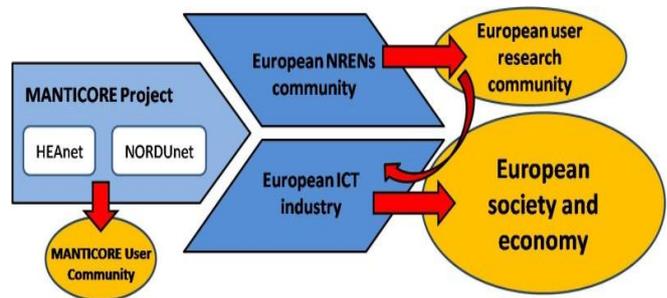


### 3.1. Publishable Summary MANTYCHORE (<http://www.mantychore.eu/>)

#### Content and Objectives

**IP Network as a Service** (IP Network Service) is seen as a key enabler of the flexible and stable e-Infrastructures of the future. Today a myriad of tool prototypes to provide point-to-point links to researchers have been developed (AUTOBAHN from GN3, Harmony and G2MPLS from PHOSPHORUS, and G-Lambda from KDDI R&D labs., NTT, NICT and AIST). These tools, while providing high bandwidth pipes to researchers only address one side of the problem. Researchers that want to create a virtual community to address scientific problems are still connected to each institution's networks, and it is a hard problem to directly connect them with high bandwidth pipes because it causes a number of issues such as security or routing integrity. One of the ways of efficiently solving this problem is to create a logically separated IP network (on top of the high bandwidth pipes), or by using separate instances of virtualized routers, or a combination of both, and dedicating it to the virtual research community. In order to maximize the flexibility and convenience of this IP Network Service, the users of the virtual community should be able to modify the characteristics of their IP network by themselves (such as the addressing, dynamic routing protocols, routing policies, quality of service and so on).

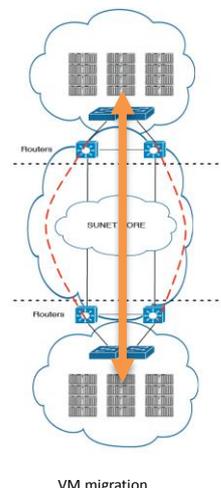


The main objective of the Mantychore FP7 project is to allow NRENs to provide an IP Network Service to the research communities they serve: HEAnet and NORDUnet will deploy and operate it as a pre-operational service. Mantychore FP7 tools that enable the NRENs to manage and operate the IP Network Service will be deployed individually over the e-Infrastructure of each NREN.

#### Mantychore Use Cases

The Mantychore FP7 project reflects the applicability of IP Networks as a Service via five use cases that span through different research communities. Three of these use cases, the core ones, are deployed as a Service Activities. Initially three research communities will benefit from the IP Network Service: the Danish Health Data Network, the British Advance High Quality Media Services and the Irish NGI effort.

- **UHD Applications** – The deployment of next generation multimedia applications is a bandwidth intensive challenge that requires flexibility to adjust the network, independently of the underlying physical infrastructure. University of Essex leads this use case, which will involve Glasgow and Cardiff sites.
- **Virtual CPE** – The management of CPE demarcation is an area where network virtualization can provide several advantages, saving equipment costs and expert intervention while providing enhanced flexibility. UNI-C and HEAnet lead this use case.
- **Distributed and Private Cloud** – Being able to aggregate local computing infrastructure with remote resources (both commercial clouds and federated sites) has a huge utility for research centers. GIOC (Trinity College of Dublin, Irish NGI) and NORDUnet lead this use case.



	<p><b>First Periodic Activity Report: October 2010 – December 2011</b></p>	<table> <tr> <td>Project</td> <td>Mantychore</td> </tr> <tr> <td>Doc</td> <td>D1.2</td> </tr> <tr> <td>Date</td> <td>28/02/2012</td> </tr> </table>	Project	Mantychore	Doc	D1.2	Date	28/02/2012
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Additionally, two Research Activities support the project use cases:

- **Marketplace** – This use case will investigate and design algorithms and procedures in order to allow automatic request matching over a pool of available network resources. University of Essex leads this use case.
- **Zero-Carbon emission virtual infrastructures** - In collaboration with the GreenStar Network project (CANARIE, Canada), this use case will accommodate requirements in order to adapt the network resources to the needs of energy driver cloud management.

### Open Source Project Management

The Mantychore project has adopted, since the beginning, an iterative and open doors approach to drive the project. This approach has proven successful both in order to ensure proper information availability inside the project and for collaborating with other research activities.

The iterative approach, following a consortium-wide SCRUM implementation, allows incorporating user feedback as early as possible in the service development process. In order to do so, releases of the software powering the service are available each month. Each month, a dialog is established between the NRENs and end-user, so requirements are correctly prioritized and clarified, ensuring the best investment and focus of the development effort. Publicly accessible and updated user manuals<sup>4</sup>, bug reporting and feature roadmap allow third parties to approach and try the software with minimum hassle. This methodology has improved the work leveraged from the MANTICORE II project, since some of the functionalities have been technologically upgraded to fit the more strict requests by the Mantychore project users.

Beyond the software development methodology, and always striving for openness, the Mantychore project conducts his day-to-day discussions on an open mailing list, where external individuals can observe and join the discussion. Both deliverables, meeting minutes and activities information can be found on the open wiki space<sup>5</sup>.

### Socio-economic impact

The economic benefits that MANTYCHORE brings are numerous and can be differentiated depending on the type of user being addressed:

- **NRENs'** (National Research and Education Networks) and **Commercial telecom operators**: MANTYCHORE tools offer a way to reduce OpEx and CapEx thanks to the MANTYCHORE virtualisation tools by providing a novel IP network as a Service.
- **Virtual Research Communities** and **development community**: MANTYCHORE will allow them to manage their own e-Infrastructure and access to the OpenNaaS inclusive community which will provide available resources for those interested in deploying and researching network virtualization based services.
- **Final users**: Mantychore expects to reduce the Internet services cost. This reduction can be carried by the definition of a new business model which is currently opening new topics in the future internet issue: the decoupling of the current Internet Service Provider (ISP) in two roles: Infrastructure Provider and Service Provider. The first one manages the physical infrastructure, while the second one deploys network protocols and offers end-to-end services. This decoupling would channel Service Provider as a new source of revenue in the market of ICT (Information and Communication Technologies) as an agent that would increase competition in the market for network infrastructures and consequently, reduce the Internet services cost.

<sup>4</sup> <http://confluence.i2cat.net/display/MANTECH/User+Documentation>

<sup>5</sup> <http://confluence.i2cat.net/display/MANTECH/Home>

These set of main socio-economic benefits are based on a new business approach. This strategy, besides defining a set of measures and processes, follows an open service innovation approach that makes sure it is focused on the business/research use of the project results. Open innovation<sup>6</sup> is “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively”. Mantychore strategy will increase the impact and demonstration of the Mantychore services and the OpenNaaS toolset while accelerating the time required to deliver innovations/services to the community/market.

The socio-economic impact of Mantychore is considering its novel service offering, NaaS; and the exploitation plan for the OpenNaaS open source implementation, which will provide a LGPL version 3 licensing for the main body and an ASFv2 for the additional plug-ins.

Moreover, Mantychore has signed a MoU agreement with ERINA+ to enhance the Mantychore socio-economic studies. The main objective of ERINA+ is to evaluate the impact of e-Infrastructure funded projects through the deployment of an effective socio-economic methodology as well as proposing, by the end of the project, a proactive self-assessment methodology.

## Final Results

The project results can be separated in two main groups. In one hand, the IP network services deployed at the NRENs and research communities, which take the name of the project itself. In order for NRENs and operators to be able to deploy and operate these innovative NaaS offerings, an appropriate toolset needs to be created. With such goal in mind, Mantychore FP7 builds on the foundation of MANTICORE I and II projects, an IP Networks as a Service middleware knowledge. The new software is named **OpenNaaS**.

### Mantychore

The Mantychore FP7 project will serve a user community that uses and takes benefit of Mantychore FP7 services offered by the NRENs.

User groups must determine the activities that they will perform using Mantychore FP7 services, and produce an evaluation report at the end of the project about how Mantychore FP7 services have been useful for its research activities. As Mantychore FP7 deployment will be a pre-operational activity with real users, it will be mandatory to receive feedback from them to improve the Mantychore FP7 services and correct the bugs that could appear. It is not a pilot phase to correct some bugs, it is an evaluation that determines whether the Mantychore FP7 services are useful for each particular research community. When the pre-operational phase is successful, the service can be role-out on an operational level to a large community. Each user group will perform different activities and use Mantychore FP7 services for different goals. This diversification of research activities in the Mantychore FP7 project is interesting, because the evaluation will be better.

Three research end-user groups form the initial user community in Mantychore FP7, where each user group represents a core use case that will use the Mantychore FP7 services for its own interests. These three user groups include the Danish HDN (Health Data Network), the British UHDM (Ultra High Definition Media) group, and the Irish NGI network. An important effort is dedicated to increase the provider (NREN, commercial) and user community, contacting new research groups and presenting them the available project ideas and results. The project already got positive feedback from several NRENs, virtual communities and research projects.

<sup>6</sup> <http://www.openinnovation.net/books/>

## OpenNaaS

The biggest part of the Mantychore FP7 efforts are centred in building and refining the toolset that allows network virtualization services to be deployed. As of now, this toolset allows to see a domain's network infrastructure as a set of resources and capabilities. These resources are abstracted from concrete virtualization technologies and vendor details. This is a prerequisite to being able to build rich network intelligence orchestration on top of it, as required by the NaaS approach.

OpenNaaS is born as a project neutral software project<sup>7</sup>, with an inclusive community and available resources for those interested in deploying and researching network virtualization based services. The software is released<sup>8</sup> with a dual GPL/ASF licensing schema that ensures that while the platform will remain open and consistent, commercial derivatives can be built on top. This open schema allows trust to be built on the platform, as NRENs and commercial network operators can rely on the continuity, transparency and adaptability of the platform.

OpenNaaS is not a tool meant to be used in isolation. On the contrary, with an eye on versatility and smooth integration, OpenNaaS offers a powerful remote command line, as well as web-service interfaces. This web-service interface will offer the possibility to both build a GUI and integrate it with existing middleware applications already deployed in the virtual organizations.

Several plugins for OpenNaaS are being developed inside the Mantychore FP7 project. These plugins cover Routers, Optical Switches, IP Networks and Bandwidth on Demand resources. Beyond that, other resources are being created in parallel projects, leveraging the same core components and bringing reusability across distinct research efforts.

## Activities performed

Main activities performed by the project are as follows:

- Adoption of the OpenNaaS in Mantychore. With OpenNaaS network operators are able to partition their physical infrastructures into virtual networks based on user/application requirements, and offer them as infrastructure services to users. OpenNaaS provides a tool set for on-demand provisioning of network resources.
- Definition of a detailed plan on how Mantychore will perform its dissemination and liaison function, and how it will work with standards bodies and commercial/NREN companies to look for exploitation models.
- Some of the contributions to standard development are done in parallel through the active liaison with other projects.
- Mantychore is establishing strategic liaisons with other projects: GN3, GEYSERS and GSN
- The Mantychore user's manual is available at the open wiki. It is continuously updated.
- A set of external users have showed their interest on Mantychore: GSN, Stratuslab, CLARIN, Masaryk University, OSAeml, SURFnet, NTUA, JUNIPER and Univ. of Gent.
- An agile methodology to gather user requirements is in place and active along the project.
- Equipment for the Mantychore's services deployment is deployed and tests have started on different user communities.
- A study, design and evaluation of a number of algorithms for the implementation of a Marketplace mechanism have been delivered and evaluated by means of simulation.
- The GSN and Mantychore subset of a Euro GSN Networks have been interconnected and Virtual Environments have been interchanged between sites without loss of data. This has been demonstrated at several GSN / CANARIE Reviews. A book of a chapter has been written between both projects and accepted in the FIA book.

<sup>7</sup> <http://www.opennaas.org>

<sup>8</sup> Software available at: <https://github.com/dana-i2cat/opennaas>