Lessons Learned

by FP6 projects in Software, Services, and Grids

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Version History

Version	Date	Comments, Changes, Status
1.0	24 September 2010	First public version with 23 FP6 projects
1.1	14 September 2011	Second public version with 25 FP6 projects, covering all possible FP6 projects.

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1 Introduction

This document is a collection of lessons learned by research projects in the domain of Software, Services, and Grids. In those domains, the Information Society Technologies programme (IST) of the Sixth Framework Programme for Research & Technological Development (FP6) offered financial contributions to 75 projects. This document gathers their main lessons learned. It is meant as a source of experience and possible inspiration for coordinators and participants of new projects and proposals. The document gives a wealth of information about issues, problems, and solutions that participants have encountered in previous IST projects. New projects and proposals are invited to take advantage of these experiences.

The lessons learned in this document are not technical, and not project-specific. Even though every project is unique, a lesson has a certain value that goes beyond the specificities of the project that defined it. Often a lesson as stated in this document is a summary and more information about the experience gained can be found in the original source.

The document is basically a collection of quotes, which are categorised in four main chapters, and subdivided per chapter. Chapters are shortly introduced, and sections start with some summarising statements. The quotes are taken from original project documents, mostly Publishable Final Activity Reports and occasionally from other deliverables. For each quote, the original source is mentioned. The links to the sources are given at the end of this document. All quotes are from publicly available documents, with 4 exceptions.

One should keep in mind that the quotes (or 'lessons') are often the opinions of individuals in projects, and their inclusion in the original source and in this document does not mean that they are supported by other people in the project's consortium. Some quotes contradict other quotes, even by the same project.

Quotes are copied from original documents as-is, except for spelling and grammatical corrections and a few occasional rewordings to improve the readability. Also, a few additions were made to some quotes to provide some context. Sometimes multiple quotes related to one project are merged into one bullet point. A very limited number of quotes are mentioned twice, under different headings. In a few cases, the names of organisations and/or individuals have been removed.

This version from September 2011 is a minor update of the first version that was published in September 2010. The update consists of the addition of two more projects that finished after the first version was published. All possible FP6 projects in Software, Services, and Grids were finalised at the time this version was published and have been considered for inclusion.

The list of sources at the end of this document shows that quotes originate from 25 projects out of a total of 75 projects. For the full list of FP6 projects in Software, Services, and Grids, please refer to http://cordis.europa.eu/fp7/ict/ssai/fp6_en.html. The number of projects covered here is quite limited, but still representative. Not all projects have used the recommended Table of Contents for Publishable Final Activity Reports (which includes a section on lessons learned), and from those that did, not all have resulted in useful lessons learned. Furthermore, there are roughly 270 quotes in this document, of which a third from a single project, TrustCoM. This was one of the very few projects with a dedicated Lessons Learned deliverable, which was similar in set-up to this document.

2 Project preparation, planning and management

This chapter includes lessons learned about selecting partners, choosing the 'right' size of a consortium, planning, defining work breakdown structures, obtaining commitment, managing expectations, project management, quality management, progress control, defining Consortium Agreements, dealing with Intellectual Property Rights, project administration, and financial issues.

2.1 Partner selection

Consortia should be kept small. Partners new to the Framework Programmes bring new ideas. Partners may come and go. Involvement of the 'right organisations' does not mean involving the 'right people'. The success of a project is largely determined by the motivation and commitment of individuals.

- "With 8 companies, MIDAS for us was a big and complex project. We know that there are even larger EU consortia, but cannot imagine that they can be productive. As the personal span of control of a manager is said to be typically around 7 people, we would suggest **keeping consortia as small as possible**, and never bigger than 10 companies." – MIDAS, p. 27
- "It is important that many partners **already worked together** in the past in other European research projects. This strengthens trust and commitment." – TrustCoM D74, p. 9
- "Inexperienced partners brought **new ideas**, but also started discussions beyond what are the **'unwritten laws' of behaviour** in European research projects. The coordinator could have avoided this by giving them 'an introductory course'. On the other hand, some opportunities may have been missed." – PROMISE mgt, p. 4
- "Three partners left the project. One of them was a key technology provider that had to leave due to financial difficulties, and which had to be replaced by a new partner. Although the new partner agreed to take over all the responsibilities of the old partner, it is a different company with different business objectives, different people and different competences. To adjust to the changed situation and **'tune in' the interface between the new partner and the rest of the consortium** takes time and adds to the complexity." – PROMISE mgt, p. 2
- "Where we were successful in MIDAS it was mainly through the **personal motivation** of particular individuals and where we failed it was mainly through the **lack of commitment of individuals**. Don't assume that because you have the right organisations in your consortium that everything will work out all right." – MIDAS, p. 27
- "When you include a user-representative organisation, select the **user-representatives** of these organizations, rather than their IT departments. They should focus on explaining business value and providing evaluation reports. They should not be asked to do complex technical tasks, even if they seem to be capable of doing so. This would contribute to keeping roles well-defined." – MIDAS, p. 27
- "Partner X should have **involved internal contracts and legal specialists** to comment in more detail on its application scenarios. This was done to a limited extent in early 2005 and into 2006. It would have been better to have done this earlier in the project in 2004." – TrustCoM D74, p. 18
- "During the trials of the media and banking pilot applications, it turned out that user friendliness was not always met, but is nevertheless absolutely crucial. Although the creation of an intuitive GUI is not a challenge from a technical point of view, a consortium of a project like GREDIA should include a **partner with profound expertise** in that field." – GREDIA, p. 41, also in Section 5.4

- "It is difficult to work towards the project objectives, and to follow the project pace, when the demonstration case is centred on a business case provided by a **partner staying outside the consortium** which was the case in this demonstrator with company X. This is true even in the company X case, where X's managers have always been very cooperative in supporting PROMISE partners in the development work. These difficulties are mainly related to the different views and objectives between the outer partner and the project consortium, even when, such as in the company X case, both actors agree on the problem to be tackled in the demonstration case and both feel the importance and potential of the application and are interested in solving the related common issues." – PROMISE FAR Annex, p. 67

2.2 Planning, project organisation, and set-up

FP6 plans revisions of the workplans at regular intervals for Integrated Projects, which creates flexibility and complexity. Work packages need to be split thematically. Projects need to be aware of the relevance of technology developments for their activities and to adapt if appropriate and feasible.

- "FP6 introduced the concept of **rolling plans**. All plans were therefore revised every 12 months. This meant that resources were redistributed, work scope reviewed and detailed (work packages were completed, amended and changed), schedules updated and project organization changed according to needs. This created a dynamic project environment providing the necessary flexibility to reach the objectives, but at the same time added to complexity and created challenges in the management of the project." – PROMISE mgt, p. 1-2
- "Idea for improvement: allow a **project contingency**. From day one, all resources were allocated on partner and task. Yet the project plan was not complete as it was expected to be a rolling plan. New ideas may be more easily implemented if there is a cost item (contingency) to be allocated during execution. This benefit would probably compensate for the internal fight for money that all partners know is still available. PROMISE had to redistribute money amongst partners which proved to be a painful and difficult process." – PROMISE mgt, p. 5
- "Regarding work plan and work package structure, TrustCoM exhibited a need for restructuring very soon. Instead of targeting the issue immediately, it led to quite a bit of confusion and compensation mechanisms. For instance, the number of face2face meetings and conference calls grew rapidly, but those measures were not able to cope with the problem. As a bottom-line, the ability to **restructure a project's schedule** is a good thing. Project management should be able to detect the necessity to do so as early as possible and encourage partners. To avoid a planning 'vacuum', project management needs to finalise the new schedule quickly, mainly in order to avoid confusion along which lines of planning partners should work and report." – TrustCoM D74, p. 10
- "A point, which turned out as problematic in practice, was the fact that **scientific planning had to be conducted on an effort basis of person months**. First, it turned out that person months are not comparable in general. When a task was scheduled to use ten person months, it was often not clear who exactly will do the task and what qualification he or she will have (this was a major issue especially at the beginning of the project when project members were not well known). Ten person month of a post doctor, in a field where he or she is an expert, are naturally much more productive than ten person months of student work. Since in some cases even the partners themselves did not know who exactly will work on a task specified one year in advance, the planning on the basis of person month sometimes turned out as invalid. For example, while ten person months were initially planned, it turned out that twenty or thirty person months were needed because instead of the initially planned post doctor only students were available." – ASG, p. 16
- "Another issue was the need for **splitting up efforts into research, management and dissemination efforts**, especially since the different types of efforts are supported by the European Community in a different way. It is simply nearly impossible to identify (especially if one person does all three types of efforts) how much of which kind of efforts

will be needed in the future to conduct a specific task. Practice showed that it is sometimes even hard to decide after the execution of a partial task where its efforts belong to when, for example, a person works as work component leader and he or she spends some hours on e-mail writing to organise and manage his research team, are these research efforts or management efforts? As a result of this experience, we propose to avoid such an unclear differentiation of effort types for future projects. Instead of the introduction of such an arbitrary differentiation, it is much more useful to let the partners explain, after conducting of the efforts, how much money was used and what for." – ASG, p. 16

- "An IP such as NextGRID, which is driven by the iterative design of an architecture rather than having an orientation to a particular development goal, presents significant challenges to coordinate the work effectively. The management of the **dependence between different tasks** across the project has been particularly demanding." – NextGRID, p. 32
- "After initial difficulties with the conceptual work, the framework has shown strong improvements and wide acceptance. Also, the collaboration between implementation and design has greatly improved with **realigning the project work package structure** to reflect the technological areas." – TrustCoM D74, p. 17
- "The top-down / bottom-up distinction between Action Line 1 and Action Line 2 caused confusion in the beginning of the project. It bears the great risk of the two ends not meeting in the middle. This caused the **work package reorganisation** at the beginning of the project. In effect, the approach has to take a middle way which results naturally from the strong overlap in partners between action lines: the 'pure' architecture work consisted in analysing the relationship between the technological areas (security, SLA etc.), and forwarding the interaction requirements accordingly and gather feedback from implementation. Within each technological area, the required functionalities and their relationships are first defined (by people involved in both action lines) and then verified and realised through action line 2. The respective results were then fed back to action line 1 to verify and/or update the according relationships." – TrustCoM D74, p. 13
- "The Amigo project started in 2004 with the technologies and expectations of that time. Furthermore, the preparations for the project started in 2003. Technology has advanced enormously during 2003-2008. These technologies, for example sensor network technologies, could have been used differently in the project. Furthermore, there was a surge of Web 2.0 technologies that are often used for social networking application, just like many applications developed in Amigo are related to social networking. To stay up to speed with regard to such advances in technology and its applications, **the project needs to be aware of the relevance of these developments for its activities and to adapt if appropriate and feasible**. The Amigo application work packages started using such services as example to illustrate the adaptability and flexibility of the system. Other activities, not foreseen in the original proposal, were started, for example, the communication framework. Furthermore, the central role for the Context Management Service in the Intelligent User Services was made explicit for the middleware architecture. The choice of .NET Web interfaces was a risky decision 3 years ago. But, it is now very much at the forefront with regard to the devices' market of today, e.g., Apple iPhone and iPod touch with a complete Safari browser, TV with CE-HTML support, and even printers." – AMIGO, p. 35
- "The creation of a **specific work package on Integration** helped a lot in the harmonisation of the technology developments and the associated implementation in the corresponding demonstrators." – PROMISE, p. 54
- "We should definitely not have major themes spread across different conceptual, architecture, design and implementation work packages. Work packages should be **split thematically** and not based on the 'type of work' required. This causes divisions and imbalances in the project team, as some people were able to move towards development quicker than others, without having reached conceptual or integration agreement." – TrustCoM D74, p. 10
- "It happened a few times that use cases had to wait for component framework features to become available. In this respect, the **coordination** between the component framework deliverables and the use case deliverables could have been better planned." – GridComp, p. 31

- “Implementation and design can be logically separated, but **equal knowledge distribution** is mandatory” – TrustCoM D74, p. 11
- “There were many technical challenges to overcome. With ‘many links in the chain’, the vulnerability is large. A server breakdown or stop at one of the software providers may cause an interruption of almost the whole project. **Such risks are always underestimated** during the planning stage of the project.” – PROMISE mgt, p. 2
- “The consortium was structured with partners in technical roles, non-technical roles and some partners as the interface between the two. There was no motivation for partners to fulfil this **interface role** so it didn’t happen” – TrustCoM D74, p. 8
- “The project had **many interfaces**. There were user companies responsible for the 10 demonstrators, there were technology providers to supply the software and hardware technology required, and there were research organizations to support research, development, implementation and dissemination. There were software interfaces between demonstrator, middleware, knowledge management, decision support, and graphical user interface systems. This added significantly to the complexity with many ‘ends’ to coordinate, and ample opportunities for deadlock situations (a number of partners waiting for results from each other in order to proceed).” – PROMISE mgt, p. 2
- “The project plan was designed such that most partners contributed to most of the work packages. Also there were a lot of **dependencies between the individual work packages**. This was done to foster cross-partner fertilisation, disseminate know-how and create commitment. In practice, this turned out to be more difficult to manage than expected. On the positive side it challenged all partners to look ‘over the fence’ to learn the hard way what it takes to succeed in a distributed, international R&D project.” – COMET, p. 6
- “The chosen **model of collaboration** within the Intelligent Manufacturing System (IMS) framework proved to be efficient in terms of production of results in each region. There was no direct collaboration in terms of production of deliverables but the workshops and other contacts that we had among the partners of the involved IMS regions contributed to the common understanding of the project challenges and the mutual interests.” –PROMISE, p. 54

2.3 Focus, expectations, objectives

All participants must obtain ownership of the objectives of the project. Project objectives must be kept very clear at all times, but may not match the objectives of the individual partners.

- “Feelings about **how the project can progress successfully** are initially seen at the proposal preparation phase. In the case of TrustCoM it was really positive.” – TrustCoM D74, p. 9
- “**Never underestimate the possibilities of motivated partners**. If you succeed showing a clear goal and the related benefits, partners get more motivated and they succeed over producing with respect to the initial expectation.” – GridComp, p. 30
- “Develop team alignment. It is important to obtain **ownership of all project organisation members to the objectives of the project**. If this fails, they will be working on the project from their own perceptions of the project objectives, which may not necessarily be the same as that of the other partners.” – PROMISE mgt, p. 2
- “Keep the **project objectives** – and how responsibility for them is allocated amongst partners – **very clear at all times**. Otherwise motivation can suffer badly, and partners lose focus and deliver poor quality.” – MIDAS, p. 27
- “For some of the large partners, the results from PROMISE were part of a larger internal research agenda. This may allow less flexibility for changes and create a larger challenge to **obtain commitment** to the overall objectives of PROMISE.” – PROMISE mgt, p. 2
- “**Empowering partners** (WP leaders) enforces commitment in the project” – TrustCoM D74, p.11

- “It was hard to determine who should be the right audience for external communication when the **objectives of the project as a whole did not match the objectives of any partner organisation or individual in the project**. The technical community addressed by researchers was not the only audience required to establish TrustCoM as influential for standardisation and exploitation by partners.” – TrustCoM D74, p. 20-21
- “Staff of partners changed along the project, and sometimes it is difficult to have an **overall vision of the project** in some partners.” – TrustCoM D74, p. 9
- “**Project focus and alignment** produced several face-to-face meetings and overspending of travel budget in some cases. There is never enough **travel budget**” – TrustCoM D74, p. 8-9
- “It may be that the **lack of project focus** is due to the lack of full project meetings or their poor leadership. However, it is very hard to get the right agenda for all parties to join in with in order to generate focus.” – TrustCoM D74, p. 19
- “The **balance** between technical and non-technical partners as well as between research and commercial exploitation staff in the project resulted in technical issues and motivations dominating the operation of the project over legal and socio-economic research or exploitation activities” – TrustCoM D74, p. 8
- “Communication between **application owners and technology providers** needs special attention. A gap between the assistance the application owner wishes and the one that the technology provider intends to give needs to be resolved early.” – PROMISE mgt, p. 4
- “The technical researchers wanted simple output as algorithms, parameters etc from the non-technical work which those working in socio-economic and legal issues did not see as appropriate outputs for them. The technical researchers were **not interested** in the issues which the socio-economic and legal researchers considered important.” – TrustCoM D74, p. 17

2.4 Project coordination

Project participants are autonomous organisations and have to be managed as volunteers. A diplomatic project coordinator initiates discussion and finds common agreements. Progress must be strictly measured and controlled due to ample opportunities for sleeping partners and for deviations in budgeted resource spending. An internal management group can secure progress. A quality management policy and plan can deal with organising the release of deliverables.

- “**Management is fundamental**. An effective management structure and effective management procedures may deeply affect (positively) the scientific results of a work package/project.” – GridComp, p. 30
- “More than 150 persons were working on the project from the 20 European partners. The management of the project therefore required **adequate coordination at project, cluster, work package, and partner level.**” – PROMISE mgt, p. 2
- “The project management has in reality **no ‘command authority’**. Partners are autonomous companies, and they have to be **managed as ‘volunteers’** in order to get the full commitment.” – PROMISE mgt, p. 2
- “The division into **operative, tactic, and strategic decisions** has proved of value. On the one hand, it reduces the amount of decisions to be taken at higher levels, which is important since otherwise the higher levels get flooded with such an amount of micro-decision requests which they cannot handle in time. On the other hand, the division in three categories raises the motivation of the lower levels by giving them an opportunity to actively work on and shape the project direction.” – ASG, p. 15
- “A large-scale integrated project (IP) needs several **layers of management** resulting in a greater proportional management overhead than in a smaller project. The management of an IP is much more complex than that of a more focused, smaller project.” – NextGRID, p. 32

- “Establish a **management group**. PROMISE had a management group that had frequent short teleconferences. This proved instrumental in keeping the pressure on work between plenary project meetings. Anyone in the group or consortium could raise a yellow or red flag escalating a problem to become a management issue. Normally task forces were formed (often informally) to resolve the issue. This proved efficient in overcoming all the smaller disagreements and problems that are inherent to emerge in such a complex project.” – PROMISE mgt, p. 3
- “Voting shares on the base of the allocated budget should be avoided. **One vote for each partner** creates a better representation and thus harmony through equal treatment of all partners. For all changes of the Consortium Agreement within the project’s duration, a persistent and quick information flow is as vital as a complete and well-structured documentation. Good personal human relations as well as personal information have proved to be important and cannot be completely substituted by electronic means.” – ASG, p. 9
- “The **regulations for the General Assembly** in combination with its power turned out as a major road block when it came to necessary decisions about project direction which might have harmed any partner. The first issue is the timing aspect; it simply takes too long if all relevant data for a decision have to be delivered 21 days prior the General Assembly meeting, especially when you take into account the needed preparation time and efforts to negotiate with all parties to work out a trade-off proposal. In fact, a General Assembly decision about changes in project direction takes about two months when the whole preparation time is included. This is a hardly acceptable timeframe for a two and a half year project; furthermore, such a process binds a lot of efforts, which are then not available for other work or other necessary decision preparations. Another issue, which makes the finding of a trade-off very hard, is the fact that 75% of the project shares and 2/3 of all parties have to agree to a change. This makes it hard to achieve any consensus if a decision might hurt a partner, even if it is urgently necessary for the project. Often, such a necessary proposal can only be ‘forced’ to get accepted when externals (for example, the European Commission) emphasise the need for the intended change. A solution for future projects which facilitates shorter decision times on the one side and which still keeps the balance of democracy and controlling possibilities by the General Assembly on the other, might look like this: project direction decisions (including alteration of project and resources planning) should be decided by the Project Manager in the first instance. After the decision, the members of the General Assembly should receive 14 days to veto against the decision. If more than 1/3 of the members veto against the decision, a General Assembly meeting has to be held to find a final decision. Otherwise, the decision of the Project Manager is valid.” – ASG, p. 15-16
- “The early development of a **quality management policy** and the appointment of a quality and integration manager contributed to the early recognition of pain points and the production of quality results and deliverables. A project with more than 200 deliverables and 150 researchers needs a clear policy with respect to review and approval of documents before they are released.” – PROMISE, p. 54 and PROMISE mgt, p. 3
- “A **quality assurance plan** has been helpful to define responsibilities in internal review of project deliverables (external and internal)” – TrustCoM D74, p. 10
- “It is desirable to have a **diplomatic project coordinator** who is always willing to initiate discussion among partners, and to find common agreement, without using authority to prioritise personal interests. Furthermore, it helps if the coordinator is not just a good manager, but also has experience of and insight into the expectations of the Commission – not least its administrative procedures and requirements. It is also a very big help if you have a Commission Project Officer who is open, co-operative and flexible. We were lucky in both respects in MIDAS. You cannot choose your Project Officer – but remember that it is possible to **change your Project Coordinator**. Use that option if you have to.” – MIDAS, p. 28
- “Management should develop more efficient **methods to better integrate/discard the partners who are performing under the threshold**. It is a challenge to work with these partners” – TrustCoM D74, p. 11

- "Increase effort in **monitoring Action Lines**, specially cross-action lines aspects to give a more coherent and consistent view" – TrustCoM D74, p. 18
- "The **administration** of Integrated Projects places considerable burdens on the Coordinator and the Commission. The overhead of a 12-monthly revision of the Description of Work is significant, the reporting requirements are onerous and the contractual constraints do not allow for the easy removal of a partner from the consortium when appropriate. It is difficult for a consortium to deal with delinquent partners on a reasonable timescale because of the inertia inherent in the contractual relationship between the participants and in the procedures to remedy lack of performance. It is not possible to monitor costs on a timescale appropriate to good project management because this information is not easily, readily and accurately available from partners outside the yearly audits." – NextGRID, p. 32
- "Don't forget **progress control**. Large projects provide ample opportunities for sleeping partners and for over/under-spending of resources as well as creating excuses for delays. To manage this requires an adequate project control system able to measure progress in real-time. PROMISE used the principles of earned value management which is common industrial practice for large projects." – PROMISE mgt, p. 3
- "Progress measured **by person hours is difficult** – milestones and costs proved effective." – PROMISE, p. 54
- "Progress measured by person hours does not help controlling progress. Planned person months are based on estimated person month rates. During execution, there are deviations as other categories of personnel may be involved than what was in the estimated rate. This may lead to significant deviations without affecting the cost performance. The best way to **control progress** is by using milestones and cost together with measured physical progress. In addition the quality and the completeness of the deliverables have to be evaluated by the project itself and by the reviewers. In PROMISE, the progress was estimated by the researcher itself. No quantitative method was found." – PROMISE mgt, p. 4-5
- "Idea for improvement: develop **responsibility charts**. PROMISE had many interface points. This was managed through an integration manager and with an option to escalate problems to management attention. However, this could have been stronger enforced by developing responsibility charts for each partner." – PROMISE mgt, p. 5
- "The **start of the project is always costly for the coordinator** when producing all the documentation that will become the basis for future work. For instance, the coordinator must provide templates at the very beginning of the project. From the beginning of the project there have been document templates for most of the papers produced (deliverables, letters, fax, etc)." – TrustCoM D74, p. 10

2.5 Consortium Agreements and IPRs

A Consortium Agreement might take a long time to agree on, but must be concluded before the start of the project. Intellectual Property Right issues should be defined in a detailed manner in a Consortium Agreement.

- "**Very long legal discussions about the Consortium Agreement** took place before the start of the project and continued when the project already started. The Consortium Agreement took a long time to agree; that put the project on hold while it was under negotiation, the resulting document is still not accepted by the EC since it includes statements about international affiliate organisations that they do not approve of [*]. It is also unclear that it addresses the serious issues of the project enforcing work on partners they do not want, or taking funding away from partners for failing to complete work to the required standard." – TrustCoM D74, p. 9

[*] Please note that the FP6 contract only states that 'the contractors are deemed to have concluded a consortium agreement (…)' and that it is not up to the Commission to approve such agreements.

- “A period of three months for negotiating a Consortium Agreement should not be exceeded. However, it seems to be better to always prepare **a first version of the Consortium Agreement in the same time as the proposal**. The ideal way of establishing the Consortium Agreement is to begin with its preparation and with getting the agreement of all participating organisations before the proposal has been submitted.” – ASG, p. 9
- “The consortium really should **agree the consortium agreement before the contract with the EC is agreed**, because by then the lead partner loses control. – TrustCoM D74, p. 9
- “The project had a large business potential. IPR issues therefore were difficult to handle beyond what was in the Consortium Agreement. In large companies, IPR issues are handled by ‘legal departments’ trying to do their best to protect the business opportunities for their own company. This implies **less flexibility in handling issues not regulated in the Contract or the Consortium Agreement**, and definitely requires ample time.” – PROMISE mgt, p. 2
- “IPR should be more detailed defined in the Consortium Agreement. Discussions about IPR at the end of the project that is not clearly addressed in the Consortium Agreement are always difficult. In PROMISE, the **IPR policy** was developed too late.” – PROMISE mgt, p. 4
- “Idea for improvement: **provide a model Consortium Agreement with more focus on IPR**. Negotiations about Consortium Agreements are very difficult even if the Commission has a recommended model. Large companies have their own model contracts and always some policy that hurdles the way to a common understanding. It would have been better to reverse the whole process by the Commission providing a model Consortium Agreement. Deviations from this can only be made with the unanimous approval of all partners. The model Consortium Agreement should provide provisions for open access to deliverables that are public. In PROMISE a few partners blocked granting free access to public deliverables against a disclaimer. Also the model Consortium Agreement should make provisions for creating spin-off companies. This was not foreseen in the PROMISE Consortium Agreement which created some difficulties.” – PROMISE mgt, p. 5
- “It was hard to communicate to non-research staff in project member organisations that TrustCoM was an R&D project and not a joint venture producing a single commercial product for exploitation. This resulted in the requirement for **cumbersome legal statements** on TrustCoM public outputs to overcome the misunderstanding.” – TrustCoM D74, p. 21

2.6 Negotiation, financing, formalities, reviews

The timing and amount of financing determines decisions about participation in projects. Administrative uncertainties must be clarified as soon as possible and must not be carried into later periods. Presentations at review meetings must be consistent with the deliverables submitted for review.

- “The negotiation phase has been considered as very important. It was characterised by a good atmosphere of understanding. The deadlines given by the Commission are short but not unrealistic. For those consortia, which are still lacking experience, **more detailed information is essential**. In order to make the work easier and to get the different partners’ information in a form that would be compatible and readable for everyone, templates on Excel and Word basis should be prepared and well explained.” – ASG, p. 9
- “Idea for improvement: **introduce a ‘miscellaneous’ cost item per partner**. In a large project all partners may be requested to offer services to all work packages even though they have no resources allocated to a work package where they are asked to contribute. A small cost item per partner should be included in the project to cover up for this.” – PROMISE mgt, p. 5
- “The **earned value concept** helped to obtain progress and secure adequate resource spending.” – PROMISE mgt, p. 4

- “It was originally planned that the portal would be used as a means of entering **exact financial data** by administrative staff in partners. Such staff is not willing to do this, so it can only be used to enter approximate effort and cost figures to be used for management planning and not for reporting.” – TrustCoM D74, p. 19
- “The project’s organization allowed **SME partners to receive EU financing in a timely way**, so their cash-flows would not be threatened. This was a crucial factor when deciding whether to join the consortium.” – MIDAS, p. 28
- “If we properly would have understood the financial conditions of FP6, as a Systems Integrator we would probably have chosen not to participate. **The difference between commercial rates and 50% of the (EU approved) cost price is just too big** and cannot be justified by commercial spin-off. But we feel we added a lot of value to the consortium. Therefore we would hope commercial conditions in new EU R&D programs can be more favourable for System Integrators.” – MIDAS, p. 28
- “The **overall contribution for FP6 (50%) is too low** to fully justify the participation of SMEs, given the additional overhead created by the consortium reporting/coordination activities. The increase to 75% for FP7 makes it more interesting for future ICT project applications.” – MIDAS, p. 28
- “**Redistribution of money** is difficult, but PROMISE managed this voluntarily. The approach by formal vote in the Steering Board failed.” – PROMISE mgt, p. 4
- “When you participate in an EU R&D program, **do not underestimate the amount of administrative overhead** for the organization and its auditors (if they are inexperienced). Make sure in the first period that you **clarify all uncertainties** (such as hourly rates and audit conditions), and don’t carry them with you into later periods” – MIDAS, p. 28
- “Right from the start of a project, an adequate **system of information and control** must be established and open to any improvement. A good preparation led by the coordinator is essential just as all partners respecting deadlines. If any problems appear, direct contact to the respective partners is helpful. Furthermore, if the administrative coordinator successfully provides each partner with individual information in order to get back the complete and individualised reporting data, he should be able to bring forward the entire reporting process and to react immediately in the case of further requests. Apart from the individualised information, a **general overview with templates and models** has to be published on the project’s website. The time-scheduling should take into consideration the contractual submission dates as well as the concrete situation of the partners’ institutions” – ASG, p. 12
- “The **reporting cycle** of deliverables, annual review, approval of the next 18 month plan, and approved payment appears out of step.” – TrustCoM D74, p. 11
- “Deliverables with multiple contributors must be also **reviewed by an English native person**” – TrustCoM D74, p.11
- “Ensure **deliverables fall on the review period boundaries** and do not cross them” – TrustCoM D74, p.10
- “The reviewers found it confusing that they were given presentations at a review that advanced the position over that in the documents they had been sent 3 months earlier. **Presentations should be consistent with the documents presented for review** so that they do not have to be updated.” – TrustCoM D74, p. 10-11
- “It is recommended to **obtain a good review team**. The reviewers have significant influence on the project and may turn out to be the difference between a successful and an unsuccessful project. PROMISE had good and critical reviewers that were able to give guidance and keep ambitions high. Of special value was the informal pre-review report (normally received the day before the review meeting) giving guidance on issues to focus on during the review.” – PROMISE mgt, p. 3
- “An **open and constructive dialogue** between the project officer and the project management is important for success. PROMISE enjoyed the benefit of highly devoted and flexible project officers.” – PROMISE mgt, p. 4

3 Internal communication and collaboration

In this chapter, various lessons learned are mentioned that concern the communication and collaboration inside projects. The chapter includes lessons learned about communicating decisions, team building, dealing with different disciplines and cultures, breaking down linguistic barriers, organising meetings, and collaboration tools.

3.1 Internal communication

Making important decisions that may affect other parties must be avoided without previous discussion about intentions and plans. Overlap of partners is a means to achieve effective communication between different parts of a project.

- "In the beginning of the TrustCoM project, none of the partners was experienced with working in an Integrated Project. This led to a considerable amount of **'experimenting'** among the partners; varying, but growing, numbers of meetings and conference calls were the result. The level of agenda, work package or action line varied as well. In the end, the result which proved most beneficial for project work was regular bi-weekly concalls on Action Line level and work package conference calls on demand in between. Meetings settled to a comfortable number every 1 or 2 months for bigger integration issues. Still, it is difficult to organise meetings with such a large number of participants." – TrustCoM D74, p. 19-20.
- "The use of **methods and tools from model-based risk analysis**, and in particular UML which is also a basis for much of the technical work in TrustCoM, facilitated communication and understanding between the different disciplines involved in the legal risk analyses." – TrustCoM D74, p. 18
- "Communication between **application owners and technology providers** needs special attention" – PROMISE, p. 54
- "Avoid making important **decisions that may affect other parties** without previous discussion about intentions and plans." – TrustCoM D74, p.16
- "Staff in certain partners change during the project. This issue causes **misunderstandings**, and causes **repetition of discussions** already done by the previous staff" – TrustCoM D74, p. 8
- "Collaboration between Action Line 1 (architecture) and Action Line 2 (design) was very good. The segmentation into the two action lines is very helpful, given a sufficient **overlap of partners** to increase cross action line communication." – TrustCoM D74, p. 13
- "When starting a project, make a **'to-do' list** of all activities in the project and show it in the Project Portal" – TrustCoM D74, p. 10
- "There was no **analysis of the non-functional requirements** defined for the CE Test Bed in 2004 to generate the functional requirements of the subsystems. This should have been done and documented in some detail. Perhaps communications would have been improved if this had been done. This is the biggest lesson for WP35." – TrustCoM D74, p. 15-16
- "Some of the more important Action Line 2 **decisions have not been clearly communicated**. One example is at the last AL2 meeting when the Scenarios WP leaders were not told about the demo plans for the two industrial test beds until they began their sessions. This was very embarrassing." – TrustCoM D74, p. 14
- "Managing a project covering lots of different partners from diverse cultural, technical and professional backgrounds poses some interesting problems to the respective partners. **Workflows and collaboration models** need to be adapted across the partners,

communication habits (such as channels) need to fit, or made to fit in order to achieve an effective and pleasurable working environment." – SQO-OSS, p. 32

3.2 Team building

A project identity can be developed via a public web site. The people factor should not be underestimated in large projects. A successful kick-off meeting can establish a good basis for cooperation.

- "A public web site available at the start of the project is also a good tool to develop the **project identity**. There was a public website available from the proposal phase which then became the official website of the project." – TrustCoM D74, p. 11
- "Maintaining and nurturing a 'team of Amigos', composed of scientists, engineers, developers and designers from different cultural backgrounds, keeping the project objectives and ambitions at course, while countering the dynamics and challenges of our R&D work takes more than just management resources. This **people factor and the complexity of making tacit project knowledge explicit and translating of expertise across multidisciplinary domains** should never be underestimated in large complex projects like Amigo. For example, the Amigo project facilitated the turnover of nearly all work package leaders, i.e., the experts within the responsible organizations, and the change of activities from one group to another within one partner organization without hampering the progress of the project. Key facilitators for this process were the communication channels in the project and the regular in-depth working meetings. The Amigo team was a TEAM in which everybody had a recognized role and acted as such." – AMIGO, p. 35
- "The importance of the **social side of project participation** (e.g. at plenary meetings) in building a team spirit – and thereby increasing motivation and effectiveness – should not be underestimated." – MIDAS, p. 28
- "A **good kick-off meeting** is important to establish a good basis of cooperation. The following actions became very helpful: (a) All partners attended the kick-off meeting. This provided a good opportunity to know who is who, the role in the project and the expectations, (b) General rules for performance, communication and initial responsibilities, and (c) A social event is necessary as ice-breaker" – TrustCoM D74, p. 11

3.3 Culture and language

Different cultures and different languages in projects may lead to misunderstandings. Communication is required to overcome preconceptions of all actors involved. Linguistic barriers may be an obstacle for effective and seamless cooperation between the EU and other geographical areas.

- "Many countries participated. Different cultures, different languages sometimes led to **misunderstandings**" – TrustCoM D74, p. 8
- "The major lessons concern the communication required to **overcome preconceptions of all actors involved**, including large companies, technical researchers, lawyers, social scientists, business analysts and reviewers. People in each of these groups are habituated to their own cultures, values, objectives, working methods and ways of co-operating. These different communities differ in most of these aspects, and the integration of these different cultures in a single project involved considerable organisational and communication overhead. The project team believes that in the end it was worthwhile and the interdisciplinary integrated results presented are the evidence behind those judgements. The single most evident activity where these different cultures met was in the integration of concepts into software, and different software components into the reference implementation and demonstrators. The project management were well aware of this risk when the proposal was drafted, and took actions throughout the project to mitigate it, and to provide contingency plans when integrations could not be met on time. An integration

roadmap showed how sub-system integration was driven by the scenarios between months 18 and 36. This focussing of integration onto concrete scenarios was found to be successful, but only when under the control of an experienced commercial software development manager." – TrustCoM, p. 35, also in Section 5.1

- "It is impossible to quantify the experience acquired by the **daily interaction with partners of different culture and technology background**. During the project duration plenty of tools, best practices, surveys and different point of views have been exchanged between the partners contributing to a general increase of the technology level of the consortium. For what concerns work package A6 the lessons learned are especially those related to the research aspects and outputs produced by the other activities." – SeCSE, p. 15
- "TrustCoM addresses a problem of a multi-disciplinary nature, however **integration of these disciplines can be challenging**. This requires not only motivated participants, but also good methods, languages and tools to facilitate collaboration across disciplines." – TrustCoM D74, p. 18
- "Advanced concepts in the involved multiple technology domains produce various **misunderstandings** and lead to a **steep learning curve** for both developers and users. However, developers in each involved sub-domain enrich their knowledge and are better equipped to think and work holistically through the experience gained in such multidiscipline RTD cooperation. Hence, they are also better equipped to provide valuable feedback to their own domains, be it Grid, Semantic Web or Virtual Organisation collaboration." – InteliGrid, p. 47
- "An important lesson that was learned within the duration of this project was that **embedding 'foreign' concepts and technologies** can help to overcome the restrictions of the current state-of-the-art. Even though, this multi-domain integration requires high efforts to align the different viewpoints from the domain experts and to bring them on a common knowledge and language level. This should be taken into account when planning further activities like this." – BREIN, p. 29
- "Communication has been the major problem with some partners during this project. Often, **late responses or misunderstandings** were the main difficulties to keep the efficiency between partners. Another problem with Chinese partners was that the initially agreed cooperation activities could not be implemented directly as scheduled due to several factors, i.e. funding limitations, budget problems. **Cultural differences** could be another minor problem during the project cooperation. A lesson learned is that the relationship between partners should not only work during the project period, but also in the future. A long term cooperation plan should be kept in mind for all partners. For example, Plugtests will continue to be held to keep attraction of grid researchers." – EchoGRID, p. 14-15
- "The cultural problem is probably the most important issue to resolve. First and foremost **everybody has to be aware that cultural differences exist**. Things a partner takes for granted might be handled completely differently in another culture. Therefore it is important to prepare well in advance of a new cooperation project. In addition to providing information about different cultures to all participants at the start of the cooperation even if such a 'lesson' seems 'childish', real face-to-face meetings at the beginning of the project are important to get a common understanding. This is the most important recommendation of the European partners, since their experiences of real meetings with all partners from both Europe and China were very helpful and productive." – STASIS D88, p. 21-22
- "We feel strongly that the **way of working is greatly different between EU partners and Chinese partners**. EU's way is more moderate during the whole period. At the beginning, we (a Chinese university) were a bit impatient and started to develop when the design was still not confirmed and discussed by all partners. So we did some useless development in the first year of the GridCOMP project. So it is important to enhance the communication about work style at the beginning, especially for Chinese, even Asian partners." – GridComp, p. 31
- "The problems which were caused by cultural differences are the most difficult ones. European and Chinese partners usually take **different ways to describe the same thing**, often taking things implicitly for granted and thus forgetting to explicitly mention it. European partners mostly express everything directly, but Chinese partners express most things indirectly. The different cultural backgrounds often hinder comprehension and easily

lead to words being misunderstood. Partners also may think differently about the same thing. Sometimes things that are simple for European partners must be described very detailed for Chinese partners, but also vice-versa." – STASIS D88, p. 22

- "Chinese partners should **take more time for communication** with EU partners, especially with WP leaders. It will be very important for the development aim and plan." – GridComp, p. 31
- "**Linguistic barriers** are still one obstacle for effective and seamless cooperation between the two geographical areas EU and China. More in-depth communication and cooperation on developing grid technologies, policy, and standards to promote interoperability are required. Continuity and sustainability especially for the exchange on grid projects of both EU and China are extremely important. Therefore, additional funding should be available also after the end of the project." – EchoGRID, p. 13
- "In order to deal with the problem of language difference, various kinds of **communication methods** were tried in the cooperation. If someone could not speak English very well or had problems with understanding, the partners changed from verbal communication to email before the weekly conference. With written communication all partners read carefully and wrote everything very detailed." – STASIS D88, p. 22
- "There were important communication troubles between European and Chinese participants at the China workshop. To solve this problem, the consortium decided to engage a team of **translators** in Beijing. The translators received a training session on the activities they had to perform during the event. As a result of the implementation of this solution, there was a large increase of the information exchange. The lesson learnt is that in the case of international conferences with a collaboration scope behind, one should not undervalue language issues. Therefore, it is necessary to foresee interpretation and translation costs and organisation. The training session was also an important factor in the performance of the translators." – FASSBINDER, p. 23
- "The experiences and recommendations of Chinese and European partners were very similar, as was the gathered external feedback. Based on these, the **Top 5 recommendations for future projects** are**:**
  a. Regular communication via telephone-conferences
  b. Regular face-to-face meetings
  c. Strict project management and monitoring of milestones
  d. Respect for the other culture
  e. Staff exchange between the Chinese and European partners" – STASIS D88, p. 27

3.4 Meetings

Face-to-face meetings must have the appropriate number of people and a specific agenda with goals to achieve. In the start-up phase of a project, more meetings may be necessary since people need to get to know each other. Meetings that turn into a discussion between only a few persons must be avoided.

- "Face-to-face meetings should be clearly designed to have the **correct number of people and a very specific agenda on goals to achieve**." – TrustCoM D74, p. 21
- "Several issues could have been solved via email, had we been more 'formal' in our discussions as opposed to too much free-form text and face-to-face meetings. The most effective meetings were those where status updates on different aspects were given. Attempts at doing conceptual or design work over the telephone failed. Face-to-face meetings had **too many participants** and should have been **a bit more disciplined** with the agenda and goals to be achieved at each sitting." – TrustCoM D74, p. 20
- "Organize face-to-face meetings/workshops to **discuss issues and integrate the work**; phone conferences and occasional plenary meetings are not enough." – MIDAS, p. 27
- "**Break-out sessions** tend to be much better focussed and so these should be adopted as the norm. Break-out sessions help focus on the objectives at the meetings." – TrustCoM D74, p. 20-21

- "Getting together for **intensive work sessions** has proven critical to the success of the SQO-OSS project, both in terms of raw technical achievements as well as in improving the barrier of communication across project partners and cultures." – SQO-OSS, p. 32
- "Meetings should be organised on **Action Line level**." – TrustCoM D74, p. 19
- "We think many of the Action Line 2 meetings were un-productive. There seemed to be occasions where **two partners had an argument while everyone else watched**... Items tend to **overrun** very badly as well. Perhaps having smaller, more focussed meetings may have improved matters. A better defined agenda, better time-keeping and a stronger meeting management style should be adopted." – TrustCoM D74, p. 20
- "Team alignment requires physical project meetings. There were **too few project meetings in the start-up phase**. In the end phase, fewer meetings are required. The persons involved in the project need to get to know each other and trust each other. This was obtained in PROMISE, but it would have been beneficial to obtain it earlier." – PROMISE mgt, p. 4
- "Project-wide and regular meetings like the 'ASG weeks' are a key enabler for a **proper project alignment**. This is especially imperative at the beginning of the project. However, at the end of the project the regular meetings are a valuable platform for dissemination of project results, since all experts are there to provide answers to any questions from the audience." – ASG, p. 5
- "At the initial stage of the project it was important to meet personally and develop a common ground for the further work. And during the course of a project live face-to-face meetings cannot be fully substituted by other means of communication. Thus, the consortium planned, budgeted and organized several such events. Those meetings helped to **iron out some potential problems** on the early stages including some personality and work conflicts." – STASIS DX4, p. 9
- "Regarding the length of the plenary meetings, it is always good to keep them **in frame of 3 days,** because more than that is tiring and de-motivating" – MIDAS, p. 28

3.5 Communication and collaboration tools

Various collaborative tools are available and must be used for document and information sharing. Glossaries may be used to gain a shared understanding of technical terminology.

- "It is recommended to take advantage of **collaborative technology**. Physical meetings in a large consortium have to be limited and the problem of daily contact between researchers and access to documents has to be catered for using collaborative technology." – PROMISE mgt, p. 3
- "ProjectPortal became a collaborative tool for keeping a **common agenda**, as a repository for **final versions of documents** and as an **address book** with all the participants in the project rather than a repository of working documents. Subversion showed a better performance for this issue (edit tracking, version control, etc)." – TrustCoM D74, p. 21
- "Document-sharing online meetings support conference call discussions. Using SubVersion for **document sharing** was a very good idea as well. Using tools like LiveMeeting for **information sharing during conf calls** was another very good thing" – TrustCoM D74, p. 19
- "Telephone conferences usually gain quality if remote **desktop sharing software** is used for the presentation of additional, non-verbal content. However, European-wide research projects like ASG have special requirements on platform independency and cost effectiveness, which are not easily met by available desktop sharing systems. Therefore, we decided to use RealVNC as desktop sharing platform. The drawbacks of this tool are its laborious handling and its bandwidth problems when more than ten persons participate in a conference." – ASG, p. 5
- "When starting a project, a list of **agreed tools for operation** was decided at the beginning (Office 2000, Project Portal, etc)" – TrustCoM D74, p. 10

- "A comprehensive and deep state-of-the-art analysis is often difficult due to the type of very-far collaboration. **Desk analysis** should be complemented with **on-the-field gathering of information**, **interviews** of main actors and leveraging national and international institutions aiming at fostering the collaboration between EU and China (ranging from national embassies to joint cooperation and supporting initiatives, even and better if co-founded by EC)" – EchoGRID, p. 10
- "A glossary of common terms would have been very useful from the beginning. It was discussed but never put in practice (a model for the glossary was presented for its inclusion as part of the portal but there were no appropriate resources available at that time for the task). This led to **different interpretations of concepts** in some occasions." – TrustCoM D74, p. 11
- "Glossaries in various deliverables have enabled the project to **gain a shared understanding** of technical terminology. These glossaries have also proved valuable as general guides to current and emerging grid and related technologies." – EchoGRID, p. 26
- "A project-wide wiki system is useful for discussion and presentation of **intermediate project results** and is therefore useful for the alignment of project members. Furthermore, if used well, it is a powerful tool for **project controlling and coordination**. Minor drawbacks of the wiki system used were the needed installation and continuous maintenance efforts and the training efforts needed for users who are not computer experts." – ASG, p. 5

4 External communication and dissemination

The chapter contains lessons learned about disseminating project results, exploiting project results, organising workshops with external experts, involving external experts, and collaborating with other projects.

4.1 Dissemination

Project presentations must be generated from the start to explain the project to people outside and inside the project. Articles and short reports must be translated into other languages than English. Projects must adopt more strategic approaches to dissemination and outreach.

- "When starting a project, generate **project presentations** to better explain and present the project goals and abstract to the world and to brief/induct new workers within the partners" – TrustCoM D74, p. 10
- "Under present circumstances, a sway towards EU-focused news channels seems inevitable, as the region boasts a considerably higher number of possible media channels that can be targeted. However, projects should focus on leveraging the real opportunities that exist through an **analysis of possible media channels and project outputs** right from the outset. Such an analysis would enable partners to gain an understanding of the plans made and expected outcomes, at least to a reasonable extent, as a means to encourage all-partner participation by providing quotes, testimonials, etc. One possible way of overcoming the different dissemination opportunities would be to foster **strategic alliances with other initiatives** in the target region for joint events and dissemination, as well as encourage all partners to circulate eNewsletters and articles to all pertinent contacts." – EchoGRID, p. 23-24
- "While English should be the lingua franca, more effort should be made in **translating articles and short reports into other languages**." – EchoGRID, p. 24
- "The persons involved in dissemination actions are convinced that a large project, such as the Integrated Project ASG, needs a strong **centralised unit also for organising dissemination, conducted by the highest management level**. With this in mind, the potential impact, the strategic goal in ASG, was to establish the work package X as an omnipresent service unit in dissemination and public relation for the whole project. The important role of this work package was ensured as it was led directly by a member of the Project Board. Since all procedures of information exchange, dissemination of knowledge, public relations and the supervision of IPR and ASG corporate identity were handled by a centralised unit, the best preconditions were given for a more effective organisation of events and impact as well as a more powerful support for scientific work components, e.g. to place proposals to the specific standardisation groups." – ASG, p. 24
- "The **promotion** of complex technical projects is perhaps better handled in-house, provided appropriate skills are available, rather than through external PR agencies. Our experience in NextGRID has been that such agencies are not always well equipped to convey complex messages well to non-technical audiences." – NextGRID, p. 32
- "There is an increasing need to **develop more strategic approaches to dissemination and outreach** by leveraging communication expertise, as well as to overcome any cultural and language barriers that may impede effective communication to the wider community. A general suggestion for the future is that project dissemination activities integrate new communication tools that are being made available, particularly dynamic, interactive tools that would help gain the interest and engagement particularly of the younger generation. Another general suggestion would be to increase outreach and engagement with Standards Developing Organisations so as to ensure grid development and deployment is aligned with

best practices and open standards, as well as the validation of specifications through compliance testing." – EchoGRID, p. 24

- "Communication experts from both regions (i.e. EU and China) should work together to develop a **communication strategy** from the outset based on an evaluation of target audiences, cultural and linguistic barriers, so that core messaging can respond to real-world needs by adapting the messaging as necessary. This guide would serve as a reference point for different audiences and enable all partners to actively contribute by identifying new communities/media channels, providing quotes, reference documents and ideas on how best to effectively convey project goals and outcomes. Projects should also encourage the production of **shorter, focused reports** summarizing key deliverables and outcomes for time-pressured audiences." – EchoGRID, p. 24
- "Projects should identify potential **strategic alliances with pertinent initiatives** with the aim of organizing joint events and dissemination activities. Co-ordination and support actions would serve as the main points of reference and create eNewsletters with contributions from the strategic alliances. Funding bodies should actively support the alliances. Such activities would help create economies of scale by offering a key information outlet and opportunities for networking and knowledge exchange." – EchoGRID, p. 25
- "Projects should analyse current networks across sectors and organizational types early on in the project so as to **pinpoint strengths and gaps**. As appropriate, projects should attend events where pertinent audiences are expected, particularly for projects targeting the business community." – EchoGRID, p. 25
- "**Collaboration between partners on publishing papers** should be emphasised, because sometimes partners see EU projects as funding for their own publications, and are not so willing to collaborate. This is unfortunate because some of the best work arises from cooperation. Publication work could also be seen as something to be planned and coordinated by WP leaders in the course of a project." – MIDAS, p. 27
- "In the early phases of the project, dissemination activities were supposed to create a common understanding of basic notions developed between the project partners. That is why in the beginning not only presentations on project-related research issues but also exercises (tutorials) between the partners were organised. Scientific sessions or tutorials, which contain project-generated knowledge for external scientific participants, could be organised not earlier than after 12 months of the project, when some first significant project outcomes became available. Workshops or demonstrations with a focus on industry people will additionally need business-oriented statements and should contain something like a requirements analysis in the first place. The preparation of such an event type will realistically take place some times later. Therefore, a **clear commitment of the industry partners in dissemination activities** is recommended. That is why in the Description of Work each of the industrial partners should have such activities clearly specified." – ASG, p. 23
- "External communication was driven by the researchers' desire to publish conference and journal papers which produced a large number of outputs to the technical community. **Document-sharing online meetings** support conference call discussions" – TrustCoM D74, p. 19
- "The Amigo Challenge has been organized as a **design competition for students and the Open Source Software communities**. The major goal was to make the software available to a large community of young designers and developers. A website was set up and used to make all the software components, tutorials and developer's guides available. Forum sites and support for developers was made available. The challenge was announced and advertised, worldwide, via email, networks and professional organizations, and supported by appropriate visuals. The project's website set up for the Amigo challenge attracted over 9000 downloads of software and tutorials. However, the number of actual participants was extremely low, probably due to the fact that the prizes to be won were rather low. But, the effort was extremely useful for the project to ensure the usability and the completeness of all software modules, documentation, developer's guides and tutorials and last but not least, to create a **great amount of positive publicity for the Amigo project as a whole.**" – AMIGO, p. 36, also in Section 5.4

4.2 Exploitation

Exploitation needs to cater for changing user needs. Take-up of technology is not about technology. Projects must focus early on exploitation and may appoint exploitation and marketing managers.

- "The original assumption of Amigo – the networked home as an important step towards Ambient Intelligence – can only be achieved if the benefits for the end-user of a networked home system are attractive and evident, and services offer a surplus over what is offered by non-networked systems today. For most consumers however, application of Amigo technologies and services as demonstrated in the project is still far away; why would a consumer talk to his/her washing machine, for instance? In home automation and domotica, people look more and more to Amigo-like results, not so much driven by the possible attractiveness of connected devices as above, but driven by e.g. energy consumption and sustainability concerns, and demographic changes, e.g. homes for the elderly. The Amigo project mainly adapted to these challenges by putting more emphasis in the dissemination activities on these applications that are particular **relevant for these evolving consumer needs** and showing how the Amigo interoperable middleware addresses these challenges." – AMIGO, p. 35-36
- "With regard to the overall dissemination of the project, the R&D expectations of 2003/2004 focusing on customer benefits of futuristic applications needed to be **adjusted for the community of application development**, emphasizing the modularity of the Amigo system and its flexibility in supporting the incremental development and integration of home automation applications. The focus of the project with regard to dissemination has been on empowering the middleware for supporting interoperability and flexibility, and especially supporting the development of networked applications in an easy and dynamic fashion, thus, enabling all kinds of networked services that go beyond or integrate the current application demonstrators. Also, several of the elements of the original Amigo scenario were not very well appreciated by the target user groups. The user requirements have been accounted for in the Amigo applications and furthermore, when using the scenarios as a communication tool for dissemination, these elements could be varied and adapted to the stakeholder requirements." – AMIGO, p. 36
- "Customers are **resistant** to use new technology, because of the high risks associated with the perception they could have of changing their standard procedures or implementations." – PROMISE FAR annex, p. 42
- "**Take-up of technology is not about technology**. The feedback given by the participants of the Amigo dedicated training program provided very useful feedback with regard to current practices, state-of-the-art in the application domain and obstacles to take-up. That is, current technology of SMEs is typically 'years behind' the Amigo approaches. They are looking for out-of-the-box solutions and are not convinced that Amigo will survive as a whole. But, they see elements of the application prototypes easily being taken up. This is not a matter of technology, but of market demands, trends, and politics, and of distribution and installation channels. However, Amigo was perceived by the SME community as setting the tone for demonstrating innovative concepts and ideas and as a source for innovative components and solutions." – AMIGO, p. 36
- "Communicating the advantages of semantic grid solutions to end-users must always be done via **direct reference to their practical industry needs**. In fact, many advanced concepts may even need to be 'screwed down' or introduced in small steps to facilitate user acceptance. Pushing technology in the technical domains of one-of-a-kind industries like construction or maritime is not necessarily the shortest way to success." – InteliGrid, p. 48
- "The path from technology to exploitation has to be defined as early as possible with **active participation of end-users**. Requirements in that regard should be as little as possible technology biased. Explanation of benefits should be done by convincing demonstrators and not only in theory." – InteliGrid, p. 48
- "**Common methodology and the corresponding templates** with concrete recommendations and steps developed for the exploitation plan were very helpful to develop a consistent document and to include a lot of details into it." – TrustCoM D74, p. 17

- “Partners had concerns about **confidentiality with exploitation plans**. Solution: 1) make exploitation plans confidential 2) partners can provide their individual exploitation plans individually to the Commission.” – TrustCoM D74, p. 18
- “The research departments of large commercial organisations sometimes don’t have very direct **links with the commercial parts** of the organisation. Project consortia should encourage such partners to be more pro-active in this respect, to play a more active part in exploitation work. This aspect should also be considered when building consortia for new projects” – MIDAS, p. 27
- “It is recommended to **focus early on exploitation and marketing**. Researchers are most interested in research and tend to postpone all marketing and exploitation issues. It is therefore imperative that this is focused early and with sufficient power in the organization.” – PROMISE mgt, p. 3
- “The appointment of a **marketing and exploitation manager** was a success factor in early focus on exploitation. We want also to stress the importance of having established a marketing and exploitation manager. Future projects would be well advised to build this in from the start.” – PROMISE, p. 54 and PROMISE mgt, p. 4
- “A professional **communication manager** (from an industrial partner) would have been useful, especially for developing a professional marketing-like communication strategy.” – XtreemOS, p. 23
- “An important lesson we learned is the **need of offering to service developers/providers an easy-to-use set of tools, accessible under different conditions and able to satisfy a wide range of requirements and roles**. Not only service integrators, which need a robust environment to deliver complex solutions on time and adapt them to the requirements of a rapidly changing business context, but also agile and smaller service providers must be taken into account, since they are often urged to speed up the time to market of their innovative solutions, and expose their core abilities just-in-time to profit from newly opened business opportunities.” – SeCSE, p. 10
- “Another lesson learned during the project is that, for the direct take-up of SeCSE results, the tools need to be turned into **industry-strength software**. Publishing them as open source is the most viable way to achieve this but still carries a high probability of them being neglected unless a SeCSE user community can be established. The next steps should be to try to establish this, preferably driven by adoption of selected SeCSE technologies by the primary industrial partners.” – SeCSE, p. 10
- “Monitored activities by the ASG Download Tracking Tool are an innovative approach to **monitor the interests of the markets** of priority areas and to keep potential industrial persons continuously interested in the project work. The ASG Download Tracking Tool helps the project to monitor the interests of third parties and to create specific profiles of such users of ASG knowledge (which document, how often, by whom and which exploitation intentions). So, the project was able to guide them proactively in usage and exploitation of the downloaded knowledge by periodic direct contact. And that helps to keep potential industrial persons continuously interested in the project work. The goal was to build up a commercial community which is not only interested in project results but also in using experiences, procedures and business models of project partners to guarantee profit, long-term stability and commercial success. The involvement of SMEs will be an essential part of being innovative, flexible and ‘on-the-market-needs’. There were defined models and procedures to involve the highly flexible business group of SMEs to guarantee both flexibility in development work and always using the newest market-proved technologies/products.” – ASG, p. 25
- “Changes in the **licence of the software** being produced during the project should be carefully thought and discussed BEFORE with the consortium. Also, industrial partners should be more flexible and learn to live with (strong) open source licences like the GPL, and dual licensing.” – GridComp, p. 30
- “Java is currently far **less supported** in the web services domain than .NET. Consequences for the project: If Java is less supported then industrial partners’ exploitations will be based on other platforms. Results and Java artefacts from academic partners might not be easy to exploit at the ‘commercial’ level.” – TrustCoM D74, p. 13

- "Using a solution that is a **mixture of two service platforms** is a pain to the end-user as well! I'm thinking of the crypto store problems between Java and .NET… This might limit take-up of the TrustCoM Reference Implementation." – TrustCoM D74, p. 15
- "A **standardization process** always needs long procedures; it needs to be continued after the project ends." – ECHOGRID, p. 14
- "Customer profit-making **strategies** and negotiation budget management strategies have a deep influence on the overall benefits that can be obtained from the market. Market strategies are also very important, due to the nature of the customer's different strategies which may be adopted to optimize the benefits. SLA policies are also important, even if it should be noticed that aiming at maximizing profits in case of SLA violations in the long run is not the best option, as reputation issues may arise." – SORMA, p. 17

4.3 Workshops and interactions with external experts

Workshops must be organised as short, focused events. There are many points of attention in organising workshops. A small, high-level advisory group may be efficient for the preparation of whitepapers. A quality, well-prepared and timely organisation is essential for the success of an event as well as a contingency plan to solve problems such as unexpected cancellations of speakers.

- "Events should be vehicles not only to interact and exchange knowledge but also to foster **effective, two-way dialogues** through dedicated break-out sessions or post-event side meetings with selected experts where more probing questions can be asked and further sources of information (e.g. quality business and government reports, white papers, etc) can be identified. **Requesting position papers** before an event could offer a way of defining key questions during the event itself and during side-meetings immediately afterwards." – EchoGRID, p. 24
- "Workshops proved to be a very efficient consultation mechanism and favoured by participants. It was observed that members of the constituency were **willing to share their knowledge and experience** with other fellows and colleagues, and they were very satisfied about being consulted about policy measures that influence them directly or indirectly. However, this is taken very seriously, so if any inefficiency in the process was noticed, their interest vanishes immediately." – 3S, p. 10
- "Consultation mechanisms must allow participants to express their ideas in a flexible way. **Openness and flexibility** is required, too much structure is discouraging." – 3S, p. 10
- "Consultation mechanisms must make sure that **the time of the involved experts is used efficiently**." – 3S, p. 10
- "Consultation mechanisms must ensure the **usability of the results**. In other words: the higher potential impact of their involvement on future policies, the higher involvement and quality contribution from the consultation participants." – 3S, p. 10
- "Consultation mechanisms must be **endorsed by the European Commission**." – 3S, p. 10
- "In organising consultation workshops:
  a. **travelling expenses** incurred by key participants should be covered
  b. the **benefits of participation** in the consultation processes should be very specific.
  c. keeping the **right focus** is critical and requires longer-term involvement of the consulted stakeholders.
  d. one or half-day, **sharply focused events** are better than multi-day big events for acquiring meaningful feedback.
  e. **co-locating workshops** with another 2-day event, even if thematically related, should be avoided.
  f. it should be avoided to schedule events on **Fridays**, as having a whole day workshop until late afternoon on Friday is discouraging for many participants.

g. **interactive sessions held in small working groups** are preferred by the participants to passive plenary parts.
h. **bridging the results** generated under separate parallel sessions and **cross-checking** is important for the overall impact and quality of the consultation results.
i. **networking opportunities** are an important aspect of consultation activities which adds value to them and is appreciated by the consultation participants.
j. the vast majority of evaluation survey respondents agreed that the workshop and similar events have a **positive impact** on European research community consolidation and expressed their belief that these events have positive impact on EU policies." – 3S, p. 10-11

- "The idea of a **smaller high-level consulting group** in the form of an advisory board also proved to be efficient for the preparation of whitepapers, really generating feedback to be incorporated on the paper contents. In the end, most members of the 3S Advisory Board considered themselves somehow co-authors of the final result. However, from the different tools used for gathering their input (meetings, mail, on-line collaborative tools, etc.) **audio-conference rounds** showed the most effective one." – 3S, p. 11
- **Web-based consultation**, open or in the form of blogs, wikis, questionnaires or similar, do not appear to be effective for wide consultation of a community which already has other means for interacting. There is a strong need to really understand available/innovative web-based consultation instruments that could be used for this purpose, and their related usability issues and participation barriers." – 3S, p. 11
- "The high risk in finding a lack of collaboration from the community was overcome by hiring a Strategic Research Agenda **editor and community liaison coordinator** and the design of an open collaboration process." – NESSI-Grid, p. 45
- "The Strategic Research Agenda collaboration process must have **very concrete objectives** to help the community understand what is required and capture the interest of contributors in collaborating." – NESSI-Grid, p. 45
- "**Public acknowledgement** and recognition of contributions are key." – NESSI-Grid, p. 45
- "The community process requires active and continuous **animation**." – NESSI-Grid, p. 45
- "For interlinking activities, **define a strategy and focus targets** depending on the context." – NESSI-Grid, p. 45
- "In order to catch the interest of SME managers, messages need to be communicated **more 'business-like' than 'research-like'**." – 3S, p. 9
- "The topic of interest representation on long-term EU research policy is very **remote** from the everyday life of SMEs." – 3S, p. 9
- "In order to participate in exercises that SMEs consider low priority, **more motivation is required** than just explaining the benefits of contributing." – 3S, p. 9
- "**Financing the cost of senior people of SMEs** spending their time with contributing seems a good additional motivating feature." – 3S, p. 9
- "**Personal contacts** – and thus trust – is a good motivating aspect for managers to at least consider their interest and potentially participate. Thus the role of intermediaries with networks (i.e. associations) is important in addressing the SME community and providing initial motivation." – 3S, p. 9
- "During the Q&A session in the Beijing workshop, not many questions were raised. This was perhaps caused by the introvert personality of Chinese people. However, this factor was taken into consideration when partner X discussed with all partners on how to organise future Q&A sessions and to get a good outcome. Eventually, in the later Bangalore workshop, **more interaction was added during the conference**, i.e., to have a short Q&A session after two speakers instead of leaving all the questions to the end of the day. The Q&A session turned into a heated discussion at the end in order to avoid the lack of feedback. So, the solution implemented proved to be effective. The feedback forms have demonstrated to be another good method to get feedback from the participants." – FASSBINDER, p. 23

- “The **website** has provided the most important support for the dissemination of the workshop. Before the workshop, it provided information about profiles of participants, venue issues, agenda, speakers, contact etc. After the workshop, it provided information about the results of the workshop, photographs of the participants, presentations on line etc. Announcements in related websites have played a key role in the promotional campaign as well as the massive email campaigns carried out by the organisers.” – FASSBINDER, p. 24
- “Ensuring quality participation was an important aspect to determine the success of the workshops. To ensure this, the workshops’ agendas were prepared in such a way that they included representative presentations from industry, academic, governance and project partners. The lesson learnt is that to have a **quality, well-prepared and sufficient advance organisation** is essential for the success of the event as well as a **contingency plan** to solve problems such as unexpected cancellations of speakers” – FASSBINDER, p. 24

4.4 Collaboration with other projects

Collaboration with other projects takes place when there is a clear benefit. Specific projects dedicated to the stimulation and organisation of coordination are necessary.

- “Significant emphasis was placed on **collaboration between projects** in FP6. The Commission took the role of coordinating that collaboration, but had insufficient resources to coordinate activities effectively.” – NextGRID, p. 32
- “Projects were only interested in collaboration where there was a **clear benefit**. Such collaboration usually took the form of bilateral activities. Generally there was little collaboration involving wide groups of projects.” – NextGRID, p. 32
- “Previous experiences in the Fourth Framework Programme, where there were well resourced **projects dedicated to the stimulation and organisation of coordination**, demonstrate that this was an effective mechanism for stimulating effective collaboration.” – NextGRID, p. 32

5 Software development

The chapter contains lessons learned about software development, including organising development, releasing intermediary versions, using scenarios, aligning technical work, architecting, integrating components, using tools, software documentation, evaluation, and involving end-users.

5.1 Organisation

Responsibility for a software component must be allocated to a single partner. Re-planning of software development should be done at least once during development. Development workshops and coordination can be quite effective. Partners must be open and honest from a very early stage about their software development resources and expectations. Projects should adopt release cycles and deliver intermediate release versions with sufficient backward compatibility. Application scenarios facilitate the work and contacts between project participants.

- “The best way to split the work on different software components is to **allocate responsibility for each to a single partner**. The components should be as independent as possible and have a good definition of interfaces and functionalities they are going to provide. Sharing the responsibility for components between more than two partners is not a good idea: the component development gets complicated, and decisions are difficult to take. However, while it can simplify things to isolate work on a particular component with a single partner, doing so also reduces the chances of real research co-operation and cross-fertilization of ideas. Remember that the IST programme is a research programme – not a source of funding for straight development projects.” – MIDAS, p. 27
- “Partners should be more prepared to **develop software in collaboration**: adhere to once agreed interfaces, keep agreed development cycles and so on.” – TrustCoM D74, p. 16
- “Some partners **preferred to implement a whole system** themselves and ignore the components produced by others rather than integrate those components, thereby making the work of the junior partner unnecessary to the project.” – TrustCoM D74, p. 16
- “Although I can’t directly prove it, there seemed to be **reluctance by some of the partners to install components from other partners**. I got the impression that some of the partners were too focussed on developing their own components. It has to be stressed that this point relates to the issues of intermediate release versions and a common, ‘shareable’ integration platform (such as Virtual PC). I understand that the partners did not so much focus only on their components, but that installation of other components was difficult and/or clashed with individual framework setups (cf. Java compatibility issues). Accordingly a stronger focus in future projects should also rest on easier and more flexible installation routines, as well as commonly agreed infrastructure setups.” – TrustCoM D74, p. 15
- “The project plan did not cater for sufficient **ramp-up and framework creation** phases. The project plan consisted of 4 incremental releases, more or less equally spaced out in time and functional scope. Only during the execution it became apparent that some of the partners decided to engage in the time-consuming creation or the refactoring of essential software frameworks, at the expense of planned functionality and agreed project planning. This caused the first COMET release to be delayed and high stress on the scope of subsequent releases. In hindsight, this could have been avoided by explicitly allowing for a ‘framework’ release of approximately 12-15 months, followed by 2 instead of 3 functional releases.” – COMET, p. 7
- “It is a good idea to perform **re-planning** of software at least once during development. It would make it possible to modify work plans according to experience gained.” – MIDAS, p. 26

- "Regular **development workshops** were quite effective. We could use more of them. However, developers meetings sometimes tend to lose focus and to be stuck in theoretical discussion. Improvement: clear focus on 'running software' from the beginning of the meeting." – TrustCoM D74, p. 19-20
- "Running **development coordination** through weekly conf calls proved to be effective and successful" – TrustCoM D74, p. 19
- "To address also technical complexity of the COMET solution, '**Installation Fests**' have been introduced from Release 3 onwards. These workshops focused on installation and initial testing of COMET releases and stimulated cooperation across partners in early phases of solution integration." – COMET, p. 6
- "The **lead development partner** should be clearly identified beforehand. This partner should have strong experience in industrial software development and/or big and distributed software development projects." – TrustCoM D74, p. 16
- "There was reluctance by certain large commercial partners to employ a **consensual approach** to defining the exact technical profiles to be used. Their slightly bullying attitude seemed to be 'we have done it this way, take it or leave it' or 'we will not use standard X at all'." – TrustCoM D74, p. 16
- "We should have been **open and honest from a very early stage in the project about our software development resources and expectations**. It seems as though the quality of software being produced and standards being affected is not that high, in comparison to the claims of the project. Rather, there is a lot of documentation that informally and verbally describes visions of Virtual Organizations. The move to more formal representations either came too late or was rushed, as we tried to get to a stage of producing software, XML documents and info-sets. We however managed to come up with some very convincing scenarios for how the vast amount of Web Service standards could be integrated and applied." – TrustCoM D74, p. 14
- "There was no genuine TrustCoM **release cycle**. This made application of the software to the two test beds difficult. Evaluation was also compromised because there was no identifiable software to focus on and evaluate." – TrustCoM D74, p. 15
- "There was too much emphasis on the Review software demonstrations. There should have been more emphasis on **integrated releases** that one could identify as 'TrustCoM Version 1', 'TrustCoM Version 2' etc that had definite functionalities, however limited. In other words, intermediate release versions should have been made available not only to gather feedback from the community, but also to ensure rollback points and enhance backward compatibility." – TrustCoM D74, p. 15
- "All development processes need to be communicated timely. **Intermediary 'release' versions** and sufficient **backward compatibility**, or at least restricting interface adaptations to a minimum, are necessities." – TrustCoM D74, p.16
- "It could help to **keep the agreements** reached during development workshops (like message sequence, etc)." – TrustCoM D74, p. 20
- "**End-users involved in technology/system development** understand much better the benefits afterwards and are more willing to propagate them further, thereby creating synergetic effects." – InteliGrid, p. 47
- "The fact that all developments have started with initial descriptions of **application scenarios** from the very first phase of the workplan facilitated a lot the extraction of requirements and specifications as well as the organisation of the feedback to appropriate research developments. In PROMISE, the fact that we started working with application scenarios even from the proposal preparation phase appeared to be a very useful strategy. This helped to keep live and active contacts between end-users, technology providers and research organisations." – PROMISE, p. 54, and PROMISE mgt, p. 3
- "Through **realigning** the legal work package **with the TrustCoM scenarios**, we were able to identify and focus on the legal issues that were of importance to the rest of the project. The legal risk analyses of the TrustCoM scenarios involved people with technical, socio-economic and legal expertise. The participants from other work packages were motivated and helpful and provided very useful input to the legal work. This **multi-disciplinary approach** to legal risk analysis proved to be fruitful and facilitated an

integrated analysis of security-, trust- and contract-related issues, leading to identification of risks and possible treatments which might not have been identified if the issues had been addressed separately." – TrustCoM D74, p. 17

- "The major lessons concern the communication required to overcome preconceptions of all actors involved, including large companies, technical researchers, lawyers, social scientists, business analysts and reviewers. People in each of these groups are habituated to their own cultures, values, objectives, working methods and ways of co-operating. These different communities differ in most of these aspects, and the integration of these different cultures in a single project involved considerable organisational and communication overhead. The project team believes that in the end it was worthwhile and the interdisciplinary integrated results presented are the evidence behind those judgements. The single most evident activity where these different cultures met was in the integration of concepts into software, and different software components into the reference implementation and demonstrators. The project management were well aware of this risk when the proposal was drafted, and took actions throughout the project to mitigate it, and to provide contingency plans when integrations could not be met on time. An integration roadmap showed how sub-system integration was driven by the scenarios between months 18 and 36. This focussing of integration onto concrete scenarios was found to be successful, but only when **under the control of an experienced commercial software development manager."** – TrustCoM, p. 35, also in Section 3.3
- "It is important to know the **scenarios of demonstrations** as soon as possible, allowing you to prioritize the importance of functional requirements to focus on ensuring compliance with the key requirements." – MIDAS, p. 28
- "The initial legal work studied rather abstract questions and was too detached from the rest of the project. To ensure that the legal work package was aligned with the rest of the project, a strong focus was needed on the TrustCoM **test bed scenarios, which form a 'glue' between the different work packages and Action Lines**. The objectives and standards of achievement of those working on legal and socio-economic topics were different to those of the technical researchers, and unclear. It was not enough to take for granted that all staff had the same motivation across disciplines." – TrustCoM D74, p. 17
- "**Architecture and development** existed 'separately' until circa the Autumn of 2005, i.e. up to month 19-20." – TrustCoM D74, p. 14
- "The project should make the **relationship between conceptual models and design** more clear." – TrustCoM D74, p. 16
- "Make sure **qualitative requirements** – such as performance – are clearly defined and just as highly regarded as the functional ones." – MIDAS, p. 24
- "Developers have diverse preferences and differ in their development approach and style. As it needs good arguments to make them **change their coding style**, we recommend highlighting the advantages of the development methodology individually for the different groups. To lower the barrier for change, the methodology should be open to traditional coding styles via guidelines and templates." – MUSIC, p. 13
- "It is important to **differentiate between development for mobile devices and development for devices with more resources** like PCs or laptops: it is not necessarily the case that the same implementation approach will work equally well for both (desirable though that would be...)." – MIDAS, p. 24
- "Unless forced by external factors (legislative, organizational, etc.) ALWAYS select a **'best-of-breed' system component** or a component that can be mapped most clearly to the business case. Standardization is good but there is no substitute for functionality." – PROMISE FAR annex, p. 54
- "On small devices, it is particularly important to weigh up the advantages offered by using **third-party components** against the extra overhead involved. Part of this involves an assessment of whether the third-party components offer facilities that you perhaps don't really need – but have to 'pay' for in terms of extra resources." – MIDAS, p. 25

5.2 Integration and architecture

Integration has to be thought through beforehand. The task of integration can not be underestimated and often takes more time and resources than expected. Standards may be invaluable in allowing integration efforts to succeed. Projects must adopt approaches that use consistent interface declarations, i.e. with backward compatibility or no changes at all, or at least ensure that all according changes are communicated timely and thoroughly.

- "In such big projects as Integrated Projects, it is difficult to **align collaborative technical work**. In TrustCoM, subsystems and testbed scenarios were identified and development started along those lines. The problem became visible, how to integrate the work conducted in separate subsystems." – TrustCoM D74, p. 13
- "Integration has been a definite handicap, which had to be **thought through beforehand**. An integration environment would have been useful for that purpose. At the start, there was no partner leading overall development. That resulted in a lot of adhoc solutions and erratic effort once such partner was finally located." – TrustCoM D74, p. 14
- "The project did not start with even a **basic architecture**. A basic implementation architecture only began to emerge in October 2004 at the Aachen meeting and only became more mature in early 2005. This was a year after the project start!" – TrustCoM D74, p. 14
- "The system architecture should have had an even **more prominent place** in the project work, with more feedback to and from the other, software-producing work packages. This might have saved some software integration efforts." – XtreemOS, p. 22
- "The overall architecture focused more on **comprehensiveness** than on UML compliance, which increased understanding significantly." – TrustCoM D74, p. 13
- "We should try to get **common UML representations** of architectures and design details agreed earlier." – TrustCoM D74, p. 16
- "The **iterative approach to API definition** was key to its success. Pre-planned API's would not have worked." – XtreemOS, p. 23
- "The creation of **a specific WP on Integration** helped a lot in the harmonisation of the technology developments and the associated implementation in the corresponding demonstrators." – PROMISE, p. 54
- "Integration is one of the key tasks in this kind of project. The **task of integration can not be underestimated** and takes more time and resources than expected." – MIDAS, p. 26
- "With many interface points, it is imperative to focus on integration. One individual must have **integration responsibility** as a main task. This may be the project manager, but it is better to have someone else as was the case in PROMISE." – PROMISE mgt, p. 3
- "It turned out that more efforts than expected were required in the integration phase. The integration process was longer than expected not only for the first release but also for the subsequent ones. We learnt that the **release manager** has a crucial role to play in coordinating the integration efforts." – XtreemOS, p. 22
- "Consistency of internal architectural relationships and alignments between the activities of the work packages should not be taken for granted. The Amigo project installed an **architecture team** to maintain conceptual consistency and technical alignment across work packages and to maintain the coherence of the middleware architecture when breaking it down to actual design decisions. The members of the architecture team were selected solely on their experience as software architects. They functioned as the technical conscience of the Amigo project. They identified and notified when problems occurred across work packages, acted on technical issues that crossed work packages and explained the architecture view within and outside the consortium. They helped individual contributors to the Amigo project to fit their work in the Amigo system and fostered cooperation between people and tasks to assure proper integration. The activities of the architecture team also involved restructuring and changing the duration of the relevant work packages and conducting explicitly enabling transfer workshops and meetings." – AMIGO, p. 35

- "On an even deeper technical level, it became apparent that even implementations based solely on comparably mature WS-Standards, such as WSDL, UDDI, and BPEL are not that easily interoperating. Even the specification of a complex message type in a WSDL file, when transmitted in a SOAP message requires careful consideration of message encoding. In an Integrated Project, **design must be done having interoperability in mind**; developing for interoperability using incomplete, not compatible standards, may lead to the risk of either 'wasting' resources in debugging a particular standard implementation or to not implement some feature simply because it is not supported by available standards." – TrustCoM D74, p. 14
- "The designs following the overall architecture called for a set of loosely coupled components interoperating as web services. As a result, **after the interfaces were defined and fixed, the development of the various components could be pursued by different development teams in parallel**. The integration of the components was quite smooth, with the exception of some adaptations and bug fixes that had to be made. So as a first lesson we report that the adherence to classical software engineering practices throughout the development phase really paid off. More effort was devoted to the design phase but we encountered no big surprises in the implementation and integration phases." – COMANCHE, p. 8-9
- "The modular approach gives significant flexibility to the platform as it allows easy extensibility and adaptation to the needs of a particular deployment. For example, it is now an easy task to integrate with a back-end proof engine to validate configurations, if more powerful functionality is required than the one offered by the current Service Consistency Validator. Moreover, as it appeared during the final project review, it is an easy task to integrate a push model for software updates that automatically trigger reconfigurations when new software versions become available. So the second lesson learnt is that **the designs and corresponding implementations should be as generic and parametric as possible**, so specializations and adaptations can be made easily." – COMANCHE, p. 9
- "'Integration' deliverables, such as use case prototypes, should be scheduled with **enough delay** from the infrastructure deliverables they integrate or use. In particular, the last 6 months of the project should be put aside to solve integration issues exclusively. No extra features should be implemented in the infrastructure prototypes during that time, only bug fixes." – GridComp, p. 30
- "A few statements can be made for the setup and execution of the Content Distribution Network (CDN) trial. The integration of the COMANCHE platform with CDN was a challenging task. The main reason was that the two technical teams that were responsible for the two platforms were communicating informally and it took some time until they were aligned. This **lack of formal communication** was a consequence of the observation that development teams are reluctant to review technical documents when they work under pressure and prefer informal human-to-human communications. This approach has its drawback though as it turns out, and may end up in unexpected delays." – COMANCHE, p. 10
- "It is also essential to produce **documentations** early enough in the process on component interfaces and also user and administrator manuals. It was difficult to keep these documents continuously synchronized with the evolving software. The organization of weekly telco involving developers and packagers helped a lot in the integration and packaging process." – XtreemOS, p. 22
- "I now understand that there have been two approaches in this project: partner X with their 'top-down' approach and partner Y with their 'bottom-up' approach to implementing a Virtual Organisation. The biggest integration problems concerned matching the two systems. I think the two teams would have benefited from **getting together in a single location, installing each others software, understanding their objectives and problems and sorting out a solution!**" – TrustCoM D74, p. 15
- "The individual development works were not communicated properly which led to confusion between different versions and interfaces. This led to high integration efforts. Future approaches should in particular try to use **consistent interface declarations** (i.e.

with backward compatibility or no changes at all), or at least ensure that all according changes are communicated timely and thoroughly." – TrustCoM D74, p. 14

- "**Aligning the integration process on sub-'demos'** increased the efficiency of the development process. This meant in particular that with each integration a diminishing amount of sub-demos were specified that pursued an increasing amount of component / functionality integration." – TrustCoM D74, p. 13
- "**Regular 'coding' sessions** involving the development team are a necessary means to ensure integration" – TrustCoM D74, p.16
- **"Sprints** (small-scale get-togethers for several days) served two major goals: collaborative design of architectural issues and moving the implementation forward. Those sprints, where usually the implementation people of various partners met for several days and conducted intensive work sessions have proven critical to move from scientific papers to a proof-of-concept implementation and finally to a production-ready SQO-OSS system." – SQO-OSS, p. 33
- "A **platform or standard** like the PROMISE PMI (PROMISE Messaging Interface) is INVALUABLE in allowing integration efforts to proceed with any chance of success. It is our belief that none of the PROMISE demonstrators would have been successful if PMI was not available in time." – PROMISE FAR annex, p. 54
- "One challenge was adopting two web service platforms: Java and .NET. Integrating certain components became too wrapped up in low-level integration issues that had no research significance. Standardising on a single platform was perhaps unrealistic, but perhaps **standardising on a single platform for certain critical parts**, in particular with a strong interdependency, would have been preferable." – TrustCoM D74, p. 15
- "One of the first important technical decisions was the choice for Java as programming language and environment / framework. While there was no single language that would have been preferable for every individual project partner, and thus **no 'perfect language'** for SQO-OSS, using Java has been easing the development of the SQO-OSS system thanks to its cross-platform availability and relative ease of learning." – SQO-OSS, p. 33
- "Early '**detection mechanisms**' to avoid incompatible components later on are direly needed" – TrustCoM D74, p. 16
- "Interoperability tests need a **timelier plan**." – TrustCoM D74, p. 16
- "One of the significant findings of our study related to the double-edged nature of **pointcuts**. In some circumstances they can prevent the propagation of changes, which both reduces the impact of change and maintains a stable design. However, in other circumstances they can cause the propagation of a modification and so increase the impact." – AOSD Europe, p. 13
- "RAPI/RMI architectures that require more than one (java) process are too resource consuming for today's small devices. The advantages of loose coupling between components that provide good debugging and error control must be **traded** for tighter coupling (and more difficult debugging) – but providing a smaller storage/resource footprint and hence better performance." – MIDAS, p. 24

5.3 Tools and documentation

A source code control system for document sharing across project partners is very helpful. Software documentation must not only cover the technical level, but also installation instructions, test procedures, user manuals, etc.

- "Using a **'production-oriented' platform in an R&D product/project** where continuous changes may be needed, is as dangerous as using an open source development-oriented platform in a production environment. Both were implemented with specific goals in mind and it may not be prudent to utilize them in a system with the opposite goals!" – PROMISE FAR annex, p. 54
- "The Portal used for technical communication in the beginning was quite cumbersome to use and not very useful for collaborative document work with more than 2 or 3 editors. The

introduction of **Subversion** improved the situation a lot. Technically, the file repository can be accessed cross-domain from each partner and keeping track of edits is quite simple." – TrustCoM D74, p. 20

- "Having a **source code control system** (Subversion) for document sharing across project partners is a very helpful thing. People have copies of all necessary documents being pushed to their machines, all partners work on the same documents, all partners see the same documents, people don't have to go to web pages and pull new information and documents. Just like e-mail, documents arrive locally. Being able to link via a URL to the latest version of that document is very helpful, too." – TrustCoM D74, p. 19
- "Subversion has become a very useful tool for **file sharing**. Edit tracking functionality and the possibility to work with the same document by several users was one of the reasons to shift from ProjectPortal to Subversion." – TrustCoM D74, p. 21
- "Following the best practices established in software industry, an automated build environment was set up based on free **Hudson** continuous integration engine. It automatically triggers builds if the code base located at one centralised SubVersion (http://subversion.tigris.org/) server was changed. The build process consists of a number of steps and among others it is necessary to emphasize a step on which all unit and integration tests were performed. If any single test failed, the person(s) who checked in code after the last successful build got notified and had to react immediately by fixing the problem. Every developer was asked to commit to and check out from the SubVersion server at least once per day. This procedure ensured that everybody was working on the latest code base and in case of build failure it was easier to track the problem right after it was introduced." – STASIS DX4, p. 11-12
- "A major role of **controlling iterations and builds** were delegated to XPlanner (http://www.xplanner.org/). Of course, a big advantage of it was that it was free of charge. There were other tools on the market, which were more user-friendly, with more functionality, etc. However, XPlanner supports all the main required functions and was pretty easy to use immediately." – STASIS DX4, p. 10
- "In order to simplify the task of **registering hours for developers**, a special software was used, namely Mylyn (http://www.eclipse.org/mylyn/). Mylyn is an Eclipse plug-in with the main goal of creating 'a task-focused interface for Eclipse that reduces information overload and makes multi-tasking easy.' Besides its great value for developers by itself, it allows automatic tracking of the time a developer spends on a certain task and synchronises it with the XPlanner server." – STASIS DX4, p. 12
- "Shareable and exchangeable **common development / testing platforms**, such as Virtual PC and VMWare should have been used more strongly." – TrustCoM D74, p.16
- "**Internet Relay Chat** has been used for quick communication, mostly among developers working on the SQO-OSS code base. In a distributed working environment, keeping short lines is critical to resolve issues that involve more than one person (or component). The SQO-OSS channel has been alive and kicking for the last two years and served as a place to get quick help with SQO-OSS, and to ease communication between project partners in general." – SQO-OSS, p. 33
- "It is important to have integrators (not involved in XtreemOS implementation) working full time on testing the software and reporting to the developers. It is essential to document a **common testing process** and that all developers test the software in the same environment." – XtreemOS, p. 22
- "A positive experience was the close cooperation with the developers. The evaluation reports and in particular the results of the evaluation were communicated to developers through **various channels**, including wiki pages, mailing lists, bug trackers, phone calls and finally a deliverable. Bugs and other issues reported through the evaluation were treated carefully to drive product improvements and guide the evolution of the XtreemOS product which became increasingly mature and complete." – XtreemOS, p. 22
- "We had great difficulty understanding all of the technical issues and how the components could have been applied. I would have had an easier time if the **software was documented** (installation, testing etc) and had the basic concept explained. We could then

have installed it, tried it out and by using it understand better how to apply it." – TrustCoM D74, p. 20

- "Software documentation for each component was in some cases very poor. Although the written deliverables contained information on the software components at a technical level, there was not much documentation that described how to install it, test the installation and so on. The project would have benefited from **documenting the installation and usage of the components** from an early stage. It may have improved the communications between the partners as well." – TrustCoM D74, p. 15
- "Mutual technical understanding was difficult because of changing interfaces and missing documentation. Improvement: **Intermediate software documentation** should be produced." – TrustCoM D74, p. 14
- "Developers would like to have even **more documentation and illustrative examples** about the model-driven methodology than provided in the additional 'MADAM How To Guide'. For example, it would be helpful to have further information on the derivation of the MADAM model from an existing application and the generation of code for the different model elements." – MADAM, p. 30

5.4 Evaluation and case studies

A project is often both a problem owner and a solution provider. The understanding of user motivations is critical for coding. Design competitions may help projects to ensure the usability and the completeness of their software modules, documentation, developer's guides and tutorials.

- "**Use case feedback is invaluable**. The use case work package contributed in a fundamental way to the development of the results of the Non Functional Component Features (NFCF) work package. The first kind of contribution was related to the feedback concerning the efficiency of the tools provided by the NFCF work package used to implement the use case applications. Several times, the implementation of the NFCF prototype has been changed upon receiving such feedback from the use case partners. The second kind of contribution was related to the patterns modelled by the behavioural skeletons. Use cases suggested the adoption of slightly different parallel computation patterns within the behavioural skeletons with respect to the ones originally planned in the NFCF work package. The final data parallel behavioural skeleton structure actually has some features that are only there as use case partners asked for these features to be in place. Overall, the contribution by use case partners has been demonstrated to be fundamental for the success of the NFCF work package." – GridComp, p. 29-30
- "In every day business practice, between the carriers of demands of solutions (the buyers) and the providers of solutions (the sellers), in a typical consulting relationship, an obvious degree of **dichotomy** arises. In fact, what is asked is one thing and what is offered is usually something else. Sometimes the latter fits within the needs of the former, sometimes it doesn't. In a research project involving commercial and academic partners the situation is different with respect to business since some needs are shared among all partners but it is similar to business practice for certain aspects. In the hypothesis to orient research projects toward a future real business world the above mentioned dichotomy comes out again. In this research project we are **both solution providers and solution requesters**. Then it has been a difficult task to devise pilot scenarios that make up two requirements:
  a. the requirement to provide a proof of concept as close as possible to a real business practice
  b. the requirement to show the potentiality of all Gredia components effectively and convincingly.

  This difficulty has turned into a benefit as far as the **business partners needs** have been considered of paramount importance pushing the researchers to make the platform to evolve toward a more concrete use, by adding, modifying or extending some of its components." – GREDIA, p. 41-42
- "Most feedback of end-users was generated by means of the evaluation of the initial application scenarios and the final integrated prototypes. This feedback is not based on

long-term usage in people's homes but on presenting and interacting with the prototypes. In general people liked the applications related to health and wellness, and home automation. However, whatever the feedback of the end-users, it is always dependent on how and to what extent they can **trust** the applications, how reliable, robust and trustworthy the system is perceived. It is important for users to have **similar or universal interfaces** for all the applications. Furthermore, the **logging** of user data, content, and context are extremely sensitive issues that need to be addressed for any subsequent implementation or follow-up research. End-users don't consider the different Amigo domains as separate domains. That is, for them **interoperability is obvious** and natural and it is much more important to maintain the overall comfort and social integrity of their home environment." – AMIGO, p. 37

- "The whole consortium recognized the importance of leveraging architectural views to foster the modernization of complex systems. In this way it is possible to deal with the huge amount of information without getting lost in low-level details. We were positively impressed by the flexibility of the achieved result: it was able to adapt itself to both of our case studies, even if they were very different, with different purposes. For this reason our confidence on the overall approach increased. However, we noticed that only working together with industrial partners we were able to **fix a huge amount of low-level details**. For this reason we plan to validate continuously our proposal with industrial partners, establishing successful research partnerships. We found out that one of the most critical issues of the overall approach is to reach a first high-level view on the system. In particular industrial partners appreciate our preliminary tool for reassembling the architecture of the system, and thus we are encouraged in creating more generic strategies to reach the architectural view on the system." – MOMOCS, p. 49-50
- "Going beyond the engineering domain, the validation of the GREDIA platform in two critical business domains, namely media and banking, provided the additional step of assessing if an excellent research outcome can be applied in real life and accepted for new working conditions. As it was highlighted through this validation period, the assessment of scientific innovations by end users can be hard. The main reason seems to be that the **gap between engineers and not ICT-skilled people** can prove to be rather large due to the ignorance of the specific requirements posed by these two different worlds. In that respect, during the trials of the media and banking pilot applications, it turned out that **user friendliness** was not always met, but is nevertheless absolutely crucial. Although the creation of an intuitive GUI is not a challenge from a technical point of view, a consortium of a project like GREDIA should include a partner with profound expertise in that field." – GREDIA, p. 41, also in Section 2.1
- "It was found that a secure and **user-friendly graphical environment** should be used for allowing users to personalise their services and privacy settings. Existing ontology editors can not provide an adequate solution for this, as they require relevant expertises, which average users do not possess." – COMANCHE, p. 8
- "The **prototypal nature of developed software** hampered the evaluation activity carried out by the industrial partners, even if on the average it was good and encouraging." – SeCSE, p. 10
- "The understanding of user motivations is critical for coding, but it is very difficult to be achieved. Programming focuses on purely technical parameters, such as software, framework, throughput, etc. Users in turn are not at all interested in how the system works, they need a very easy point of entry and a clear perspective how a new tool actually helps them in their work and does not deviate far from their everyday tasks. This is what we would now sum up in the sentence: "**It's not the pipe, but the plugs**". GREDIA would have needed a dedicated WP task anticipating agile development of interfaces that would transfer the technical aspects into usability." – GREDIA, p. 41
- "The Amigo Challenge has been organized as a design competition for students and the Open Source Software communities. The major goal was to make the software available to a large community of young designers and developers. A website was set up and used to make all the software components, tutorials and developer's guides available. Forum sites and support for developers was made available. The challenge was announced and advertised, worldwide, via email, networks and professional organizations, and supported by appropriate visuals. The project's website set up for the Amigo challenge attracted over

9000 downloads of software and tutorials. However, the number of actual participants was extremely low, probably due to the fact that the prizes to be won were rather low. But, the effort was extremely useful for the project to ensure **the usability and the completeness of all software modules, documentation, developer's guides and tutorials** and last but not least, to create a great amount of positive publicity for the Amigo project as a whole." – AMIGO, p. 36, also in Section 4.1

- "**Software testing** should be done on target devices, at all stages during development." – MIDAS, p. 24
- "A **high-quality documentation and responsiveness from internal developers** are key features to attract people from outside. A simple installation/configuration process is also crucial." – XtreemOS, p. 22
- "Another major lesson learned was that **implementing demonstrators too late** during the course of the project results in missed opportunities to show them and thus less impact than if the demonstrator had been available on time. Thus it would have been better to plan more application-based scenarios so that they could be implemented with earlier releases of XtreemOS and also to more actively encourage the developers to fix the specific bugs that are blocking the demonstrators. It would have been better to have these videos and demonstrators earlier to be used for communication activities. But developing an operating system (OS) takes a long time and demo applications cannot be tested before the OS is available." – XtreemOS, p. 23
- "The software evaluations would have benefited from more information on **what the reviewers were expecting** – the level of evaluation and so on. This is a customer-relationship issue that doesn't appear to have been managed very well." – TrustCoM D74, p. 9

6 Sources

[3S]
3S, Final Activity Report, June 2009,
ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/st-ds/3s-far_en.pdf

[AMIGO]
AMIGO, Final Activity Report, September 2008,
ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/st-ds/far-v3_en.pdf

[AOSD-Europe]
AOSD-Europe, Final Activity Report, March 2009,
ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/st-ds/final-report-aosd-europe_en.pdf

[ASG]
ASG, deliverable D0.I-2, Analysis of Management, March 2007
http://tb0.asg-platform.org/download/downloadrequest.php?asgdocument=D0.I-2_Analysis_of_Management.pdf

[BREIN]
BREIN, Final Activity Report, March 2010,
ftp://ftp.cordis.europa.eu/pub/ist/docs/grids/brein-far_en.pdf

[COMANCHE]
COMANCHE, Final Activity Report, January 2009,
ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/st-ds/comanche-far_en.pdf

[COMET]
COMET, Assessment Report 4, October 2008,
Confidential report. Extracts are quoted with permission.

[EchoGRID]
EchoGRID, Final Activity Report, July 2009,
ftp://ftp.cordis.europa.eu/pub/ist/docs/grids/echogrid-d6-3-final-report_en.pdf

[FASSBINDER]
FASSBINDER, Final Activity Report, July 2008,
ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/st-ds/fassbinder-d5-5-final-report-final-version_en.pdf

[GREDIA]
GREDIA, Final Activity Report, June 2008,
ftp://ftp.cordis.europa.eu/pub/ist/docs/grids/gredia-d10-5-final-report_en.pdf

[GridComp]
GridComp, Final Activity Report, June 2009,
Confidential report. Extracts are quoted with permission.

[InteliGrid]
InteliGrid, Final Report, June 2007,
ftp://ftp.cordis.europa.eu/pub/ist/docs/grids/inteligrid-final-report_en.pdf

[MADAM]
MADAM, Final Activity Report, May 2007,
ftp://ftp.cordis.europa.eu/pub/ist/docs/st/madam-final-report_en.pdf

[MIDAS]
MIDAS, Final Activity Report, April 2009,
ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/st-ds/midas-final-report_en.pdf

[MOMOCS]
MOMOCS, Final Activity Report, December 2008,
ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/st-ds/far-v1-8_en.pdf

[MUSIC]
MUSIC, Final Activity Report, October 2010,
Confidential report. Extracts are quoted with permission.

[NESSI-Grid]
NESSI-Grid, Final Activity Report, March 2009,
ftp://ftp.cordis.europa.eu/pub/ist/docs/grids/nessigrid-final-activity-report_en.pdf

[NextGRID]
NextGRID, Final Activity Report, June 2008,
ftp://ftp.cordis.europa.eu/pub/ist/docs/grids/nextgrid-finalreport_en.pdf

[PROMISE]
PROMISE, Final Activity Report, June 2008,
ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/st-ds/far-draft-final-activity-report-preliminary_en.pdf

[PROMISE FAR Annex]
PROMISE, Annex to the Final Activity Report, September 2008
ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/st-ds/far-promise-final-activity-annex-demonstrations-v1_en.pdf

[PROMISE mgt]
PROMISE, Experience from managing a FP6 IP, July 2008,
Confidential report. Extracts are quoted with permission.

[SeCSE]
SeCSE, Final Activity Report, November 2008,
ftp://ftp.cordis.europa.eu/pub/ist/docs/st/a3-d21-engineering-of-service-based-systems-future-perspective-final-report_en.pdf

[SORMA]
SORMA, Final Activity Report, October 2009,
ftp://ftp.cordis.europa.eu/pub/ist/docs/grids/sorma-far_en.pdf

[SQO-OSS]
SQO-OSS, Final Activity Report, November 2008,
ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/st-ds/final-activity-report-final_en.pdf

[STASIS DX4]
STASIS, deliverable DX4, “STASIS Development Process”, May 2009,
http://cordis.europa.eu/fp7/ict/ssai/docs/stasis-dx4-extra-process_en.pdf

[STASIS D88]
STASIS, deliverable D8.8, “European-China Cooperation Report”, September 2009,
http://cordis.europa.eu/fp7/ict/ssai/docs/stasis-d88-european-china-cooperation_en.pdf

[TrustCoM D74]
TrustCoM, deliverable D74, “Lessons Learned”, June 2007,
http://cordis.europa.eu/fp7/ict/ssai/docs/trustcom-d74-lessonslearnt-final_en.pdf

[TrustCoM]
TrustCoM, Final Activity Report, July 2007,
ftp://ftp.cordis.europa.eu/pub/ist/docs/st/trustcom-finalreport_en.pdf

[XtreemOS]
XtreemOS, Final Activity Report, May 2011,
http://cordis.europa.eu/fp7/ict/ssai/docs/finalreport-xtreemos.pdf