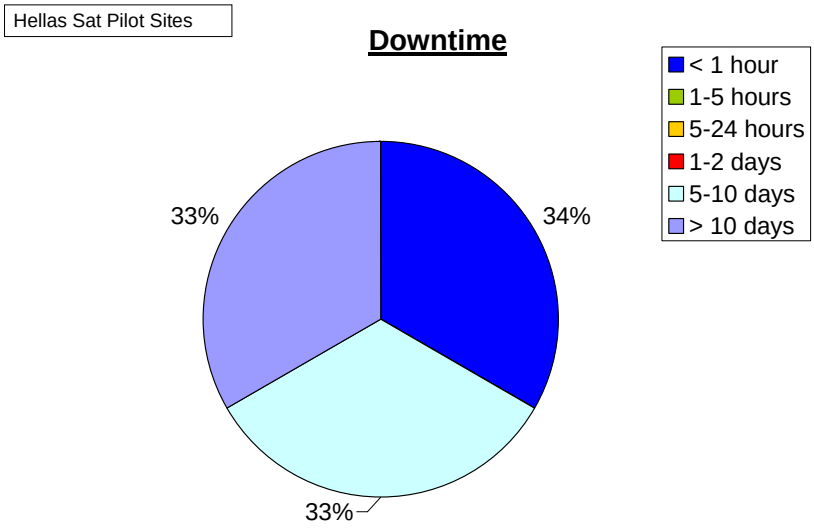


Avanti incident with the wireless antenna was a hardware problem. One of the satellite modem incidents too. The PEP router incident was a configuration problem while the rest of the satellite modem incidents (4) were due to the software.

For Hellasat, 62% (5 tickets) of the incidents were due to a configuration problem while the 38% (3 incidents) were due to a wrong manipulation of the equipment.

7B Distribution of incidents per downtime



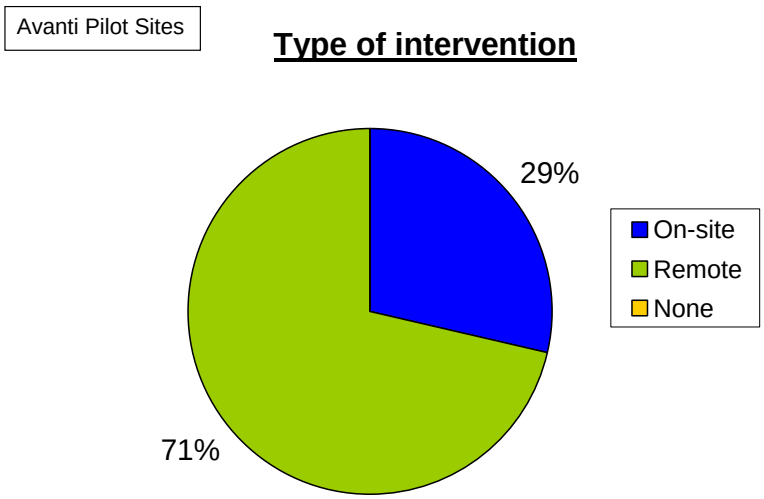


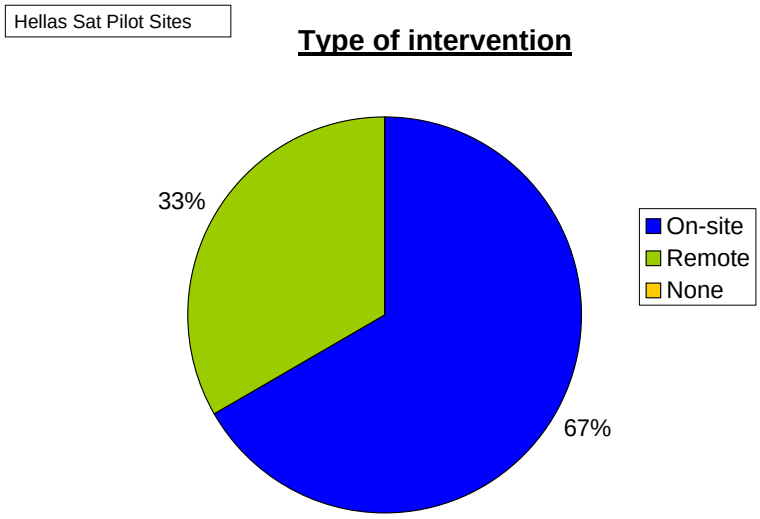
For Avanti sites, only 2 incidents took between 5 and 10 days to be solved, these were hardware failure that requires replacement (as shown in figure 9B) thus a longer downtime is logic. 2 anomalies were solved within one day, another 2 in less than 5 hours and one incident was solved in less than 1 hour.

For Hellas Sat anomalies whether the downtime was long (more than 5 days) or they were solved very quickly in less than 1 hour. The downtime distribution is equitable between more

than 10 days (3 incidents), between 5 and 10 days (3 incidents) and less than 1 hour time was required to solve another 3 incidents.

8B Distribution of anomalies per type of intervention



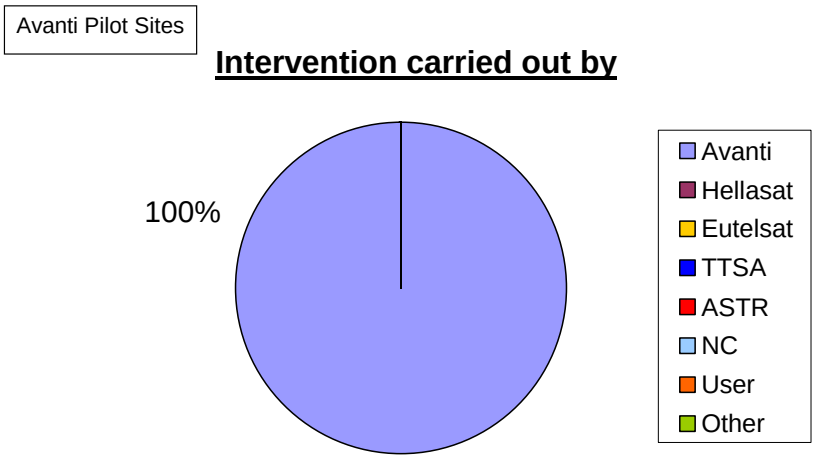


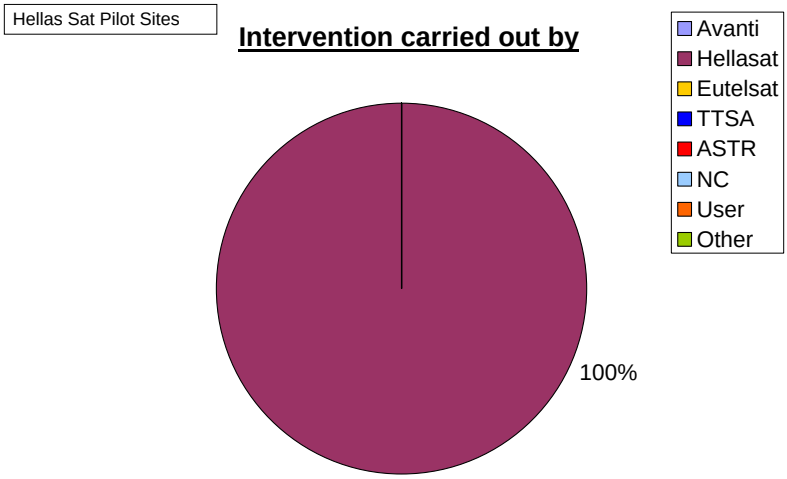
These pie charts are almost opposite one to the other. Avanti mostly solved its anomaly remotely while Hellas Sat incidents mostly required on-site intervention (6 tickets).

The on-site intervention cannot be avoided when there are hardware or manipulation problems that require the replacement of the faulty or damaged equipment.

Since on-site interventions are more expensive than the remote ones for all the incidents that can be solved through a reconfiguration, the ideally is to be able to take control of the equipment remotely. However if the terminal is completely shut down this is not possible. Intervention of the end-user or national coordinator (when present on site) could be very useful in these situations.

9B Distribution of incidents per participant

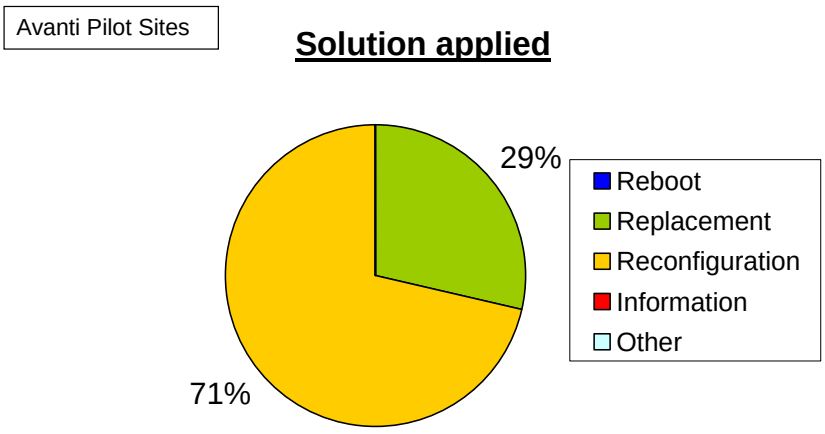


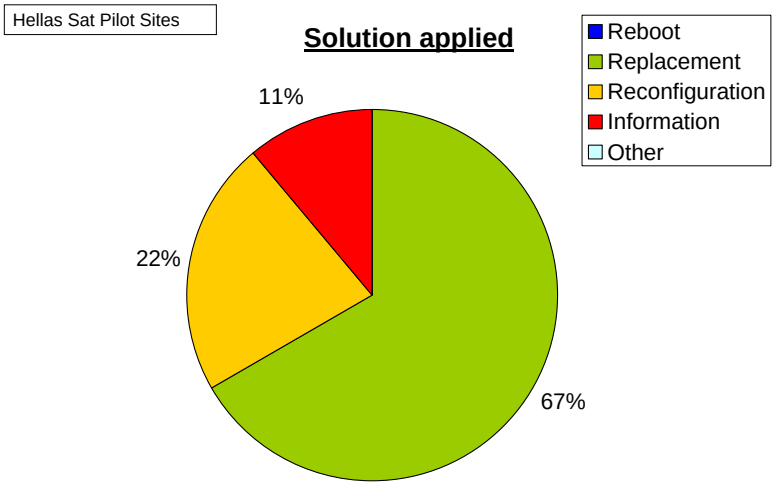


These graphs show that all the interventions were carried out by the Avanti or Hellas Sat. No other actor was implied. This is normal given the type of the incidents registered.

From Astrium experience in previous projects like TWISTER we have seen that a lot of incidents (for instance caused by software conflict or problem) can be solved by terminal reboots (there has been no anomaly like this in the First Rural Wings Test run as it can be confirmed with 10B images). In this situation first level actions that end-users, local administrator or national coordinators can perform might be enough to solve the incident provided that they have received a correct training on fist level maintenance procedures. This approach will enable extra expenses saving on travel costs and working time of technical personal on site.

10B Distribution of incidents per type of solution applied





71% of the Avanti incidents were solved through a reconfiguration of the equipments. 2 other incidents, the ones caused by hardware problems were solved on-site by the replacement of the faulty element.

In the case of Hellas Sat, there were 6 replacements, which correspond to the 6 on-site interventions. The reconfiguration (2 tickets) and information (1 incident) were performed remotely.

Conclusions

Anomaly reports registered by Avanti during the fist test run period mostly concerned the satellite modem software that had to be upgraded or reconfigured surely due to the hub migration from the Newtec solution to the STM one. Such incidents were solved remotely in less than 1 day.

Hellas Sat incidents mostly concerned the external ODU of the satellite terminal and required on-site replacements. These interventions required the sending of a technical team on site thus downtime was long, usually between 5 and 10 days. Other type of anomaly concerned the satellite modem and this was solved though a remote reconfiguration in less than 1 day.

No anomaly tickets have been registered for TTSA Pilot Sites. The fact that no network incident has been notified from 15 operating Pilot sites during the 2 months of the Test Run period is quite surprising. This situation might be reflecting a not enough clear maintenance procedure established by the pilot site operators. This is the responsibility of the NC's coordinated with the SSPs.

From Astrium experience in other projects we suggest revising the communication and supervision procedures for all Pilot Sites between the different Rural Wings actors involved: end-users, National Coordinators and technical partners (SSPs). A clear maintenance procedure is of key importance to improve the effectiveness of the Pilot Site's operation and the end-user satisfaction. Besides first level maintenance training of end-users and national coordinators has a very positive impact on the rapidity in which basic anomalies are solved since simple actions such as CPE reboots etc can solve many issues reducing also maintenance costs.

5.3 Conclusions and next steps

As already mentioned the results provided in this section enabled us to validate the Rural Wings monitoring platform implemented by the three Rural Wings SSPs (Avanti, TTSA and Hellas Sat) under the coordination of Astrium.

For future Test Run periods the current monitoring platform (deployed at satellite hub level) could be enlarged with local monitoring in those pilot sites that have shown a particular network activity. The investment on a local supervision system together with a QoS equipment can be justified by a large number of end-users and/or connected PCs or by an important traffic volume.

Network usage results show that the RW Pilot sites activity is increasing with the time as the end-users get used to exploit RW satellite access new opportunities. Nevertheless, given the important presence of Peer to Peer activities registered, Astrium recommends supervising closely the impact of theses aggressive applications for the sites and end-users fair bandwidth access and for the correct Rural Wings applications performance.

In order to enrich the network usage analysis, two main measures must be taken:

- correlation with the number of end-users per site is urgently required. For this first analyse, it has been impossible to recover the number of users per site. A table with the number of users per site is thus asked to National Coordinators and other RW partners. For networking purposes we have agreed the following definition of user per site => 1 user = 1 PC connected to the satellite access point either by a wired network or by a wireless one. Knowing the number of users will help us justify why some sites present more activity than others or identify problematic Pilot Sites where not enough activity is being carried on given the expected number of users.
- Further correlation with National Coordinators and end-user system experience. National coordinators can provide complementary information on the users profile, computer literacy and context. This will be very useful for the interpretation of the statistiques.

Finally, an additional measure can be proposed. Since National Coordinators are in charge of Pilot sites operation they often deal with system anomalies too; thus it would be recommended to communicate them the proposed Anomaly Report ticket template. This would enable to complete the incident record data base with those anomalies that do not reach the Rural Wings SSPs.

6 Summary

The usability evaluation of the RW infrastructure and services was conducted using four different approaches (heuristic evaluation of Rural Wings CAP, monitoring during user training, assessment through online-questionnaires and network monitoring). In this deliverable procedures and results were presented in detail. In the following, the most important findings and recommendations will be summarized.

6.1 RW-CAP

Nearly all participants in the usability evaluation survey (50 out of 53) have used the RW-CAP during the test runs and 40% did name it as one of the three most visited websites. It thus seems to play an integral part in usage and perception of the RW project.

Results from the feedback during user training and the usability questionnaires show that the RW-CAP should be further improved in order to literally serve as a “central access point”. The main focus in this context should be to improve the accessibility of the RW applications by simplifying the sites structure and thoroughly revise and complete the available link-lists. There are also still some open points from the heuristic evaluation that could be continuously integrated. As discussed in 3.2 of this deliverable indicates, translations of the RW-CAPs content and integration of localized RW-sites and training materials should be considered by some NCs.

6.2 RW applications

Although 22% of the participants in the survey had not used any RW applications when answering the questionnaire, 15 different RW applications were used and rated during the test runs.

The usability ratings for the applications were overall positive but relatively low ratings of single applications or usability aspects should be considered seriously by the respective platform providers. In this context, platform providers should also obtain feedback from the NCs in whose pilot sites the applications were used (see table in 4.2.1 of this deliverable) in order to gain more insight in potential shortcomings and areas for improvement.

6.3 RW support and training

Concerning the competences of the end users it became obvious from the usability survey that the IT knowledge varies widely. Thus NCs should be very aware of their end users different needs in terms of support and training. The usability monitoring showed furthermore that additional competencies might be necessary for different user groups in different contexts (i.e. online collaboration). In this respect measures should be taken to enable users to fully profit from the RW services. The translation of manuals and the preparation of additional tutorials form an important part of this complex.

While the overall rating of the RW installation services and the RW support was very positive, 13% of the end users rated the introduction to the platform and to the overall infrastructure as poor over 70% of them students. One possible explanation given above is that user training conducted by the NCs focused more on the participating teachers and that information needs of students were thus not fully covered by this approach.

6.4 RW infrastructure

The RW services are mostly used during the week, nearly one third of the end users has no access on weekends. The end users were mainly using web browsing (89%), e-mail (79%), file transfers (52%), software updates (40%) and RW applications and tools (38%) via the RW internet access.

- **Network monitoring**

Definition of the User concept

1 User = 1 PC connected to the satellite access point either by a wired network or by a wireless one.

Since National Coordinators are in charge of Pilot sites operation, they often deal too with system anomalies. The next step will be to communicate this template to the NCs so that to complete the Rural Wings incident record.

7 References

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8 ANNEX

8.1 List of usability problems in the prototype RW-CAP (heuristic evaluation)

General problems

- homepage suggests depth/ much content, but there are merely linklists
- => triggers wrong expectations; scope has to be made clearer
- Navigation seems oversized for content available; information cannot be accessed quickly enough

Missing features

- Imprint with contact details (including postal address, phone number and topic specific e-mails i.e. webmaster, national coordinators, ...)
- A disclaimer should be added
- It should be indicated, when the content was put online or was last updated
- „help"-page or function should be added and links to it provided on every page
- FAQs should be added and updated on a regular basis
- A site-map could be added in order to visualize the site-structure
- Print-options/pdf-files should be integrated when presenting long text or linklists

Structure

- Structure ist not clear/consistent
    - o „platforms for students" can only be reached via „all rural wings" (which is expected to be a summary of the other categories with no additional platforms) not via „learn@school,
    - o users expect the same content in „Home >All Rural Wings >Medical" as in „Home>Medical"; this doubled stucture is very confusing and should be improved.
    - o Navigation and paths should match!

Design/ Layout

- Fontsizes should be reworked, i.e. headlines are smaller that text
- One font should be used consistently
- Colors are pleasant in general, but font-colors should have more contrast to background (i.e. greeting above logout-button is hardly readable)
- Layout will have to be improved (i.e. home>All rural Wings>learning@work)
- Lists are not formatted consistently

Broken Links/ missing attributes

The following elements are missing height and width attributes

- http://ruralwings.rd.forthnet.gr/components/com_joomfish/ima.../en.gif
- http://ruralwings.rd.forthnet.gr/components/com_joomfish/ima.../gr.gif
- http://ruralwings.rd.forthnet.gr/images/stories/iconagric.gif
- http://ruralwings.rd.forthnet.gr/images/stories/iconhome.gif
- http://ruralwings.rd.forthnet.gr/images/stories/iconkeys.gif
- http://ruralwings.rd.forthnet.gr/images/stories/iconmedical.gif
- http://ruralwings.rd.forthnet.gr/images/stories/iconplatforms.gif
- http://ruralwings.rd.forthnet.gr/images/stories/iconschool.gif
- http://ruralwings.rd.forthnet.gr/images/stories/iconsearch.gif
- http://ruralwings.rd.forthnet.gr/images/stories/iconwork.gif

The following links are broken

- http://ruralwings.rd.forthnet.gr/favicon.ico
- http://ruralwings.rd.forthnet.gr/templates/cap_local/images/iconUsers.gif

Other Features that should be improved

- Visited links should have a different color
- Links should always have a mouse-over explanation
- External and internal links have to be distinguishable
- The final URL should be international (.org or .net) and easier to remember than http://ruralwings.rd.forthnet.gr.
- Wording should be target-group-specific (i.e. tools for students)

Comments on single Pages

HOME

- Purpose of website is not clearly expressed at the beginning. What is the platform for?
- Abbreviation RW-CAP in headline is not advisable.
- Layout in the Login-Area should be refined
- Link to RW-Projectsite should be marked as external and open in a new window
- It does not become clear how the links on the right side are chosen (www.forthnet.gr,...) as they don't represent the linklist; should have headline;
- Links in the header are repeated below on the right side, take out once.
- The „contact other user"-button is not working; community-features should be integrated (as discussed in the rw-plenary meeting in Toulouse)

My Services – large direct-links

- have no labels (only Tooltip)
- are not concise (i.e. learn@work-icon could be medical topic as well; different styles)
- are different to icons in navigation
- wording is different to navigation
- direct-links are redundant as they merely double the navigation

Your Details -> Edit Your Details

- Save / Cancel Buttons should be below formular and be labelled

Submit WebLink -> Submit A Web Link

- Save / Cancel Buttons should be below formular and be labelled
- No rule for URL (with http:// ?)

Registration

- It becomes not clear why users have to register to access the website
- It should be made transparent, what the personal registration data will be used for (privacy protection)

Search-function

- Search function is not reliable: search for category „learning@home“ and „nemed“ showed nemed in the learning@work-category; „Category“ and „platform title“ should be connected by logical AND not OR

Comments

- it should be made clear if the comments will be read/monitored by the platform providers
- is should become more clear, what the comments are good for – community-idea should be communicated
- No rule for URL (with http:// ?)

Change Language

- More languages are expected for a european project
- Layout is broken in the greek version

8.2 List of usability problems and questions that occurred during user training

1. Manuals
   - Manual on how to use moodle was developed for Spanish users (Spain)
   - A specific tutorial was integrated in the YouRa manual for Spanish users (Spain)
   - Medsky and Marratech were difficult to install and the manual is not available in French (France/Martinique)

2. Tools
   - reorganization of Spanish rw website to allow faster access to manuals (Spain)
   - Users had to be explained and given tutorials on how to work with learning management systems (LMS) i.e. upload documents in moodle (Spain), test creation, annotation of scores (Romania)
   - Access and usage of collaboration platform and video conferencing was difficult for the end users – video presentations were prepared by NC (France/Martinique)
   - Users found it hard to register in some applications (Spain)
   - Users are not interested in certain application – it was explained that they are not expected to use all applications but choose the offers they are interested in (Spain).
   - **HET**-related questions: how to contact course instructor and other users, how to display right answers in online tests; support had to be given on local sound settings and required plug-inns; One of three courses did not open (Estonia).
   - **Web-TV** related questions: which plug-inns are needed; how is it possible to make a live-transaction? (Estonia) Users had videos in a format not supported by Web-TV and are not able to change the format and upload videos without help by NCs (Spain). Users found it difficult to choose the appropriate type of upload interface.
   - YouRa related questions: path to enter includes to many steps – Spanish NCs entered a direct link in the Spanish RW website. How to enter data? – oral explanation was given and a tutorial created by NCs (Spain)

3. Infrastructure
   - satellite link failed during training session in Martinique and Romania
   - lost connection to marratech server (France/Martinique)
   - quality of video and sound was low during a tele-lecture training session between Martinique and Montereau (France/Martinique) and in Romania
   - initial installation of satellite equipment in Martinique was delayed
   - decreased performance since hub upgrade (UK)

- users asked why the quoted bandwidth was not available to each user at all times – shared bandwith was explained (Spain).

4. CAP

- CAP was not well populated, users expect more content (Spain)
- Users were unsure about how to find applications on the RW-CAP – structure was explained by NC (Estonia)
- CAP was not available in local language – users want to have trainings and RW materials/applications in local language as they don't speak English (France/ Martinique, sites in France)
- CAP structure: Not all applications are listed under ALL RURAL WINGS. (Estonia)

5. Other

- end users have not sufficient understanding of team dynamics, collaboration and knowledge management – NC video conf. on team building and collaboration was scheduled for mid-February (France/ Martinique)
- difficulty in managing collaborative sessions – local moderators will be coached (France/Martinique)
- users compared prices of satellite connections to cheap ADSL offers – it was explained that ADSL is not universally available and that satellite prices would need to be kept in touch with ADSL prices. (Spain)
- Concerns about online safety and privacy (i.e. online banking) – information on safety issues was given by NC (Spain