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1. EXECUTIVE SUMMARY

This deliverable describes the envisioned V-MUST.net Exploitation Structure, and presents its implementation as an operational Competence Centre that provides not only long-term access to the knowledge of the V-MUST.net Network of Excellence but also provides implementation of projects in the museum and cultural heritage domain and offers a repository of digital museum objects and virtual reconstructions of historical buildings and landscapes for re-use.

This Exploitation Structure provides the blueprint for the exploitation of the knowledge and excellence of V-MUST.net and outlines the path towards a fully operational Competence Centre, of which the detailed description of its activities, business models and structure will be described in the Exploitation Plan (deliverable D8.6 at the end of the second year).

The Exploitation Structure, described in this text, will be made operational during the course of the V-MUST.net project, to allow that this organisation reaches a certain degree of maturity and independence before the project and its funding stops. Although this puts an additional workload on the shoulders of the project partners, we are convinced that this approach improves significantly the viability and robustness of this Competence Centre.

The goal of the Competence Centre will be not only to provide knowledge on virtual museums and digital heritage to the museum and cultural heritage domain, but also to implement projects in that domain and to develop solutions that help to improve this domain. The Competence Centre therefore will be composed of V-MUST.net members as Founding Members and a wide variety of companies, experts, research centres, museums, cultural heritage institutions and governmental organisations as Associated Members. The companies, experts and research centres will act as providers of knowledge and services and developers of new solutions. The museums, cultural heritage institutions and governmental organisations act as the customers and help to define their needs and the best way to integrate digital technologies into their activities.

By involving into the direct implementation of projects, this Competence Centre not only secures an important source of income but also provides one of the most direct ways of knowledge transfer to a sector that is somewhat slow in adopting new technologies. But such an approach has also a third advantage: it creates a direct dialogue with the museum and cultural heritage domain on the integration of new technologies. We are convinced that this slow adoption is partially due to a lack of insight of the technical partners into the real needs and workflow in museums and cultural heritage institutions, and a lack of knowledge in the museum sector about the capabilities of ICT and VR, so direct cooperation on projects, driven by the day-to-day needs and goals of this sector is the best way to solve this. Besides implementing projects, the Competence Centre will also involve in training and running a digital heritage repository, which will also create additional income.

The Competence Centre will be a small European non-profit organisation that acts as a knowledge and service broker, having most of the project or knowledge transfer activities performed by its members. This outsourcing will be governed by contracts, while the Competence Centre will act as the single reference point towards its customers, throughout the full length of the project, from conception over realisation to maintenance and re-use of the assets. This approach is implemented through the use of project coordinators and local affiliates, ensuring a presence of the Competence Centre in most of Europe.
2. INTRODUCTION

V-MUST.net tackles one of the key problems concerning research networks, which is turning research into services and products in a sustainable way. For this reason, V-MUST.net contains a work package (WP8) that focuses on this issue. This deliverable explains the methodology, goals and structure that V-MUST.net wants to adopt to implement an exploitation activity during the project but also after the project closure. We have chosen to implement this exploitation activity through the V-MUST.net Competence Centre that not only provides knowledge and support to the museum domain, but also plans to do full projects that incorporate the competence and knowledge of the V-MUST.net network. We believe that by organising the Competence Centre as an operational unit that realises real museum projects, we can fulfil both the goals of transferring knowledge and of providing exploitation of that knowledge in a sustainable, long-term way.

This choice is based upon many discussions with project partners and upon extensive study on the subject that took place in the EPOCH Network of Excellence (2004-2008). Additionally, there is since a few years a clear transition visible in the museum domain to adopt actively ICT and virtual reality (VR) technology, but with an explicit need for support on the conceptual, organisational and technical aspects. The museum domain also expresses the need for sustainable solutions that can be maintained easily and with minimal costs, in other words the need for maximising and safeguarding the investments in such installations, seen in the light of the current reduction of budgets in the cultural domain.

So this deliverable proposes an exploitation structure that is based on a Competence Centre organisation with full project implementation capabilities. We are convinced that the project consortium has the right capacities to endeavour on such an approach as half of the consortium consists of research centres with operational skills while there are also three museums amongst the consortium members (with many more as associated member).

A Competence Centre of a European project needs to provide access on a continuous basis for a certain user community to the knowledge that has been gathered in that European project, on a self-supporting basis, all over Europe, possibly wider. This means that the creation of such a Competence Centre needs to deal with the following issues:

- all knowledge, acquired in the project, needs to be formalised in a way that is suited for practical and continued use
- that knowledge needs to remain up-to-date after the closure of the project (and the availability of funding)
- that knowledge needs to reach a majority of European users so it needs to be made available to users in their own language and in their own region
- the activities of the Competence Centre need to generate a sufficient amount of income to support the cost of running the Competence Centre, including the updating of the knowledge
Integrating technology, and especially VR technology, into the museum domain is a complex matter as many different skills, ranging from museology over user interfacing and cognitive sciences to 3D and interactive storytelling, are combined into one application. At this moment, the cultural heritage (CH) domain is not capable of mastering all these skills, so we need to find a structure that is capable of putting all these skills to work in concrete projects. On top of that, the V-MUST.net project focuses on creating systems that are robust, well designed, easy to maintain and having a long life cycle. We are convinced that the best way to implement knowledge transfer within the domain of museum technology is the realisation of such museum installations and applications from beginning to end.

In other words, we believe that the implementation of the V-MUST.net Competence Centre (VCC) includes the implementation of a large project team that is capable of realising museum installations, based upon the V-MUST.net guidelines. This project team consists of the V-MUST.net partners together with a range of specialised companies, CH and ICT experts and research centres active in the ICT and CH domain. To create such a project team, a selection procedure needs to be in place to pick the organisations and individuals that have the required competences and commitment.

To implement such a selection procedure, we propose that all organisations and individuals that want to participate in this project team, become formal member of the VCC. In other words, membership of the VCC is subject to an assessment procedure that evaluates not only the skills and competences of the candidate member in the domains of ICT and CH (for example by estimating the percentage of projects in these domains), but also looks into the stability of the organisation (similar to the assessment that the EC uses for approving organisations as partners in European projects), the commitment of the member towards ICT and CH (for example, by evaluating the investments done towards these domains in terms of training, equipment, software, tools) and towards V-MUST.net (by evaluating the commitment to have staff follow training by the VCC, and use and further improve the VCC guidelines). VCC training and guidelines are direct derivatives of the V-MUST.net training activities and deliverables.

We are convinced the VCC can be effective only if a set of services is provided from conception over realisation to maintenance of museum installations. In other words, the VCC should provide services such as consulting, creation of tendering documents, advice and support for obtaining funding, creation of an optimal consortium, implementation and maintenance of museum installations, assessment of the impact and fitness-for-use of museum technology, and training concerning museum technology.

Additionally, we believe that we only can implement this if the VCC has sufficient knowledge of the local situation (laws, structure of the cultural heritage domain, customs, government policies, ...) and is sufficiently connected to the local CH domain (by knowing people, organisations, administrations at different levels, common practices, ...). This means in practice that the VCC needs to have local “affiliates” in some European countries or use local experts in other countries. These affiliates are VCC members that want to implement local activities such as events, training or seminars, and document local projects for use by the other members.
3. ACTIVITIES OF THE COMPETENCE CENTRE

The VCC should focus on knowledge transfer and innovative implementations in the domain of digital heritage, providing the complete pipeline from inception over realisation to maintenance in the CH and museum domain. This museum domain should be interpreted in a fairly wide sense, and incorporate also sites and monuments. The VCC can offer an interesting approach through the focus of V-MUST.net on installations with a long lifecycle, holistic design and easy maintenance. Additionally, the VCC should enable and stimulate the re-use of digital assets through the exploitation of a digital repository.

The VCC should focus on providing services, not products. As the VCC is not providing these services itself, but has the VCC members doing this, it acts as a service broker. Services are done on a paid basis, providing income for the VCC as a brokerage fee. In addition, the VCC should provide training and organise seminars and events.

In the realisation of a project, the first step in the pipeline is first-line consulting. First-line consulting focuses on orienting cultural heritage organisations to find the appropriate technologies that match the goals and requirements of the museum. Such consulting can result in a report plus cost estimate, so that the museum management can take decisions on which solution to adopt and how to implement it.

Another possible form of consulting is socio-economic impact studies. In these early days of creating and using digital heritage, it is not only important to show the economical and social advantages (or disadvantages where applicable) of these new technologies but also to point out the best workflows that have more social impact with less costs or investments (see Scenarios below).

Another consulting service that the VCC can provide is the assessment of digital heritage installations in terms of fitness-for-use, cognitive quality and communication effectiveness. Such assessments can be applied to define improvements to existing installations and turn them into better applications that have a longer lifecycle and are easier to maintain and re-use.

Once decisions are taken, a second step can be made towards implementation. The VCC can take on the redaction of tender documents (if implemented as commercial project with public tendering) or provide support in finding the appropriate funding mechanisms and partners for funded national or European projects (if implemented through a funded project). The creation of tender documents is a form of consulting and is done on a paid basis, providing income for the Competence Centre. For European and national projects, VCC members can participate as partners. The VCC will have a legal structure that allows it to be a coordinating or participating member in funded projects where necessary (therefore it needs to have a solid financial base and a long term strategy). Requests for submitting national or European funded projects need to be directed to the Board of Directors, who decides if the VCC makes the investment to write the proposal and create the consortium, and potentially takes the responsibility to lead such a project or participate in it (including matching funding).

The special structure of the VCC (see Structure below) however will allow it to propose a direct implementation by the VCC. For this implementation, the VCC needs a pool of organisations that have implementation capabilities and skills. We envision that this pool mainly consists of research centres and...
companies. Research centres are used when there is still research and development to be done in the implementation, while companies provide efficient, high volume production facilities for parts of the implementation where no research is involved. The VCC is composing the project consortium, defining the details of the implementations together with the museum, coordinating the activities of the different partners and taking the final responsibility for delivering the project in time and budget. We believe that the major income for the Competence Centre will come from such direct implementations of museum projects, as a small percentage (brokerage fee) of the total project budget.

Another type of projects that the VCC could implement is the redesign of digital heritage applications to improve their quality, lifecycle and maintainability. Many first generation digital heritage applications experience a range of problems (technical, usability, robustness, …) or have ceased operation due to these problems or to insufficient fitness-for-use. As V-MUST is in the process of providing solutions for these problems, the VCC could easily profile itself by providing such a service, as nearly nobody is doing this for the moment, while there is a clear need for such a rescue operation.

A major problem today in digital heritage projects is the maintenance of digital heritage projects. Through the specific focus of V-MUST.net on robustness, long lifecycle and re-use, the VCC can offer museums to maintain their digital heritage applications, not only those that have been implemented by the VCC but also by others. This can be seen as a kind of central maintenance service on European scale for the CH sector, implemented in a distributed way, and can provide another steady source of income for the VCC.

To present this approach to the museum and CH domain, it is very useful to structure these solutions into a set of scenarios plus implemented example projects. These scenarios can be based upon a classification system (as developed by V-MUST.net) and provide a standardised description of pros and cons of each scenario. This approach can be very useful in the first-line consulting phase, but also gives managers in the museum and CH domain a detailed view on the trajectory from concept to working application and how this implements curatorial goals and public outreach. Providing detailed information on good example projects (from a structured knowledge base) will help to convince museum management to adopt digital technologies as one of the ways to do research and public presentation.

The scenarios should also take into account how to obtain the targeted robustness, maintainability and long lifecycle. The VCC should adopt a methodology (based upon the V-MUST.net approach) that gives museum applications a lifecycle of at least 15 years. A period of 15 years means not only that the application needs to be ported at least 4 more times to another computer after installation (i.e. a new computer is needed typically each 3 years) but also that the application will have at least one major port to another software in its lifetime (most software has a typical lifetime of 10 years).

In its implementation of projects, the VCC project partners will heavily rely on a collaboration platform (see WP4) that not only stores the intermediate results but also stimulates proper documentation of the workflow. Additionally, the VCC will maintain a repository of digital museum objects and virtual museums for re-use by other museums and third parties, and have a certain percentage of the “re-use fee” as additional income. Annex 2 provides an analysis of the Etruscanning project to demonstrate the role of this platform in the VCC.
Finally, *training* can be provided on a paid basis, both in a customised way for one CH organisation or in an open workshop or seminar format, and can be a source of income for the VCC, re-using and localising the training material that V-MUST.net is developing. Training activities and seminars will be supported by a range of publications, if possible in local language. V-MUST starts a new series of know-how books that can be continued by the VCC. These know-how books are practical guides for CH and museum managers through specific topics such as interactivity in museums, digitisation, use of 3D in research, … that help to integrate these technologies into the day-to-day reality of museums, sites and monuments. The new know-how books that are currently in the making, focus also on example projects (which are stored in the knowledge base) that help managers to envision more easily how similar projects can be integrated in their own organisation.

*Sponsorship* is another potential source of income, but accepting sponsorship could jeopardise the independent status of the VCC (see chapter 4). Instead of direct sponsorship, cooperation can be established with certain partners when providing training or organising events, this can be considered as indirect sponsorship.

The Exploitation Plan deliverable (D8.6) will give a detailed proposal on the business models concerning these different activities, and make a first business plan for the VCC. The business models will deal with the financial streams within service brokerage (in other words, how much does such a system cost and how large is the perceived value for the ‘customers’), with the position of the VCC within the business of digital heritage (in other words, does such a brokerage system compete with other organisations and how easy do commercial partners embrace this approach) and with the acceptance of the museum and CH organisations of a brokerage system instead of direct contact with commercial partners.

Another important part of this Exploitation Plan is the definition of the business models for the V-MUST repository. These business models not only need to define the potential customers for digital heritage assets (which can be outside the museum and CH domain, such as film, games, tourism or publications) but also the financial models (for example, what is the fee for using a digital museum object in a temporary exhibition), the IPR (for example: who gets a part of that fee: the person or organisation that did the digitisation or digital restoration, the museum that owns the physical object, the expert that wrote the background information) and the services (more precisely, the VCC that maintains the repository, acts as middleman between the two museums and delivers the digital model). In most cases, digital museum objects will most probably not be delivered in a ‘naked’ form (the digital 3D file and its metadata) but in a ‘packaged’ form (an application using the digital object that gets integrated in the temporary exhibition), which will create extra business for the VCC.

These business models will be verified and discussed by ongoing consultation with potential members of the VCC, museums and CH organisations, to make sure these new concepts are realistic and conform the needs.
4. ORGANISATION OF THE COMPETENCE CENTRE

We propose to create a non-profit organisation as coordinating body of the VCC. Through a study done under the EPOCH project, we are convinced that an International Non-Profit Association (INPA), as it exists under Belgian law, is the best legal structure to implement the activities mentioned above. The other legal structure that has been studied in detail is the (European) Economic Interest Group.

The main advantages of an INPA are the limited liability (the organisation can be suspended without remaining financial or legal consequences for the members), the absence of the need for a starting capital and the capabilities for being a fully operational entity within a non-profit framework. If a starting capital would be collected from the Founding Members, this is the only financial amount that those members risk to loose if the INPA would be terminated in a very bad way. Normally, the Founding Members would get their contribution back when the INPA would be abolished.

It is considered that the INPA will have bookkeeping just as a small enterprise, including a VAT number. A non-profit organisation is also more easily accepted in the museum domain than a commercial entity, provided it can deliver quality within time and budget. Non-profit organisations are considered to cooperate more easily with public institutions than commercial entities. Some countries have laws that allow non-profit organisations to do projects without public tendering.

A key element of the status of non-profit organisation is that profits are not returned to the founders but re-invested in the goal and activity domain of the INPA. This could result concretely into investment in the knowledge of the VCC (materialised by the knowledge base), into training of its project coordinators and members, into cooperation platforms for its different categories of members (companies, museums, …), into development of services and tools that are made available to the members. Normally, the INPA would not invest in equipment or other material assets, leaving this to the members.

There is a consensus within the group to make the activity domain of the INPA quite wide, it would look like "ICT and Media for museums, cultural and natural heritage" with museums being understood to cover cultural and natural heritage, history, art, design, science, etc.

As a coordinating body with a minimal staff, the INPA relies on its members to execute the work and implement its presence in a number of European countries. These partners can be Founding Members (those V-MUST.net partners that start the VCC) and Associated Members (organisations and individuals that join the VCC after its start-up). Associated Members of V-MUST.net will be invited to become Associated Member of the VCC. The Members of the VCC will be research centres, universities, companies, museums, governmental organisations and experts, and can only become member after a successful selection procedure.

The selection procedure should take place at the moment that the organisation or individual makes an official request to become member. The details of such a selection procedure need to be defined in the start-up phase (see chapter 7), but need to focus on defining the best capacities of the members concerning
long-term involvement in the VCC and on refusing those organisations and individuals that lack the required competences, stability and long-term commitment.

When an organisation or individual (expert) wants to become member of the VCC, they need to demonstrate a clear commitment to the goals and activity domain of V-MUST.net. Commitment means that the organisation or expert that provides services needs to be actively involved in the museum and ICT domain and invest in skills, knowledge, equipment and management structure for both domains.

The results of this independent assessment for each member are used by the Board of Directors (BoD) to decide whether to accept a candidate member or not. If the membership of the partner would have little to no advantage to the VCC (for example, if there are already enough companies or experts for a certain competence in the same geographical area), then the BoD could decide to put the candidate member on a waiting list after the assessment procedure. Whenever a member goes through major changes, or when doubts arise about the capacities of a member, the BoD can decide to re-assess that member. All such decisions are made through voting within the BoD.

For museums, CH institutions and governmental organisations (the ‘customers’), a VCC membership would be optional when using the services of the VCC. In any case, it is useful to have not only service providers in the consortium but also service users, to receive feedback on training needs, methodology and offered solutions, and to give them the opportunity to participate in the general management (through voted members of the Board of Directors) and important decisions (through voting by the General Assembly). Nevertheless, there would be no formal selection procedure for such members. Being a customer of the VCC would serve as selection procedure because the Executive Director – or in difficult cases even the Board of Directors – would always assess if it would be an advantage for the VCC to accept a project, or to subscribe to a call for offers.

Within a non-profit organisation that provides a clear advantage for its members (see chapter 5), it is common to have a yearly membership fee. The consensus within the group is to have a small fee in the order of 100 to 300 euros per year for Associated Members. Founding Members could not pay a membership fee but instead contribute to the starting capital at the founding of the INPA (a contribution of 1000 to 3000 euro). In the first year, the membership fee could be waived to attract more easily Associated Members and to compensate for the investments that early partners will do by following training by the VCC, for which they would pay. VCC Members will of course always enjoy reduced training fees, this is one of the advantages that they enjoy as member.

The INPA will have contracts with each Member to define rights and duties and to define responsibilities and financial streams. The INPA will also be the legal identity that makes the contracts with museums and takes the operational responsibility for the execution of projects within time and budget (through its contracts with the project coordinators). Scientific responsibility should be taken by involved scientific partners. Potentially, members need to pay a small membership fee that covers amongst others the administration cost of contracts and the knowledge bank in which project information and the profile of each member is kept up to date.
When the VCC starts a project, it looks for the most suited project coordinator and for the most suited project partners to implement the project.

For a project coordinator, most suited means that this person has the right skills and competence for the project at hand, has sufficient knowledge of the local aspects of the project (i.e. local language, laws and context) and is capable of being the interface with all organisations involved in the project (i.e. lives close to the project location or is capable of establishing good communication channels to all project partners). The project coordinator is assigned by the Executive Director, based upon the information in the VCC knowledge base.

For a project partner, most suited means having the appropriate skills and knowledge and being able to perform the work efficiently and with the highest quality (i.e. this means in some cases to be local to the project when physical presence is needed) and having capacity and experience in the type of project at hand. Parts of the project that require research will be subcontracted to one or more research centres, parts that require implementation will be subcontracted to companies. An up-to-date knowledge base with competences, completed projects and geographical area of operations of all available partners is the basis for selecting the partners. If there is more than one partner that can do the job, an internal offer will be asked to select the best partner for the job.

This approach gives the VCC a large flexibility and scalability, and allows it to function for a wide variety of projects over all of Europe. Currently, we envision the following workflow:

- when a project arises, the VCC finds the most appropriate project coordinator to lead this project (in which the technical, organisational and diplomatic skills of the person, his/her knowledge of the local situation and language and the geographical location is taken into account), this means concretely that there needs to be a first assessment of the potential project by the VCC

- this project coordinator analyses the needs and phases of the project, initial phases such as first-line consulting can be done directly by the project coordinator

- the project coordinator ensures qualitative and timely execution of the different phases of the project by dividing it into different tasks depending on skills and excellence of available VCC members

- the project coordinator is the contact person for the whole project towards the project responsibles (for example a museum director) and takes care of the complications of this distributed process

- the project coordinators are trained by the VCC and use V-MUST guidelines and project coordination and documentation standards that are defined by V-MUST (this helps improving the scenarios and project workflows but also transferring the project to another project coordinator in case the first project coordinator would become unavailable)

- when a project is finished, its quality and implementation should be assessed independently to assign it a Virtual Museum Quality Label (that will be developed together with ICOM and UNESCO), the quality label is very important for the VCC to create an image of quality and reliability
The cornerstone of this approach is the use of trained project coordinators. This means that selection and training of project coordinators is a key activity of the VCC, in other words most of the profit of the VCC needs to be re-invested in this. In the start-up phase (see chapter 7), the selection procedure and training of project coordinators needs to be defined in detail.

By providing a set of standards and guidelines for the way a digital heritage project is implemented in Europe and maybe wider, and by providing a controlled and documented workflow for this implementation, we can envision that an implemented project can be awarded with a Quality Label for Virtual Museums. This Quality Label should be developed together with ICOM and UNESCO, and can be a major driver for having projects implemented by the VCC (see chapter 5). We need to look also into involving ICOMOS and ICCROM, if we want to deal with more than museums only.

VCC members can obtain the status of affiliate of the VCC based upon negotiation (to obtain an optimal set of geographically distributed centres). These local centres deal directly with the customers (museums, CH organisations, …) in the local language, on behalf of the VCC, for projects, training, seminars and events.

Concerning training, it is crucial that the knowledge in the V-MUST network (both project partners and Associated Partners of V-MUST) becomes available to the VCC so that it can be used locally. Therefore, V-MUST.net partners, that are experts in a certain field, should give training to VCC affiliates (and other VCC members) in English. The affiliates translate the training material (presentations, video, handouts…) into their local language, adapt the material concerning local laws, customs, legal structures and replace example projects by local examples where possible or needed. Training sessions are organised by the VCC, based upon requests and perceived needs.

Project coordinators for a region, in which such an affiliate is available, can be independent or employees of this affiliate member, depending on the assigned tasks (i.e. contract) of that affiliate member. By making the appropriate mix between affiliate organisations and independent project coordinators, an optimal coverage of Europe can be achieved over time.

As these affiliates fulfil a task of disseminating digital heritage knowledge and implementing digital heritage projects locally (hence creating jobs locally), it should be envisioned that these organisations apply for local funding, for examples in funding schemes for creative industries. This local funding would avoid having substantial financial streams from the VCC to these affiliates that would create a substantial overhead to the VCC operations.

One of the key elements in the project approach described above is the distribution of project subtasks over specialised partners all over Europe. To make this work, the VCC needs a Collaboration Platform that takes care of the documentation of the project workflow, of exchange of intermediate results and of tools that support this distributed workflow (such as visualisation of 3D results or planning tools). Annex 2 shows an analysis of the Etruscanning project that is a first project by V-MUST partners that tests the V-MUST concepts of robustness and re-usability (see also annex 1). WP4 elaborates this topic much further.

In doing projects, the VCC provides only services, products and tools that are developed remain property of the developing parties. The VCC however can take the decision, in concertation with involved partners, to
turn a prototype, developed by a research centre, into a more stable and mature tool or product by a company. This could be supported by a market study by the VCC.

It is also an option, once this structure proves to work, to widen the scope of the VCC outside the museum domain and deal with for example tourism, city marketing, monuments, … It could also be envisioned to have operations outside Europe on the longer term. The VCC should however start in the beginning by establishing co-operations with similar organisations outside Europe. For example, there are good links towards CHIN (Canadian Heritage Information Network, http://www.chin.gc.ca/) and other major groups in China, Hong Kong, USA and Australia.

The financial income of the VCC, as described above, is used to pay the permanent staff and to maintain and update the knowledge base that also incorporates the scenarios, new technical developments, new virtual museum installations, interesting projects and examples and interesting events. The permanent staff of the VCC takes care of the creation of a project structure and coordination for each project (through the appointment of a project coordinator) and supports that through legal (making the contracts plus follow-up) and financial (follow-up of payments and invoices) services.

As mentioned above, one of the approaches that the VCC can take to implement projects is the submission of proposals for funded projects on national and European level. In most cases, VCC members will be partners in such projects. When necessary, the VCC can participate itself in such projects by hiring specific experts for the duration of the project.

The VCC should also actively engage in international conferences, events and CH related fairs, while its affiliates should engage in more regional activities. V-MUST.net is currently playing an active role in the Federated Cultural Heritage Event, which is a working title for a conference that tries to unite the major conferences that focus on the Digital Heritage domain. So it is conceivable that the VCC becomes a major partner in organising this Federated Cultural Heritage Event and will use it as a major communication channel for its members and activities.

The VCC needs to be independent from any national, international or commercial organisation or interest group to provide unbiased, long-term services of top quality. We are convinced that the outlined structure can also provide a cost-efficient and stable way to support the creation of a museum and digital heritage industry.

Currently, the involved partners prefer to make the VCC grow in a natural way, through its activities, without doing active prospection.
5. BENEFITS FOR THE INVOLVED PARTIES

We believe that the approach described above can only be successful if it has sufficient added value for all parties involved (i.e. research partners, companies, museum and CH organisations). In this section, we analyse this added value for all involved parties.

As explained above, the VCC Members can be service providers (companies, research centres, universities, experts) or service users (museums, CH institutions and governmental organisations). For the Service Providers, we see the following benefits:

- most companies are SME and only work in a confined geographical area (which means that most SMEs in the VCC consortium will not compete with each other), so it will be very helpful for these SME to cooperate, to exchange knowledge, workflows and experiences (a SME platform is envisioned to support this)

- the goal of the VCC is to reduce all factors that hamper the use of digital heritage technology, so this should result in an increase of business and increase of quality of the projects (hence improving the image of Service Providers that endorse this approach)

- distributing subtasks of projects on a European scale to those Service Providers that excel in a certain domain will improve the quality of the results and presumably create more business as customers get the best experts in Europe working on their projects

- as we expect that the use of digital heritage will grow significantly in the coming years (simply because it is the right moment now), distributing subtasks of projects on a European scale will also make the creation of high-quality applications and installations much more scalable and robust (provided that the VCC can find a sufficient number of Service Providers as members)

- the introduction of a quality label and the guarantee that applications will be operational for a longer time (goal is 15 years) will significantly improve the trust that the museum and CH sector will have in digital heritage, resulting in more business

- the focus of the VCC on maintenance and re-use, should result in a larger business volume, as maintenance is a repeat business that is often forgotten today, and as re-use will allow to create high-quality results at lower cost, creating additional business

- seminars and training sessions by the VCC will improve significantly the understanding of the use of digital heritage in museums and CH institutions, resulting in a better communication with the Service Providers and finally in better results

- the bundling of a wide variety of skills (from consulting over design to implementation and maintenance) into the VCC as a one-stop solution for digital heritage, will presumably create more business as it becomes much more easy for museums, CH institutes and governmental organisations to successfully use digital heritage
- the involvement of CH and museum experts in the VCC will improve the focus of the solutions on the real needs of the sector and on their efficient integration

The Service Users have the following benefits:

- the museum and CH sector will benefit from a uniform approach on European scale to conceive, implement and maintain digital heritage applications with a longer life cycle and a higher quality

- the V-MUST.net and VCC approach focuses on integration of digital heritage applications into the workflow and methodology of museums and CH, resulting in better solutions that fit with their needs (in V-MUST.net and in the VCC, the Museum Advisory Board and ICOM will give formal input in the policy)

- the central coordination and training of project coordinators by the VCC guarantees that all projects are done with the same methodology and quality norms, yielding a self-regulating quality system as the customers will have input in these norms

- the introduction of a quality label (with independent assessment) will stimulate Service Providers to invest in quality, cooperation and image, resulting in better and more sustainable applications and installations

- the concept of service brokerage (by a consortium of certified, specialised parties on a European scale) not only provides a one-stop solution and a single responsible for the customers, but also guarantees that each subtask is done by real specialists that have sufficient capacity and provide the best, most up-to-date solution, yielding the best results in time and within budget

- the concept of service brokerage, yielding a highly robust and scalable way of generating services in the museum and CH sector, and the cooperation of both Service Providers and Service Users into one consortium will result in a much higher chance that the VCC consortium can be sustainable and stable over a long period

- the implementation of robust, maintainable systems that last for at least 15 years and are re-usable is highly innovative and will change drastically the value perception of the museum and CH sector towards digital heritage applications

- seminars and training sessions by the VCC will improve significantly the knowledge and awareness of Service Providers in cultural heritage, yielding results and potentiality that fit much better the needs of the sector

- the repository will not only allow museums and CH institutions to re-use existing digital assets at a much lower cost (than developing them) but also allows costs of digital assets and their applications to be spread over multiple exhibitions (so that a museum will rather see digital heritage rather as an investment than as a cost)

A main aspect of the VCC approach outlined above is that profit by the VCC is re-invested in the museum and CH sector. This means concretely that:
- Profits need to be re-invested preferably in activities that improve the knowledge and capabilities of the VCC, hence improving the longevity and stability of the VCC.

- The most important goal of re-investment is training of the project coordinators and members (hence it is important to take measures to keep them in the consortium).

- Secondly, profits should go into the collaboration platforms (SMEs, museums, expert groups), the knowledge base and the repository.

- Thirdly, profits should go into new developments and prototype projects (for example as matching funds in European projects).

Currently, there are already two expert groups in the Netherlands (Amsterdam and Venlo) that meet regularly in the context of V-MUST.net. The Virtual Museum Network Amsterdam (http://www.meetup.com/Virtual-Museum-Network-Amsterdam/) has currently 111 members and meets every 6 weeks (about 15-20 people attend each meeting) in the Allard Pierson museum. The Venlo group has 20 members and meets every month at one of the members in the province of Limburg (Netherlands). The home location is the Limburg Museum in Venlo and the group has been founded by the EPOCH project in 2004 and meets for the 33th time on March 2, 2012 in the cultural heritage department of the city of Venlo. Both groups have both cultural heritage experts and ICT experts.

In these groups, there are many presentations of heritage projects and technologies. Local V-MUST.net organisations can also start such meetings, to improve the exchange of ideas on the use of digital heritage and to have a better overview of projects in the field. Both groups invite regularly external experts to present specific topics in both cultural heritage and ICT.

It needs to be investigated how these groups can exchange information on an international scale. One possibility is to broadcast (videostreaming, skype, …) and record the presentation by the experts so that other groups and individuals within the VCC can see the presentation (in real-time or later on), and even interact with the speaker. The VCC and its members will need to invest in good video conferencing soft- and hardware to establish regular contacts between the groups without major costs.
6. SWOT ANALYSIS

The goal of this document is to start a discussion within the V-MUST.net consortium on the details of the structure and activities of the VCC. This discussion will happen during 2012. A part of this discussion will be an extended SWOT analysis of the concept and implementation. For this reason, we start here already a first SWOT analysis that needs to be expanded and elaborated during this discussion.

Strengths

It is the right moment to start such an organisation. Museums and CH institutes are open now for ICT solutions, which can be seen by many activities and events on digital heritage in which museums are involved.

The VCC fills a real need in this sector, as information about the correct use of ICT in museums for public presentation but also for research, about longevity and robustness of applications, about digital museum objects and recontextualisation are being asked by museums and CH institutions.

The VCC has experienced partners with project implementation skills. Many of the VCC partners have extensive experience in creating virtual museum applications and did receive recognition for this (for example, in 2011, NoHo received the Award for Best European Cultural Game in Bilbao).

The creation of the VCC and the proposed structure has already gone since 2005 through an extensive process of discussion and reflection. Many companies, research centres, CH organisations and experts have been addressed to give their input and assessment of the proposed structure. In other words, the proposed structure of the VCC is based upon a wide consensus within the sector.

Weaknesses

We try to establish a new type of organisation in a difficult sector. There is little experience in setting up brokerage services for the cultural heritage domain, and making it sustainable for the longer term, especially if this needs to happen on a European scale. Some organisations involved in digital heritage (such as Digital Heritage Netherlands, http://www.den.nl/english/) seem to evolve in the same way.

There is a lot of interest for the concept of the VCC. However, the VCC will only be able to reach its goals if it has the right set of partners that have the required skills and production capacity and can deliver virtual museums and other digital heritage applications with the required quality. In other words, the VCC is very dependent on the selection of the right partners, especially in the starting-up phase, when the number of partners will still be limited.

In a service brokerage system, it is crucial that selection and decision mechanisms are transparent and just, and accepted by all partners. Discussions amongst partners on such decisions by the Executive Director or Board of Directors could easily damage the trust and good relations between VCC members and could absorb a lot of time and energy of the BoD. Avoiding this situation by
proper stating the rules in the contract, by explaining the rules and their interpretation before signing the contract and by refining the rules where needed is crucial.

Although it has clear advantages to start the VCC early in the project, it creates an extra workload on top of the normal work that V-MUST.net needs to do.

VCC company members can surpass the VCC system when having worked with a certain VCC customer and work directly with the customer. This will happen if there is not enough added value in working through the VCC.

**Opportunities**

The European Commission and several national funding agencies are focusing more and more their funding on activities that are creating jobs and business in the creative industries business (in which virtual museums and digital heritage belong). We expect the VCC to create extra business by convincing the CH and museum domain to use the opportunities that digital technologies provide and countering their objections against the limitations of digital heritage in terms of cost, stability, fitness for use or conceptual approach.

The European Commission is actively supporting the concept of Competence Centres and stimulates the mutual exchange of information on turning Competence Centres into successful organisations (see chapter 10).

**Threats**

Although there are very few organisations that are active in service brokerage in cultural heritage, there will be resistance from companies that act as a single contractor in creating solutions for the CH domain (and are subcontracting most of the subtasks to small companies), this is the case for example in Spain where the museum sector is dominated by a few large companies.

Companies can think that they need to share all their production secrets to be able to work in the VCC, while cooperation with similar companies or even competitors can be very positive without undermining their competitive position.

Companies can think that the VCC will put itself between the companies and their customers, while the VCC will only be involved when the company wants such an involvement.
7. STARTING UP THE COMPETENCE CENTRE

As outlined above, the VCC can only exist by the grace of good projects. The quite exceptional structure of V-MUST.net, which several research centres, companies and pioneer museums as partners, provides the right context and implementation power to start this VCC structure. The consortium also has a strong desire on implementing projects.

Currently, key V-MUST.net partners (CNR-ITABC, Allard Pierson Museum, Visual Dimension) are implementing the *Etruscan* project (through Culture 2007 budget) in close cooperation with major museums in the Netherlands, Belgium and Italy. This project can be seen as a try-out for certain aspects of the workflow described above. CNR-ITABC develops, as research centre, an innovative natural interface for real time 3D visualisation of Etruscan tombs (developed in three different versions with different interaction paradigms). Visual Dimension creates new ways of digital restoration, suited for real time visualisation. The Allard Pierson museum does visitor behaviour assessment of the different versions and hosts one of the exhibitions in which the VR application is used. From this project, a lot of methodology and practical issues can be derived already.

On the other hand, V-MUST.net plans in the near future several calls for projects with museum partners, in which the outlined methodology can be tested. Internally within V-MUST.net, a Task Force will be created that will take on these projects and in fact test out in the course of 2012 the concepts described above, but mainly with internal V-MUST.net partners.

Also several other external projects have already asked for V-MUST.net support, providing external budget, proving that the outlined VCC concept should be viable. They could be executed by the VCC as soon as the legal and operational structure of the VCC is in place, which cannot be expected earlier than 2013.

The following projects could be implemented by the V-MUST.net Task Force to test out the VCC structure, based upon the V-MUST.net methodology and guidelines (see annex 1):

- Villa di Livia – Via Flaminia (V-MUST.net budget)
- Cyprus virtual museum (V-MUST.net budget)
- Sarajevo Historic Museum (V-MUST.net budget)
- Catalhuyuk museum (V-MUST.net budget)

After that, several other projects could be implemented by the VCC, with a limited number of new members (annex 1):

- Hal Saflieni Hypogeum (Heritage Malta, external budget)
- Prehistoric temples (Heritage Malta, external budget)
- Ename Heritage centre (Prov. of East-Flanders, external budget)
- Ename archaeological site (Prov. of East-Flanders, external budget)
- Rokin metrostation (Noord-zuid metro line Amsterdam, external budget)
8. JURIDICAL STRUCTURE OF THE COMPETENCE CENTRE

The above mentioned activities and operational structure will be implemented within the legal framework of an International Non Profit Association (INPA), which is a legal entity under Belgian law. This choice was partially based upon a comparative study about the best legal structure, carried out under EPOCH in 2007-2008. The efficiency and success of the VCC will depend heavily upon its juridical structure, that will be defined by its statutes. These statutes are being developed with the help of a Belgian notary (Floris Ghys, Kluisbergen).

A first draft of the juridical structure could look like this:

- Founding members of the INPA: (subset of) partners of V-MUST.net (all partners will be asked to become member, need to fulfil certain criteria concerning commitment, responsibility, start budget)

- Associated members of the INPA: (subset of) associated members of V-MUST.net, completed with new associated members (need to fulfil certain criteria concerning commitment, training, … and need to pay a small, yearly membership fee), associated members can be companies, museums, governmental institutions, research centres, universities, experts

- Board of Directors: representatives from 4 Founding Members, 4 Associated Members, plus one chairman (representative of a Founding Member)

- General Assembly: one representative per Founding or Associated Member

- Museum Advisory Board (can be identical and continued from V-MUST.net), providing advice and guidance for the Competence Centre concerning museums and cultural heritage policies

- Expert Advisory Board (can be identical and continued from V-MUST.net), providing advice and guidance for the Competence Centre concerning technological and political policies

- Staff: Executive Director plus small staff (contract specialist, repository and knowledge bank expert, secretary, …)

- Network of CH Companies: provides an operational platform for the companies that are associated member (typically within the context of a well attended conference such as the Federated CH Event) to exchange information, experiences, knowledge and create cooperation

- Network of VM: idem for museum and CH members

- It is possible to create a category of members that has no voting rights, but would remain member as long as they pay their membership fee or do not withdraw their membership (members that have not voted for three consecutive years could be transferred automatically to this category)

- The Competence Centre will be geographically distributed, to provide access to the museum and CH domain based upon in-depth knowledge of the local organisations, structures, laws and customs
This would result in the following operations:

- the day to day operations are in the hands of the Executive Director
- the activities of the INPA need to be approved every three months by the Board of Directors, the Executive Director is a voting member of the Board of Directors (i.e. has a vote in the Board except if there is a conflict of interest)
- the Board of Directors (including the function of chairman) is voted by the General Assembly, based upon a list of candidates from the Founding Members (4 seats + chairman) and the Associated Members (4 seats)
- The General Assembly approves with a 2/3 majority proposals by the Board of Directors, approves the results of the past year and the budget of the next year, and votes for the members of the Board of Directors every two or three years
- Voting by the General Assembly happens electronically before the physical meeting of the General Assembly, which is optional for members (typically within the context of a well attended conference such as the Federated CH Event) and focuses on the presentation of results and new realisations by the Competence Centre (the law prescribes voting by writing, so approval is needed from each member to replace that by electronic voting)
- A detailed list of the decision domain of the Board of Directors needs to be made, could contain actions such as the overall operational structure for projects and exploitation of the digital repository, approval of membership, of new associated members (after assessment procedure, giving them the right to be active in the Competence Centre), financial decisions (concerning remuneration, investments, membership fees, …), approval of the budget and yearly accounts, discharge of the Executive Director and statutory auditors (when appointed, see legal requirements for INPA), representation decisions towards third parties (such as participation in conferences, events or European projects), calling regular or exceptional General Assemblies (including the organisation of the voting and the GA meeting)
- When a BoD member would drop out during the regular term, the Board of Directors can propose a replacing person by co-optation, which need to be approved at the next General Assembly meeting
- The Board of Directors proposes to the General Assembly changes to the statutes or fundamental changes of the INPA structure and operations to the General Assembly, dissolution of the INPA (including the destination of the assets), new members, exclusion of members, …
- In the statutes, a maximum needs to be specified for the membership fees, but the Board of Directors proposes the annual membership fee for approval by the GA (changing the maximum fee is a change to the statutes)
- In the statutes, the seat of the INPA needs to be specified (specifying the area of jurisdiction, a change of seat outside the area of jurisdiction is a change of statutes)
- A detailed list of the decision domain of the General Assembly needs to be made, could contain actions such as approval of the proposed membership fee, changing the statutes and operational
structure of the INPA, dissolution of the INPA (including the destination of the assets), exclusion of members, approval of the budget and results, approval of changes to the Board of Directors outside the regular period, approval of new members (giving them voting rights at the next GA), …

- The INPA would have four sources of income: membership fees, percentage on the budget of projects that are realised by the INPA, percentage on maintenance contracts on running projects and fees from the re-use of digital assets in the repository

- The permanent staff of the INPA should be kept as small as possible, they need to be paid from the yearly income of the INPA, any surplus is re-invested in events, tools, knowledge or projects that benefit the majority of the members

- A key activity of the INPA is to maintain a pool of project coordinators (including an up-to-date specification of their language skills, geographical action domain, competences and performance), an up-to-date database on the competences and projects of the partners, and a knowledge base on technologies, methodologies, best practices, …

- Projects are coordinated by project coordinators, which are hired through result based contracts based upon their skills and knowledge domain(s)

- Project coordinators can be commissioned from an early stage of the project, steering (or doing) the first line consulting, and guiding the project through its different stages up to maintenance and storage of components in the repository

- When a project is executed, project teams are composed by the project coordinators, based upon the required skills, following the CC rules to assign specific project tasks to CC members
9. TIMING

Proposed step-by-step implementation:

- Redaction of texts about the Centre of Competence concerning operations and structure by involved V-MUST.net partners (WP8, coordinator)
- Choice of a public notary (for legal creation of INPA) in Belgium
- Approval of a first version of these texts by the V-MUST.net Executive Committee by February 2012
- Each V-MUST.net member receives a Letter of Intent to become Founding Member (March 2012)
- Extension of the V-MUST.net consortium by companies and CH partners (as Associated Partners) from March to June 2012
- Consultation of ICOM about goals and approach of the CC in March 2012
- Wide consultation within the Associated Partners of V-MUST.net (collecting feedback on proposed structure, requirements and operations), we will need to prove that being member is a clear win-win situation for the different types of partners in April 2012
- Creation of a temporary team (from V-MUST.net partners) to start operations
- Decision on list of Founding Members and seat of the INPA
- Redaction of the detailed statutes, with input of notary in May 2012
- Execution of Competence Centre projects with internal budget (see Appendix on CC Projects) to test workflow (can coincide with V-MUST.net calls, a close interlinking with the calls can be considered)
- Official creation of the INPA by the notary (June 2012)
- Preparation of Competence Centre projects with external budget (see Appendix on CC Projects) concerning budget, definition of projects, …
- Definition of selection procedures, knowledge base, project coordinator pool (September 2012)
- Official approval by Belgian Ministry of Justice as Royal Decree (Oct. 2012 = day of creation + 100)
- Deposit deed of incorporation at commercial court (Nov 2012 = day of creation + 120)
- Potentially, collecting the start budget from Founding Members (November 2012)
- Official publication of the creation of the INPA in Belgian “Staatsblad” (November 2012 = day of creation + 120)
- Detailed definition of VCC operations (Exploitation Plan – D8.6)
- Start of execution of Competence Centre projects with external budget (2013)
- Selection of staff and physical location for INPA (2013)
10. OTHER COMPETENCE CENTRES

After a meeting at the European Commission in Dec 2010, projects that have started a Competence Centre or are in the process of starting one, have decided to start a blog (http://centresofcompetence.wordpress.com/). This should provide a platform to exchange information and experiences in creating and running competence centres. The blog has been established in June 2011 but is however not yet actively used.

The European Association for Virtual Reality and Augmented Reality, aka EuroVR (http://www.eurovr-association.org/) is one of the first competence centres that was established (even before the concept of competence centres was established by the European Commission). The knowledge domain is VR/AR. The juridical form is INPA and it has major industrial and academic members. Entrance fees are 300 euro for organisations and 50 euro for individuals. The organisation does not look to function properly, the only activity that looks successful is an annual conference that is organised by the organisation.

Open Planets Foundation (http://www.openplanetsfoundation.org/) is the first competence centre in FP7 and was established in June 2010. The knowledge domain is digital preservation. The juridical form of the organisation is a non-profit organisation under UK law and members are major research and national libraries, national archives, leading technology companies and research universities. Yearly membership fees range from 11,600 euro for non-commercial organisations to 17,400 euro for commercial organisations, universities can contribute up to 80% of their fee in kind. They have a yearly turnover of 135,000 euro with 3 people employed.

The Centre of Competence of the IMPACT project (http://www.digitisation.eu/) was launched in October 2011 and is a not-profit organisation. The knowledge domain is digitisation of historical texts (OCR), the organisation gives access to knowledge, tools and datasets. There is free, basic and premium membership, and “pay as you go”.

The 3D-COFORM project on 3D digitisation of cultural heritage and museum collections (http://www.3dcoform.eu) is about to launch a Virtual Centre of Competence, with the legal form of a Community Interest Company (a social entreprise under UK law). The term “virtual” refers to the distributed nature of the centre.

Presto projects resulted in the PrestoCentre (http://prestocentre.eu) that was inaugurated in March 2011 and focuses on the digitisation of film, video and audio. They will provide online services and advice for funding. Membership is still free, but will become available in three categories in 2012. Headquarters are in Hilversum (Netherlands) with local offices in Paris and London. Legal form unknown, is described as “membership organisation”.

The Alliance for Permanent Access (http://www.alliancepermanentaccess.org/) who had European projects such as Aparsen and CASPAR, position themselves as a kind of lobby group on digital preservation (again…) and seem to focus on the creation of a Digital Information Infrastructure and repository for science and research data. The website says “APA will become a world recognised Virtual Centre of Excellence in digital preservation”. There is a “full membership” and a “forum membership”, they currently have 17 members (all large institutions) and seem to focus on getting more European projects. The legal form of the organisation is unknown, it is based in the Netherlands.
### 11. CONCLUSIONS

Most other competence centres (see list above) have only a vague range of advantages for their members and seem to struggle to attract members (and membership fees). The proposal to use project implementation as the major activity and income generator for the V-MUST.net Competence Centre could ensure a much better sustainability than vague membership based activities. The key of a successful implementation of such an approach lies on one hand in a good framework for research centres, universities and companies to work together and on the other hand on a transparent structure to provide services to the museum and CH domain, where all details of subcontracting, project management and liability issues are absorbed internally in the project, so that museums and CH organisations see this as an easy and safe one-stop-shopping approach.

We need to be aware that this different approach is only possible through the specific nature of the cultural heritage domain in which most companies are small enterprises and most museums are small organisations, where there is very little ICT knowledge within the museum and CH organisations, and where there is still no structured industry. In other words, a one-stop-shopping approach encapsulated in a non-profit structure can be a win-win situation for all involved partners. For companies, it provides them with a stable, specialised structure that absorbs most of the overhead and burden of winning projects. For research centres, it provides an environment in which their development capacities can be put to work in an optimal way, taking away the burden of production issues and cost efficiency. For museums and CH organisations, it is very important that their projects are implemented by specialists on European level, with a sound methodology and assuring maintainability and long lifecycle.

On the other hand, we need to recognise that this approach is far from obvious and will only succeed if this approach is established step by step, taking care that at all steps in the process, the win-win situation for all partners needs to be maintained. For example, positioning a Competence Centre between companies and their current customers has the risk that companies will prefer direct access to their customers, so we need to create an approach that brings more advantages to these companies than disadvantages. For example, the creation of a Network of CH Companies within the VCC, in which the companies can exchange practical project information and create co-operations, could convince them that “working as a group is better than working alone”.

This text is an overall description of the possible structure of the VCC and serves as a discussion text for V-MUST.net WP8 members and Executive Board. Further meetings and research need to be organised and existing Competence Centres need to be interviewed to learn more about their strengths and weaknesses and about potential organisational and legal pitfalls. The goal is to finalise this description in the course of 2012 and use it to establish the legal structure, with (a subset of) V-MUST members as Founding Members. In the meantime, internal V-MUST projects can be used to test out the communications mechanisms, the technical platform, the methodology and project management. In parallel, new Associated Members need to be screened and selected for the first external projects. The criteria for the selection procedure will come from running the internal projects as a test.
12. ANNEX 1: COMPETENCE CENTRE PROJECTS

Villa di Livia – Via Flaminia, Rome, Italy

This major application about monumental and archaeological remains along the Via Flaminia is to be redesigned and ported towards a new serious games platform. This project is an ideal example to try out and document how to make a project portable to a new technological platform. It should result in guidelines on how to document, structure and re-use project data and how to build an application that has an envisioned long lifecycle (for example 15 years) and hence is ready to be installed on an evolving line of hardware and ready to be ported to a next generation of software platform. Additionally, the issue of installing it in a robust way in the museum will produce additional implementation guidelines.

Sarajevo Historical Museum, Bosnia-Herzegovina

This application will present the history of the city of Sarajevo based upon a physical model of the city in the 17th century. The interactive application will complement the physical model through interactive storytelling, giving stories about the development of the city, the people involved and the important buildings of the model.
Catalhüyük museum, Konya, Turkey

In the summer 2012, a new museum of Catal will be created in Konya (the closest city to the Catalhüyük site) and also the visitor centre on site will be completely renovated. By the creation of a digital installation in a new museum and online, research and educational activities on site (digging and 3D) will be communicated to the visitors and the online community. A selected number of students from different countries will be involved in the entire pipeline.
Archaeological Virtual Museum of Cyprus

This project concerns the creation of a virtual museum, contain about 25 iconic and representative museum objects that are used to explain and tell the history of Cyprus. The project would contain 3D digitisation, some of these objects are outside Cyprus. Storytelling would be an important part of the project. The application would be available online and in the Cyprus museum.

Hal Saflieni Hypogeum, Malta

The Hypogeum at Hal Saflieni is an underground prehistoric temple and cemetery in Malta and was nominated UNESCO World Heritage site in 1980 (the oldest parts are 6000 years old). The hypogeum consists of a network of about 40 underground spaces with a surface of about 500 m². Some of the spaces still have visible decorations in ochre. The complete complex has been digitised through laser scanning in 2010. The access to the monument is limited to 80 people per day to maintain a stable climate inside. The 3D model will be made available in Europeana. Heritage Malta wants to have an online 3D application that allows to explore the hypogeum interactively and combine it with 3D models of finds from this hypogeum which are now in the archaeological museum in Valletta (such as the famous Sleeping Lady). This virtual museum, that recombinesthe site with the finds, would provide virtual access to this site, which is full-booked months ahead. The project includes the creation of an interactive 3D application, storytelling and digitisation of the museum finds. The budget is provided by Heritage Malta. The result will be made available through Europeana.
Prehistoric temples, Malta

Malta contains several major prehistoric temples, which are considered to be the oldest standing buildings in the world. Several of these temples have been laser scanned for documentation and restoration purposes but lack the top part of the walls as the laser scanning was performed from ground level. Heritage Malta wants to have these 3D models updated by adding the top part of the walls (through photography by drones) and have them presented online, together with storytelling about their origin and use (had similar functionality as Stonehenge concerning solstice, ...). The result will be made available through Europeana. The budget is provided by Heritage Malta.
Ename Heritage Centre, Ename, Belgium

The new Heritage Centre in Ename, Belgium, wants to establish a new permanent exhibition concerning the international aspects of cultural heritage in Ename and in the province of East-Flanders. The Heritage Centre overlooks the archaeological site of Ename. The exhibition is situated on the second floor and seeks to use the most recent technologies in heritage presentation. The exhibition wants to focus on individual visitors, tourist groups and school groups and will have only a few real objects. The proposed technology contains mobile devices (for educational purposes), digital museum objects, virtual spaces, augmented reality in the exhibition and looking out towards the archaeological site. The budget is provided by the Province of East-Flanders.

Ename TimeScope and TimeFrames, Ename, Belgium

The Ename974 project has developed one TimeScope and two TimeFrames in the period 1998-2003. The two TimeFrames are still operational, the TimeScope (depicted below) has been reduced to a non-interactive system. The plan is to run on all three systems an updated version of the Open Source TimeFrame software and to update the content and storytelling of all three systems. The budget is provided by the Province of East-Flanders.
Noord-Zuid metro station, Amsterdam, Netherlands

The new Rokin metro station that is being build at 200 m from the Allard Pierson museum has yielded a very large amount of archaeological finds (700,000) as the excavated area was a canal and harbour for several centuries in the historic centre of Amsterdam. The archaeologists of the city of Amsterdam have asked the Allard Pierson museum to develop an innovative concept to show the archaeological finds in the metro station in such a way that the richness of the discovered information becomes apparent and that this presentation remains interesting for people that pass by every day. In other words, the innovative concept should combine (visual) storytelling with the finds and present a very rich set of stories in an ever-changing combination, to be “consumed” in the short time period that people take the escalators up and down the metro station. The APM is having meetings with the archaeological service of the city of Amsterdam about this project since the beginning of 2011, the design of the metro station has provided space for such a virtual museum. The budget is provided by the city of Amsterdam.
13. ANNEX 2: A FIRST ANALYSIS CONCERNING THE V-MUST PLATFORM

Introduction

The V-MUST.net platform is an operational platform that supports basic goals of the V-MUST.net project, such as delivering high quality, maintainable and re-usable digital museum installations. As a second goal, and closely related to the previous goal is the functionality of repository of digital assets for museums and museum applications.

These goals need to be seen as creating a service to the museum world, which will be implemented and exploited in the first place through the V-MUST.net Competence Centre, but needs to be available to the wider digital museum community. We deliberately use the term “digital museum installation” and not “virtual museum” as we think that the platform needs to be conceived wider than the use of virtual reality or 3D in museums, but needs to work for all digital platforms in museums.

This text tries to establish a first set of use cases for a common platform for digital museum projects, focused on the planned operations in the V-MUST.net Competence Centre. This first draft needs to evolve in WP4 towards a wider definition that allows use outside the Competence Centre, by partners that adopt themselves the V-MUST.net methodology for their projects. In this text, we try to analyse the different groups of users and the different workflows in which such a platform could fit. As a basis, we use the Etruscanning project.

First of all, the platform needs to serve the creation, update, maintenance and re-use of digital museum installations and hence have two distinct functionalities, which are collaboration platform and repository. We should not focus on the creation tools but on the documentation of the creation process and on the exchangeability of intermediate results through the use of appropriate file formats and methodologies. The reason for this is simple: the variety of tools is too large while content creators will not change easily to other tools as they typically invest a lot in the optimal use and concatenation of tools.

Secondly, digital museum applications and digital assets that result from the creation of digital museum projects can be exchanged and re-used by other museums or content creators. In this approach, the focus should be on the long-term exchangeability and re-usability of the final results, including IPR and a good documentation of the creation process.

In this text, we want to demonstrate that the platform is more than a pure repository or a provider of creation tools because it also needs the functionality of a collaboration platform.

Collaboration platform

The concept of the V-MUST.net Competence Centre is that the best way to provide efficient knowledge transfer to the museum domain and the content creators in this domain is to provide the capability to realise projects, in cooperation with existing content creators (companies and research centres). This means that a
Project is divided into distinct parts by the project coordinator, and each part is assigned to a specialised partner somewhere in Europe (this does not hold for some parts of a project, such as digitisation, where the geographical location of the partner can be important). The creation of the digital museum application is governed by the methodology and rules that are developed by V-MUST.net. This means that the distributed nature of the Competence Centre needs to be supported by functionality in the collaboration platform.

Let’s illustrate this with the real project *Etruscanning* that currently is being implemented by V-MUST.net partners. This project consists of the following parts:

- virtual reconstruction of the original Etruscan tomb
- digitisation of the physical tomb and the museum objects
- digital restoration of the museum objects and tomb
- creation, translation and recording of storytelling
- creation of the digital application that uses all these assets
- installation in different museums
- evaluation of the installations and feedback
- update and maintenance of the installations

Some of these parts are executed by one of the partners, in collaboration with external experts, at four different locations in Europe. Most parts are even divided over different partners at different locations. Currently, the exchange of data happens in a variety of ways: by ftp-server or by sending hard disks, DVDs, emails. The documentation of the process is scattered over a blog, emails, Word files and Excel files, a part of the process is not documented at all. A lot of knowledge about the workflow and the methodology is implicit and only in the heads of people.

As can be seen from this quick dissection of a real project (which very much resembles many other digital museum projects), the bottleneck is in the lack of a structured repository that combines the collaboration data (how and why something is done) with the data (which exceeds already the 100 GB mark). In the project, conversion of formats, to link the different parts of the process to each other, are crucial (but mostly done by tools within the software platforms that created the data, not by external tools). The 3D data of the virtual reconstruction process (which used dummy objects) had to be converted from ArchiCAD (.pln) to 3D Studio Max (.3ds) for integration into the Unity 3D platform. The photographic documentation, provided by the Vatican Museums, was provided in TIFF format (hence taking about 80% of the total data volume) and had to be converted to JPEG to feed the 3D dense stereo matching processes to create 3D models (in .ply) or to create Object VR movies for the multimedia systems that will support the 3D VR application. The digital restoration created .max files (through manual 3D modelling) or used depth maps (created as .psd files in Photoshop, exchanged as b/w JPEG uncompressed) that were converted to normal maps within Unity3D.

The exchange of the data between the different groups and project parts is an unstructured ad-hoc process, mainly based upon email exchanges. This means that no other team could take over the current project, not now or in the future.
In other words, the future V-MUST.net platform should provide first of all good and efficient tools to store the data (which can be excessive in size) and good tools to link information and knowledge to this data (and communicate it to the involved people, for example through an automatic email). In this project, none of the conversion was done through external tools (except some TIFF to JPEG bulk conversion), but through the integrated functionalities of the creation software used.

We can conclude that the creation of high quality, maintainable and re-usable digital museum installations needs a repository with integrated collaboration tools, not only to enable the collaboration of expert groups at different geographical locations, but also to enforce the required documentation of the process, which is crucial to ensure re-usability, proper updating/maintenance or porting the data to another VR software platform.

Repository for collaboration

A repository for collaboration needs several functionalities:
- documentation of the underlying knowledge, scientific results and decisions by experts
- documentation of the production chain (files, softwares and processes)
- documentation of the methodology (why and how)
- visualisation in a platform independent way of 3D data
- versioning of files and applications

Let’s take again the Etruscanning project as example. A large body of research results in the form of scientific publications, images, historical documents or specific research was produced to underpin the virtual reconstructions and storytelling, amended by two external domain experts where needed. A part of this process was documented through a public blog (http://regolinigalassi.wordpress.com/) while another part of the decision process resides in emails. A part of the process (for example most of the creation of the storytelling text) is not documented explicitly. It needs to be noted that a public blog does not work for scholars, nearly no comments were produced on the blog but remarks were send by email. This probably has to do with the fact that scholars consider a blog as a publication, and not as an exchange of opinions, hence as research.

Most of the production chain is not documented at all, but done through ad hoc processes of 3D creation (manual or through dense stereo matching), digital restoration (through Photoshop or 3D editing), processing of laser scan data (cleaning, merging, texture mapping) or creation of the interactive VR application (animation, combination with storytelling)

A small part of the methodology was documented through Word-files or entries in the project blog. Most of the methodology is simply not documented at all. This has several implications.

First of all, to be credible within the museum domain, we need to be able to proof the scientific accuracy of the digital data (for example as result of digital restoration). This means that we need to have full
traceability of creation, editing and decision processes at all times. Additionally, many digital assets of the Etruscanning application went already through an updating cycle as the partners continue to improve the content and the functionality of the existing VR application. We need to be aware that digital assets do not have the invariability of most museum objects. Digital museum assets have complex creation processes and can continue to change through updating and adaption to different uses and contexts.

Secondly, Etruscanning is not a single installation project. During the two years of the project, the VR application is permanently improved while the digital assets are updated through innovative techniques of digital restoration. The VR application will be installed in 6 museums, each time within a different context, and complemented by other multimedia systems that use other instances of the digital assets. This means that VR application and digital assets are re-used several times, hence the need for a proper documentation.

The Etruscanning application will be used from 2013 onwards by three museums on a permanent basis (Museo Gregoriano Etrusco in the Vatican, Villa Giulia in Rome and the Etruscan museum in Formello, Italy). This has two major consequences. First of all, it is very unlikely that all three installations in those three museums will be identical, so each installation will be a different implementation based upon the same data. Secondly, each of these permanent installations need to be maintained for a long period, as they will be an important part of the permanent exhibitions of these museums.

Thirdly, the lack of documentation of the workflow means that the current data is only accessible to the people involved in the project. Transferring the data to a third party can only be done through structured documentation via metadata.

Let’s have a look at a small part of the Etruscanning creation process (the digital restoration process) to outline the functionality of the V-MUST platform as a collaboration repository. The goal of the Etruscanning project is to show two Etruscan tombs in their original state, at the moment that the tombs were closed. This means that both the tomb and the objects in the tomb need to be shown as they were without any damage or corrosion. For the Regolini-Galassi tomb, the objects were extensively photographed in the Museo Gregoriano Etrusco in the Vatican, for digitisation (through dense stereo matching), documentation (to derive the details of the objects) and Object VR (for use in multimedia systems). These photographs were delivered by the photographic department of the Vatican as high resolution TIFF images on DVD. CNR-ITABC made these images (78 GB) available to Visual Dimension through sending a hard disk by courier (and partially through the CNR ftp-site beforehand). Visual Dimension and CNR-ITABC used the images to make 3D models (dense stereo matching) and unwrapped textures (different 2D and 3D techniques). These unwrapped textures were used by Visual Dimension to make digitally restored depth maps, that were applied as normal maps by CNR-ITABC within Unity 3D. To verify the 3D result of this digital restoration process by Visual Dimension and external experts, a Unity 3D visualisation module is being developed. Once approved, the digitally restored objects are positioned correctly in the tomb, based upon a dummy 3D model that was the result of an extensive virtual reconstruction process. Once positioned, the objects are animated based upon interactive input from the Kinect camera.
As can be seen from this example, there is quite a lot of exchange of images and 3D models between partners in the execution of this small part of the Etruscanning project. On top of that, there is a visualisation need of 3D models for feedback between project partners and for formal approval by external experts. For data security, it is important to have versioning and write protection.

We can conclude that a platform with collaboration and repository functionalities is crucial for the implementation of the distributed Competence Centre concept as outlined. By suggesting the appropriate documentation of processes and files and by enforcing a structured storage of the files, the V-MUST guidelines for project execution can be incorporated in the repository.

Some research is needed to find out if existing systems can implement such a collaboration platform with integrated repository, or if this needs to be developed.

**Repository for re-use, exchange and maintenance**

Once digital assets and applications are finalised, they can be stored permanently for re-use, exchange and maintenance.

**Re-use** means that the digital assets are used to create another application. For example, the Etruscanning VR application can be re-purposed to an application on tablet that allows to see the tomb and digitally restored objects when walking around in the Museo Gregoriano Etrusco in the Vatican and seeing all objects from the Regolini-Galassi tomb (this is probably what needs to be done to integrate the application in the Vatican Museums). Technically, this means that a different application needs to be build based upon the available digital assets, and possibly part of the earlier application. As it is not always the case that final results from one application do work for another application, this means that one need to start from the documented workflow and work towards digital assets and a new application possibly from intermediate results. A texture for example can be high resolution and optimised (mipmapped) for one application while another application will need a non-optimised version at a lower resolution.

**Exchange** means that digital assets and applications are provided to other users for a similar use as initially intended. In this case, good documentation (metadata) of the asset or application is important. In most cases, there will be an integration issue as the asset or the application needs to become part of a larger context in a new environment. 3D assets for example could be needed in a lighter version to allow a less powerful visualisation platform, 3D applications could need another type of stereo visualisation to accommodate existing hardware.

**Maintenance** means that a party, possibly different from the creator, is capable of keeping the application running, even on new hardware or updated operating system. Long-term maintenance needs to be able to deal with changes in software and/or hardware platform or needs to migrate digital assets to file formats that are better suited for those future applications. This is a major task that requires good documentation of the chain of processes that has lead to the digital application or assets to be performed successfully and efficiently.
While using the platform as repository for re-use, exchange and maintenance, the timescales are quite different from using the platform as collaboration repository. In the former case, timescales extend to 15 years at least, while in the latter case, timescales are months to one or two years maximum. This means that the quality and extent of the provided metadata in the former case is much more important. As in the former case, users are different from the creator (while in the latter case, users are typically creator themselves), the documentation of IPR aspects is much more important.

Also visualisation and searching on the assets is an important aspect of the functionality of the platform when used for re-use, exchange and maintenance.

While the platform as repository for collaboration acts just as a communication channel between a limited number of partners in a creation and collaboration process, the repository for re-use, exchange and maintenance should have a much more central character, under control of a stable and accredited organisation to guarantee long term availability and proper management of the repository. We are convinced that the Competence Centre can play this central, long-term role, and make the repository part of the business model of the Competence Centre.

Caveat

It is very ambitious to document in detail the production process of a digital museum application, but practice shows this will only work if there is a significant added value and if that added value is obvious. Documenting for a future use is always prone to be delayed or minimised, as the cost of this work should not be underestimated, while the advantages are not always that visible or clear.

Nevertheless, we are convinced that the benefit of this documentation clearly outweighs the costs that result from loosing or re-creating digital assets. We should invest however in calculating these costs, based upon some real projects, to turn this guts feeling into fact.

We need to make people aware about those costs by training and cases studies.

We think that Etruscanning is an ideal test project to demonstrate and quantify the concepts that are explained in this text. Fitting this project into an early version of the platform will help to make the needs and flaws of the platform visible, and produce answers on how to implement these concepts. For example, we should look into existing systems concerning collaboration platforms and project management systems, to see how much they fit with the needs.