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Abstract

This deliverable describes the proposed method for the international governance and the legal aspects regarding the operation of the EuWireless infrastructure. It studies the options for the legal forms, and the governance thereof, that can be adopted to provide a legal framework of cooperation between researchers, mobile operators, national agencies and regulatory bodies.

Keywords

Infrastructure; governance; spectrum regulation

Executive Summary

The goal of this deliverable is to formulate recommendations for the post-project further development of EuWireless. This could be achieved within the GÉANT model, as an entity similar to GÉANT, or as an independent research infrastructure. This deliverable analyses the different legal form options and the corresponding governance aspects, in order to determine which option would be most suited for EuWireless. In doing so, it reports the work conducted under Task 3.3, by NORDUNet, UMA, DEKRA, ISW, and Timelex, and Task 3.4, by Timelex, NORDUNet, UMA, DEKRA, and ISW.

Our legal analysis has shown that the most beneficial legal form options for the EuWireless entity would be the European Research Infrastructure Consortium (ERIC). The benefits offered by the ERIC and its specific orientation towards research infrastructures make the ERIC the most ideal legal form to be pursued by EuWireless for its establishment as a fully independent legal entity.

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List of Abbreviations

EEIG	European Economic Interest Grouping	MNO	Mobile Network Operator
ERIC	European Research Infrastructure Consortium	NREN	National Research and Education Network
EU	European Union	POD	Point Of Deployment
GTS	GÉANT Testbeds Service	SE	Societas Europaea
JU	Joint Undertaking	vMNO	Virtual Mobile Network Operator
MANO	Management and Orchestration	VNF	Virtualized Network Function

1 Introduction to EuWireless

The goal of the EuWireless project is to develop the design of the first pan-European infrastructure to support research in mobile communication networks using regulated spectrum, with the goal of contributing to keep Europe's leadership in mobile communication technologies. As part of achieving this goal it is also the aim of the EuWireless Project to study the technical, legal and economic solutions that encourage mobile network providers to share their infrastructures with universities, research centres and small businesses. This project comes under the framework of new infrastructure designs resulting from European research. The consortium comprises the University of Málaga (coordinator), VTT (Finland), DEKRA Testing and Certification (Spain), NORDUnet (Denmark), IS-wireless (Poland) and Timelex (Belgium).

On a technical level, the aim of the project is to design viable solutions for sharing parts of the mobile network with the research community. This will be achieved by first examining current mechanisms and those under development, to share the spectrum, the access nodes, the transport network and the core network. For instance, although the MOCN and DECOR solutions will be considered, the project will also propose advancements in sharing solutions as defined in 5G networks (slicing mechanisms for services with SDN, NFV, 5G core, etc.).

From a legal standpoint, within the project, a study on all European countries was completed to identify possible regulatory barriers so as to propose workable solutions for each country. That comparative study on EU spectrum regulation was presented in deliverable D1.2.

On an economic level, the project will identify those business models which will ensure that commercial operators directly benefit from the controlled transfer of their resources for research purposes.

This set of solutions will lead to the design of a mobile operator for European-wide research to act as the broker between the commercial operators and the research community. The creation of this operator will necessarily imply the development of software to link resources shared with the commercial operators with the resources and points of deployment (PoD) belonging to EuWireless, in those areas of Europe where the service will be offered. A responsible entity will also have to be created to manage all legal and economic aspects.

2 Objectives and scenarios

2.1 Objectives

The goal of this deliverable is to provide a legal analysis of the possibilities for the post-project operationalization of EuWireless. This analysis will focus on two main research questions.

First, it must be assessed what the options are in terms of legal constructions for the operationalization of such a cooperation between researchers, mobile operators, national agencies and regulatory bodies. This could, for instance, be achieved through the establishment of EuWireless as an independent legal entity, or through the integration of EuWireless components into an existing model – such as GÉANT.

Second, it must be assessed how EuWireless – whatever the legal form adopted after the project – will have to obtain radio spectrum usage rights. For this, we will leverage the findings of our earlier legal analysis [1] on the possibilities to obtain radio spectrum usage rights on the EU's primary and secondary market. Those findings will be applied to the possible scenarios for post-project operationalization.

2.2 Scenarios

As already hinted at in the previous section, there may be several options for the post-project operationalization of EuWireless. In Deliverable 2.1 [2], on the Initial EuWireless Architecture, a number of scenarios were formulated and discussed in terms of their feasibility. These findings will be briefly summarized here, as they will serve as the basis for our further analysis.

2.2.1 Infrastructure owned by EuWireless

EuWireless could become a full Mobile Network Operator (MNO) and own its own networking equipment and infrastructure. EuWireless will then make this infrastructure and equipment available to the research community. Capabilities of existing platforms – such as the ones developed in EU-funded projects, such as 5GENESIS¹ – can be leveraged and extended to interconnect with commercial operators. This model would provide its users with great flexibility in terms of the selection and configuration of network elements.

However, this model will of course require substantial investment to obtain the necessary equipment and to compete with commercial operators in license auctions. Moreover, given that radio spectrum allocation is a national matter, operations would have to commence in all EU Member States. However, this last element could be offset to certain extent by agreements concluded with commercial operators to provide the so-called 'last mile access'. This would allow EuWireless to utilize the infrastructure of a commercial operator – the same way as with roaming – and thus to expand the range of its network without having to provide full network coverage itself. Nevertheless, the cost of this model – and the corresponding need to comply with local legislation regarding operators – remains substantial.

2.2.2 Infrastructure leased by EuWireless

In this model, EuWireless would not own or operate its own infrastructure, but would work as a Virtual Mobile Network Operator (vMNO), building its services on top of the resources of commercial operators. EuWireless would then only lease or rent 5G slices from commercial operators to offer to researchers, and not obtain a license of its own. Such slices can be offered in

¹ <https://5genesis.eu>.

a wide variety of configurations, thus offering maximum flexibility. Connections between slices of different operators could be made through the wired GÉANT network.

While this model is of course much more affordable than the previous scenario, there are also drawbacks. The main drawback is that EuWireless as a vMNO would completely rely on commercial operators to offer the 5G slices, which may be subject to certain usage limitations.

2.2.3 Virtualized slices

Another possibility would be to offer virtualized network slices, which would constitute the foundation of the network instead of pure 5G resources. Such slices could be configured in various ways – even as raw connectivity slices – which would allow researchers to also use other technologies – such as 4G – through Virtualized Network Functions (VNF), rather than being bound to 5G only.

The main benefit of virtualized slices is that they can be offered as part of both of the previous scenarios – thus with EuWireless being either a full MNO or a vMNO. An additional network layer would hide the underlying resources to provide researchers with the level of abstraction their experiments need. The greatest challenge of this approach is that the abstraction layer should be able to manage the reservation, utilization and release of resources – addressed as Management and Orchestration (MANO). However, such MANO is already being researched by standardization bodies and academics and should therefore be possible to implement. Moreover, GÉANT already offers virtualized slicing – be it only for wired networks – as part of its GÉANT Testbeds Service (GTS). Further analysis conducted as part of D2.1 [2] found that the architecture model of GÉANT solves most of the interconnection and aggregation issues by existing MANO solutions. The use of the GÉANT solution would therefore be the preferred option.

Virtualization is therefore not so much a scenario on its own, but rather an additional layer that can be implemented on top of the previous scenarios. The goal of this additional layer is then to reduce some of the constraints following from those scenarios.

2.2.4 Infrastructure as a Service

A last scenario is to offer physical raw network slices, rather than virtualized ones. In this scenario, EuWireless would provide Infrastructure as a Service (IaaS). Physical network slices provide researchers with full control over all aspects of the network configuration and capacity – subject, of course, to legal constraints and EuWireless' fair-use policy. As a result, researchers would be able to test the limits of the technology and possibly even conduct experiments beyond current 5G standards.

However, this scenario is the most advanced and complex to implement. Moreover, the additional possibilities offered by this scenario would only really be useful to a limited number of researchers. The capabilities offered by the previous scenarios would suffice for most experiments.

3 EuWireless within the GÉANT model

From the summary of the different scenarios developed as part of D2.1 [2] in the previous section, it already becomes clear that from an architectural point of view the preferred option would be to expand the existing GÉANT GTS with radio spectrum resources that can be managed through GTS and used by researchers. This, however, still leaves a number of options on the table on how to operationalize this from a legal perspective. This section will explore those options and their potential legal consequences.

For the sake of completeness, we will begin by analysing the legal ramifications of the GÉANT model. This is followed by an analysis of EuWireless as GÉANT's wireless component and of the GÉANT NRENs as wireless operators.

3.1 The GÉANT model

GÉANT itself is incorporated as an association ('Vereniging') under Dutch law. Its members are the National Research and Education Networks (NRENs). It is funded through contributions by its members and through EU research projects – currently under the Horizon 2020 program.

Apart from its main national members, there are also a few associate members, amongst them companies such as Cisco. The end-users of the network, being academic researchers and government entities, are not directly party to GÉANT. Instead, they will become members of their respective NRENs, and through those entities, will be connected to the wider GÉANT network.

GÉANT's Open connectivity service allows NRENs to flexibly and effectively exchange connectivity. By also allowing certain companies to access the network, this effectively allows researchers to connect to those companies through the GÉANT network.

While GÉANT's main product – the high-bandwidth connectivity between NRENs – is only available to its direct members, there are also numerous other services being offered that are available to the end-users. An example of such service is the GTS discussed earlier. In obtaining such ancillary services from GÉANT, the end-user will enter into a direct agreement with GÉANT.² However, for the access to the interconnected network, end-users will only enter into a direct agreement with their local NRENs.

GÉANT does not currently offer the wireless connectivity provided by mobile network operators. If wireless connectivity were to become part of the GÉANT network, it would most likely be offered in the same way GÉANT offers its current wired network. This means that, in essence, the NRENs would obtain radio spectrum usage rights and offer access to that radio spectrum to their respective members. GÉANT itself would, in such model, not necessarily become a wireless operator itself. Of course, being incorporated in the Netherlands and only having a subsidiary office in the UK, GÉANT would in many EU Member States not even meet the criteria to become such operator. It therefore seems more likely and feasible for NRENs to become the operators.

It could, in this sense, be argued that GÉANT would not even need to become an operator: if the NRENs can provide wireless connectivity to end-users in their respective territories, GÉANT really only needs to provide the link between those networks, which it can achieve through its regular wired network. The only reason for GÉANT to, in this scenario, obtain radio spectrum usage rights of its own is to offer wireless connectivity directly to the end-users rather than through its members. However, also in such case it would be easier for GÉANT to lease or transfer

² This becomes evident, for instance, through the eduTEAMS' privacy policy that clearly identifies GÉANT as data controller.

the radio spectrum usage rights from the NRENs, rather than having to go through the difficulty of obtaining radio spectrum usage rights on the national primary markets itself – which in any case may require a national incorporation.

As becomes clear from the previous paragraphs, the most feasible way forward to expand GÉANT's network in its current form with wireless connectivity would be to have the NRENs obtain radio spectrum usage rights in their own territories. If GÉANT itself would need such radio spectrum usage rights, it makes more sense to lease or transfer them from the NRENs, rather than obtaining usage rights on the primary market itself. The following two subsections expand on how EuWireless would fit into this narrative.

3.2 EuWireless as GÉANT's wireless component

As noted in the previous subsection, GÉANT is an association under Dutch law, having the NRENs as its members.

GÉANT or the NRENs do not currently offer access to licensed radio spectrum. As noted earlier, GTS would offer a suitable platform for research experiments to be extended with access to mobile technologies.

One way of achieving this would be to incorporate EuWireless as a separate member of GÉANT, where the hardware needed for access to mobile technologies could be managed and which could gain access to licensed radio spectrum for research purposes.

In the legal sense, such entity could take several forms. Given the nature of providing this service to the research community, a non-profit form entity seems the most well-suited model here. Within non-profit entities, there is still the choice between a formal incorporation with legal personhood and a more informal incorporation without legal personhood. The former seems the most suited model here, as it provides the entity with more legal capacities and allows limited liability to its shareholders. As a formal requirement, some countries do require incorporation of an association with legal personhood through a notary deed.

However, this formula poses a number of drawbacks.

First, there is the question of funding. Being a separate entity, EuWireless would have to develop a business case that would secure the funding for its operations. Connections to GÉANT are currently paid through fees levied by the connecting NRENs. One potential revenue model would then be to levy fees to researchers that want to set up experiments requiring mobile technologies using the GÉANT GTS, with the fee being divided between GÉANT – providing the main backbone and GTS services – and EuWireless – providing the wireless component to the experiment. It does, however, remain to be seen whether this would suffice to render EuWireless' activities as an independent entity a solvent and self-supporting solution.

Second, there is the question of obtaining access to licensed radio spectrum. While this matter will be explored more in depth in section 4 of this deliverable, it can already be stated here that in most cases – both when obtaining radio spectrum usage rights on the primary market and when obtaining usage rights on the secondary market through incumbent MNOs – a local establishment would be required. This essentially would require EuWireless to set up an establishment for this purpose in each of the states in which it aims to offer its services, thus creating a significant regulatory and financial overhead.

In assessing the possibilities for EuWireless as a separate entity, it should be mentioned that there is also the possibility of EuWireless following the GÉANT model and establishing itself as a central association with members in the states it aims to serve. Essentially, EuWireless would then become the equivalent of GÉANT, but for mobile facilities. However, it is clear that this model would be far too ambitious, as it would require EuWireless to create its own network –

physical and wireless – entirely. Furthermore, there seems little benefit in to large extent duplicating what is already present in GÉANT.

3.3 GÉANT NREs as wireless operators

In this scenario, EuWireless would not become an independent entity, but its solutions – being the abstraction layer needed for network slicing – would become fully integrated in the existing NREs' infrastructure. The equipment needed for wireless experiments would be made available to local researchers requiring such equipment for their experiments. Moreover, the NREs would become the rightsholders for licensed radio spectrum. This option closely follows what was described as part of section 3.1.

From the point of view of EuWireless, this would be the easiest model to achieve. The project can develop its solutions and deliver them for integration to GÉANT. There would, therefore, not be a direct need for post-project continuation through an entity established specifically for EuWireless.

The main drawback of this model, however, is that it shifts the burden to the GÉANT members, the NREs. The NREs would have to procure the necessary equipment for wireless experiments and make this available to researchers and would have to obtain the licensed radio spectrum to which access is needed. While this may at first glance impose a significant burden on NREs, it must also be acknowledged that current research demands may already push NREs in this direction anyway. For instance, Dutch NRE SURF is already involved in a 5G pilot – 5Groningen – where a 5G field lab is developed. Other 5G testbeds – such as those developed as part of the 5GENESIS project – are also all connected to their NREs. Such test beds could then form the basis on which a more permanent and wider solution can be build.

4 EuWireless as a separate legal entity

In the previous section we have discussed the GÉANT model and possible ways to operationalize EuWireless within that model. It is, however, also possible to create a completely independent legal entity for EuWireless for further post-project development and operationalization. Here, a distinction can be made between economic and non-economic forms.

Annex A depicts an example of a Bylaws proposal for the entity, whichever legal form it may take.

The economic forms analysed here are the EEIG, the SE and national limited liability companies. Non-economic forms are the ERIC, the international organisation, the JU, and associations and foundations.

4.1 Economic forms

The most traditional and straightforward way to establish a legal entity is to create a national or European company. Several options exist, all having the main goal of establishing an entity for economic purposes.

4.1.1 European Economic Interest Grouping

The European Economic Interest Grouping (EEIG) was created in 1985 as a legal form facilitating cross-border economic cooperation between different business entities. In essence, two or more companies established in EU Member States can pool resources, activities or skills and jointly offer those to the market.

An EEIG can be created by means of an agreement between the establishing parties, governed by the laws of the Member State where the EEIG will be located. It requires no minimum capital, but also offers no limited liability to its parties – who thus maintain joint and several liability. Profits made by the EEIG are apportioned between the establishing parties, as defined in their agreement. The agreement also defines the EEIG's management.

While easy to establish and creating a legal entity with full legal capacity, there are also a number of drawbacks to this legal form. The lack of limited liability and the impossibility for the EEIG to make profits for itself can make this legal form unsuited for certain economic collaborations.

4.1.2 Societas Europaea

A second legal form created at the European level is the Societas Europaea (SE). This is a public company with the goal of allowing easy moving between EU Member States. Alternatively, a statute was also adopted for a European Cooperative Society, with a statute for a European private company still being under debate.

A SE is a public limited liability company, therefore having full legal personality and protecting its shareholders from being held liable for more than their contribution to the capital. A SE can be created by merging existing public limited liability companies within different EU Member States, by establishing a new SE as a joint venture, by establishing a SE as a subsidiary, or by transforming an existing public limited liability company into a SE.

Generally, there must be a strong cross-border dimension here. While some aspects of the SE are regulated by EU law, the SE will also resort under the laws of its Member State of establishment, for instance for taxation purposes. The main asset of the SE is that it is easy to move the legal entity from one Member State to another.

A SE requires a subscribed capital of EUR 120.000. A SE can have a single tier of administration or it can add a second tier of supervisory organ. Members of those organs are appointed for

maximum six years. A specific negotiation procedure is required to determine the level of employee participation in the SE.

The SE is an interesting and fairly lean form of cooperation between companies from different EU Member States. However, its employee participation negotiation and rather high capital requirement can be off-putting for smaller and younger companies.

4.1.3 National limited liability company

Apart from European entities, companies can also choose to establish a purely national legal entity as an economic joint venture between them. These will generally be either private limited liability companies or public limited liability companies. Being completely national bodies, they fully resort under the laws of their Member State of establishment.

Any national limited liability company will have full legal capacity and protection of its shareholders. Capital requirements depend on national law, but can be very low – even as low as EUR 1 in some Member States – for private limited liability companies. Management will generally follow the usual structure of general assembly of shareholders and a one- or two-tier management body. Establishment of a national private limited liability company is cheap and straightforward.

The main benefit of a national legal entity is the very low barrier in terms of capital, cost and establishment. However, a completely national entity may not always be the easiest form of cross-border cooperation between entities stemming from different EU Member States.

4.2 Non-economic forms

Given the inherent research-oriented goals of the project, it may prove more advisable to look at the establishment of a non-economic legal entity. Also here, several options are available at the European and national level.

4.2.1 European Research Infrastructure Consortium

The European Research Infrastructure Consortium (ERIC) is a fairly new legal form created at the level of the EU with the goal of establishing and operating a research infrastructure for non-economic purposes. Some limited economic activities are allowed if they fit into the general scope of the ERIC and do not jeopardize its aims.

For the purposes of an ERIC, a research infrastructure is defined as “*facilities, resources and related services that are used by the scientific community to conduct top-level research in their respective fields and covers major scientific equipment or sets of instruments; knowledge-based resources such as collections, archives or structures for scientific information; enabling Information and Communications Technology-based infrastructures such as Grid, computing, software and communication, or any other entity of a unique nature essential to achieve excellence in research. Such infrastructures may be ‘single-sited’ or ‘distributed’ (an organised network of resources)*” (article 2(a) Council Regulation (EC) No 723/2009 of 25 June 2009 on the Community legal framework for a European Research Infrastructure Consortium (ERIC)).

According to the European Commission, an ERIC should be a European joint venture, establishing an infrastructure necessary for research programs and project with an added value to the development of the European Research Area. It should provide effective access to the European research community, enhance mobility of knowledge and researchers, and contribute to the dissemination and optimization of its results.

An ERIC is a full capacity legal entity governed by EU law and the laws of the Member State in which it is established. It qualifies as an international organization for tax purposes, thus exempting it from national taxes. Its status as an ERIC must be reflected in the name.

At least three EU Member States must be member of the ERIC, although they can let themselves be represented by one or more public entities or private entities serving public purposes. This could, for instance, be a publicly funded research university. Also non-EU states and international organizations can become a member of an ERIC, as long as the EU Member States hold a majority in the voting rights. Of course, any non-EU members must recognize the legal personality of the ERIC, its governance under EU law and tax status.

A number of requirements apply (article 4 Regulation 723/2009):

1. It is necessary for the carrying-out of European research programmes and projects, including for the efficient execution of Community research, technological development and demonstration programmes;
2. It represents an added value in the strengthening and structuring of the European Research Area (ERA) and a significant improvement in the relevant scientific and technological fields at international level;
3. Effective access, in accordance with the rules established in its Statutes, is granted to the European research community, composed of researchers from Member States and from associated countries;
4. It contributes to the mobility of knowledge and/or researchers within the ERA and increases the use of intellectual potential throughout Europe; and
5. It contributes to the dissemination and optimisation of the results of activities in Community research, technological development and demonstration.

Setting up an ERIC requires an application to the European Commission, including the proposed statutes, its scientific description, and the agreement of a Host Member State. The Commission will assess whether all the requirements are fulfilled, if needed consulted by experts. When such is the case, a formal request can be submitted in order for the Commission to adopt the final decision to establish the ERIC. This procedure is estimated to take at least nine months, which does make the establishment of an ERIC a rather lengthy procedure.

The Commission has determined the minimum contents of the ERIC's statutes (article 10 Regulation 723/2009). These statutes and any later amendment must be approved by the Commission. Note that the Commission has only determined the topics that must be arranged in the statutes and not so much their contents. Members therefore enjoy great flexibility in deciding on the precise terms.

The ERIC can be set up as a single entity operating several facilities in different sites, or as a hub coordinating operations of different distributed facilities. This gives the ERIC great flexibility in either setting up a completely new infrastructure or leveraging existing facilities and infrastructures.

In terms of management, the ERIC must have a general assembly and a director or board of directors. The statutes determine the precise roles of these. Sound and transparent financial management is also key, with a balanced budget being a requirement. The ERIC is in itself liable for its debts, with the members only held to their own contribution. Annual reports must be submitted to the Commission. The Commission can decide to repeal its decision if certain violations are found and remain unremedied, which would entail the dissolution of the ERIC.

4.2.2 International organization

There are several research infrastructures that take the form of an international intergovernmental organization, such as CERN, EMBL and ESA. However, setting up such an international organization is a difficult political process, requiring an agreement between its founding states. In the case of EMBL, for instance, the political lobbying and negotiation procedure took 12 years before the legal entity was established. The main benefit of such an international organization is that it could receive beneficial tax and procurement status. Nevertheless, given the difficulty of

establishing such an organization, this cannot be considered as a directly feasible option for EuWireless in the short term.

4.2.3 Joint Undertaking

Article 187 of the Treaty on the Functioning of the European Union allows the EU to set up joint undertakings (JU) “*for the efficient execution of Union research, technological development and demonstration programmes*”. These entities are therefore created by the EU – at the initiative of the European Commission – and have the European Commission as founding member.

While the JU is a fairly free form – there are no set statutes or articles of association – it does in any case require the initiative of the EU itself. EuWireless members can therefore only lobby the EU to create an EuWireless JU but cannot take the initiative themselves. Therefore, while more realistic than an international organization, this is still not a legal form feasible in the short term.

4.2.4 Associations and foundations

Apart from limited liability companies for economic purposes, EU Member States also recognize the association for non-profit purposes as a legal entity. Also here, members can benefit from limited liability.

As this is a national form, the precise requirements and consequences will depend on the national law of the Member State where the association is established. Generally, members will receive equal rights, and associations can receive a beneficial tax status. While some limited profit-making activities could be allowed, this will be fully subject to the limitations and requirements set by national law.

Similar to associations, foundations have full legal personality, a non-profit status and beneficial tax treatment. A foundation serves to pool assets together in order to achieve the purposes of the foundation. Given that a foundation does not have members, adding new participants requires agreements between those new participants and the foundation. Just as associations, foundations are national legal forms and the precise requirements and consequences can therefore vary depending on their Member State of establishment.

4.3 Assessment of legal form options

Having briefly introduced a number of legal form options for the further development of EuWireless, we can now assess these options according to a number of criteria. These criteria, while certainly not exhaustive, can help guide the EuWireless partners in selecting the most feasible and appropriate form option.

4.3.1 Criteria

4.3.1.1 Legal person

While partners in a joint venture will generally have legal personhood themselves, not all possible legal form options also result in the creation of a separate legal person for that joint venture. For the purposes of this assessment, we have focused on providing the legal form options that do result in the creation of a separate legal person. This criterion is therefore fulfilled by all of the above options.

4.3.1.2 Limited liability

Limited liability is also not present in every legal form option. There are several options where the partners in a joint venture would remain fully responsible for the liabilities of that joint venture, in some cases having joint and several liability.

Of the options discussed here, only the EEIG would not result in partners receiving limited liability. That option may therefore be less suited for the purposes of establishing a more permanent infrastructure for EuWireless.

4.3.1.3 Management

Generally speaking, the legal form options discussed here do leave some flexibility in determining the management structure of the resulting legal entity. However, in some options that flexibility may be greater than in others. For instance, the SE requires a consultation procedure to determine the degree of employee participation, which may prove more onerous than the other options.

4.3.1.4 Capital

In order to establish a new legal entity, partners are expected to contribute capital to that legal entity, either in cash or in kind. While most options do not require a minimum capital – or have fairly low minimum capital requirements – it is of course advised to furnish the legal entity with some starting capital.

The notable exception here is the SE, which requires a minimum capital of EUR 120.000. This may prove prohibitive for smaller businesses that want to establish a joint venture.

4.3.1.5 Costs and taxes

In any case, the establishment of a joint venture will entail a few start-up costs. These include drafting articles of association, costs related to the involvement of a public notary – where required – or dealing with the European Commission in case of a JU or ERIC.

Generally speaking, all legal entities are considered tax subjects. As a result, they will be subjected to corporate tax and VAT. However, there are a couple of non-profit legal form options that do benefit from beneficial tax status and can therefore be exempted. These include international organizations, JU, ERIC, and associations and foundations.

4.3.1.6 Implementation process

Some legal form options are easier to implement than others. While establishing a national limited liability company is in many jurisdictions a very swift and easy process, there are also options that take considerably more effort. The SE, for instance, is more difficult to establish, mainly due to the internal stakeholder consultation process. Also, the ERIC and JU may be harder to achieve since they require talks with and decisions by the European Commission. Last, the establishment of an international organization is a very difficult and lengthy process, requiring much lobby work to be done.

4.3.1.7 International dimension

Given the inherent goal of EuWireless to create a pan-European research infrastructure, the international dimension of the joint venture must be taken into account as well. The eventual legal form should therefore be suited to facilitate cross-border cooperation. Of course, the more international forms discussed here are best suited for such purposes, including the international organization, EEIG, JU, ERIC and SE.

Nevertheless, some aspects of national law must always be taken into account, and national legal forms do generally also allow participation from members abroad. While more international forms could therefore be preferred, national forms should not be excluded *a priori*.

4.3.1.8 Suitability for research

While most of the discussed legal form options have a broad field of applicability, there are a number of options that are more specifically suited for the establishment of research infrastructures. In particular are the international organization, ERIC and JU very suited to – or even created especially for – research infrastructures.

4.3.2 Assessment

In this section, each of the legal form options will be assessed according to the aforementioned criteria.

4.3.2.1 EEIG

An EEIG is a separate legal entity. However, it does not provide its members with limited liability.

The EEIG is relatively easy to establish, with no minimum capital requirements. Members of the EEIG decide on its management. Members are taxed in their own jurisdiction for their share in the profits or losses.

The EEIG is a clear international legal form. However, as the name suggests, it is mainly suited for an economic joint venture between members of different EU Member States, and not specifically suited for research cooperation.

While the EEIG is therefore easy to implement and cost-effective, its lack of limited liability for its members and the fact that it is less suited for research cooperation make it not the most ideal legal form option for EuWireless.

4.3.2.2 SE

The SE is a full legal entity with limited liability for its members. It has a clear international dimension, being an EU-wide legal form, but is more suited for economic collaboration than for research infrastructures.

The SE is not the easiest legal form option to implement. It requires a minimum capital of EUR 120.000 and a stakeholder negotiation procedure to decide on the degree of employee participation in the SE's management. The SE is taxed in its Member State of establishment.

While the SE does offer a few benefits with its legal personality, limited liability, and international dimension, its difficulty to implement, heavier management structure and rather high capital requirements make it a less attractive legal form option for EuWireless.

4.3.2.3 National limited liability company

A national limited liability company is a full legal person with limited liability for its members. Given that this is a purely national legal form option, the international dimension is rather limited. This legal form option is the most traditional means for economic ventures and is not specifically tailored to the establishment of research cooperation.

Most Member States allow for a fairly easy and cost-effective establishment for their limited liability companies. Nevertheless, the intervention of a public notary may be required in some jurisdictions. Capital requirements are low or even non-existent. National limited liability companies are fully subject to national taxes. The management structure can be fairly lean in most Member States, while there are also Member States – such as Germany – that do require employee participation. Selecting the right Member State for establishment will therefore be key in ensuring a lean and smooth management structure, as well as for taxation purposes.

While leaner and more cost-effective than a SE, a national limited liability company has a few drawbacks, such as its lack of international dimension and not necessarily being suited for research cooperation.

4.3.2.4 ERIC

The ERIC is a relatively recent EU-wide legal form providing full legal capacity and limited liability to its members. It is specifically aimed at establishing research infrastructures.

While the core members of an ERIC will in principle be EU Member States, these members can delegate their membership to national public and private entities. Also non-EU states can become a member, as well as international organizations, but those members will have to recognize the legal form of the ERIC and applicability of EU law.

Setting up an ERIC requires a proposal thereto submitted to the European Commission and involvement of the host Member State, who will decide on the matter. While this is therefore not as straightforward as setting up some of the other legal forms analysed here, it is more feasible than, for instance, setting up an international organization or a JU.

The legal framework on ERICs defines some of the elements that must be arranged in its articles of association, yet without specifying their contents. The constituting members of the ERIC are therefore relatively free in determining the specific elements of the ERIC, including its management structure. Being non-profit in nature, the ERIC enjoys beneficial tax status.

The benefits offered by the ERIC and its specific orientation towards research infrastructures make the ERIC the most ideal legal form to be pursued by EuWireless for its establishment as a fully independent legal entity. Nevertheless, the fact that the ERIC does require approval by the European Commission makes it not the most straightforward legal form to attain.

4.3.2.5 International organization

An international organization constitutes a recognized legal entity. It is a clear international legal form option and well-suited for the establishment of research infrastructures – as evidenced by several examples in practice.

However, setting up an international organization is a difficult and lengthy process, requiring political agreements between the constituting member states. While the management structure can be freely decided, it is more difficult to change that structure afterwards, as such would require amendments to the intergovernmental agreements establishing the international organization. International organizations can receive beneficial tax status, which makes it an attractive legal form option.

Despite the clear international dimension, suitability for research and beneficial tax status, the international organization is certainly not a feasible option for EuWireless in the short term. The establishment of an international organization generally requires years of high-level political lobbying and does not seem to offer substantial benefits over the ERIC.

4.3.2.6 JU

A JU is a recognized legal form with a clear international – albeit only European – dimension and specifically suited for establishing research infrastructures.

The JU has no predefined structure, allowing members to decide how to set up the management and capital of the undertaking. It can receive beneficial tax status.

Nevertheless, given that the establishment of a JU requires the initiative of the European Commission, and also supposes membership – and therefore decision-making power – of the Commission, this legal form offers no significant benefits to EuWireless over the ERIC.

4.3.2.7 Associations and foundations

Associations and foundations enjoy full legal personality and can offer limited liability for their participants. These forms are primarily national in nature, but international participation is possible. Associations and foundations have a non-profit purpose. They are not specifically designed to establish research infrastructures, but they can be used for that purpose. An important example here is GÉANT, which itself is a Dutch association.

Being national forms, associations and foundations are easier to establish than the more international forms. They can receive beneficial tax status, although this depends on national law. Setting up an association or foundation may require the intervention of a public notary. The management structure is determined by national law, so it will be key to find the right Member State for establishment. Generally, no minimum capital will be required.

While setting up an association or foundation would certainly be the easiest to implement in the short term, these two forms offer no other tangible benefits over the ERIC.

4.3.2.8 Conclusion

The results of the assessment can be summarized in the following table. For the purposes of EuWireless, the ERIC comes forth as the most desirable and feasible option. If an ERIC would

not prove attainable, a national form such as an association or foundation could be considered for ease of implementation.

Table 1: Summary of assessment

	Legal person	Limited liability	Management	Capital	Costs and taxes	Implementation	International dimension	Suitable for research
EEIG	Yes	No	Jointly	n/a	Low	Easy	High	No
SE	Yes	Yes	To be negotiated	High	Local tax, considerable cost	Hard	High	No
National legal entity	Yes	Yes	Fairly lean	Low to none	Local tax, cost dependent on national law	Fairly easy	Low	No
ERIC	Yes	Yes	Freely determined	n/a	Beneficial tax status, some cost	Medium	High	Yes
International organization	Yes	Yes	Freely determined	n/a	Beneficial tax status, high lobbying cost	Hard	High	Yes
JU	Yes	Yes	Freely determined, but involvement EC	n/a	Beneficial tax status, some cost	Medium	High	Yes
Association and foundation	Yes	Yes	Fairly lean	n/a	Beneficial tax status, some cost	Fairly easy	Low	Possible

5 Obtaining radio spectrum usage rights

Another question related to the EuWireless entity is how – and by whom – radio spectrum usage rights, as well as rights to operate and utilize wireless infrastructures such as antennas, can be obtained in order to provide researchers with access to licensed parts of the radio spectrum for their experiments. As noted before, the radio spectrum market in the EU was analysed in depth in D1.2 [1]. The conclusion there was that radio spectrum usage rights can either be obtained on the primary market, or on the secondary market.

The primary market for radio spectrum usage rights entails that the entity that wants to acquire such usage rights will have to apply for a license directly at the local governing authority. In most EU Member States, this means that such entity will have to participate in a license auction, through which parts of the radio spectrum allocated to mobile communications technologies are awarded to future rightsholders. This is, however, a very complex and expensive procedure, as the potential rightsholder will have to enter into direct competition with established telecom operators. Moreover, given that licenses are awarded on a national basis, a license would have to be acquired in each of the EU Member States where experiments are to be offered. This option will therefore not prove feasible for a newly established entity with limited financial resources.

In terms of infrastructure, obtaining full usage rights would require the rightsholder to install and operate its own antennas and other equipment, which will of course bring an additional investment. Moreover, European legislation allows national regulators to “*impose the sharing of such facilities or property, including buildings, entries to buildings, building wiring, masts, antennae, towers and other supporting constructions, ducts, conduits, manholes, cabinets*” (article 12 amended Framework Directive). In Belgium, for instance, this principle is formulated in article 25, §2 of the Act of 13 June 2005 on Electronic Communication. This article provides that any operator of an antenna-site must reasonably, proportionally, and non-discriminatorily allow the shared use of such site. If a new operator would therefore want to place antennas, it must first consult with the existing operators of antenna-sites to share such sites and negotiate a reasonable remuneration therefor. Also, when a new site is developed, other operators must be notified on beforehand in order to negotiate the shared use thereof.

As a result, if EuWireless would gain radio spectrum usage rights itself, it also needs to invest in installing and operating its own network equipment. Moreover, it would have to negotiate the shared use of existing antenna-sites with incumbent operators or allow the shared use of any new site it may develop.

While all EU Member States do offer a lighter licensing scheme to obtain radio spectrum usage rights for research purposes, those licenses are only awarded for fairly short durations. Such temporary research licenses would therefore not offer a solution with which radio spectrum usage rights can be gained on a more durable basis. In the context of EuWireless, this would mean that for every experiment a procedure must be started to obtain a temporary license within each of the national jurisdictions in which the experiment will take place. While this is certainly more feasible than obtaining a full license through auctions, it is not a very practical solution.

The secondary market for radio spectrum usage rights entails that usage rights are transferred or leased for the purposes of EuWireless. In this scenario, a part of the spectrum usage rights of rightsholders can be either transferred or leased to EuWireless. Particularly in the case of leasing, this procedure would – in principle – only require the negotiation of the terms of lease with the rightsholder and notification of the lease to the supervisory authority. Transferring is a more difficult procedure, as it still requires the recipient of the transferred rights to comply with all license requirements – and thus potentially needing to register as an operator. The main difficulty in leasing lies in the need to negotiate a leasing agreement with operators in all EU Member States where EuWireless aims to offer infrastructure for wireless experiments. In terms of equipment, a

lessee of radio spectrum usage rights would not become a licensee to operate wireless infrastructure in its own right. It would therefore need to operate any equipment in accordance with the conditions imposed on the lessor's license and in accordance with the terms of its lease negotiated with the lessor. This option may therefore be cheaper than obtaining full usage rights in its own right, but requires more difficult negotiations with incumbent rightsholders.

Alternatively, EuWireless could operate as a vMNO. In such case, EuWireless obtains no radio spectrum usage rights itself, but would only be a customer with an existing MNO. Under this scenario, EuWireless would also not be able to operate its own equipment, as it does not have any radio spectrum usage rights. Most MNOs do already serve as hosts for vMNOs and offer specific packages to this market. This option is much more feasible than obtaining radio spectrum usage rights on the primary or secondary market, but of course also much more restrictive in what EuWireless could do.

The conclusion of this is that if EuWireless would be established as a separate entity, leasing spectrum usage rights from existing rightsholders in different Member States will constitute the cheaper way forward, but require tougher negotiations. This scenario would require more initial work in negotiating the leasing agreements with those rightsholders, including the use of their existing infrastructure, but once obtained it would offer EuWireless clear and durable radio spectrum usage rights that can be used by researchers – of course within the boundaries of the leasing agreements. While obtaining temporary research licenses would be an easier procedure initially, those licenses cannot provide durable radio spectrum access in the long term and would therefore require a new license for each experiment.

If EuWireless were to be integrated into GÉANT, the most logical way forward would be for the NRENs to make radio spectrum usage rights available to GTS as extended with wireless capacities. Given the public interest tasks of NRENs, it could be envisioned that Member States reserve some radio spectrum for research purposes and make this available to NRENs. However, to ensure cross-EU compatibility for wireless experiments, such reserved spectrum should ideally be in the same bands in all EU Member States, which may not prove practically feasible. In the short-term, the more likely solution would be to connect with existing 5G test beds – as is already being done in the Netherlands – and seek a more durable solution from there.

6 Conclusion

The analysis of the possibilities for the EuWireless architecture already uncovered that from a technical point of view one option would be to integrate the EuWireless solution into the existing GÉANT services, potentially linked to GÉANT Test bed Services as reported in deliverable D2.2 [3]. The architecture reported in D2.2 is the basis to offer resources to researchers through the use of network slicing.

This architectural choice can be validated from a legal point of view. Establishing EuWireless as a separate legal entity in the vein of GÉANT would require incorporation in at least one Member State, and directly obtaining radio spectrum usage rights on the primary market would require further establishment in all EU Member States where EuWireless aims to offer its services. This model – which at least to some extent would correspond to GÉANT’s model – would be rather complex to establish from a legal perspective and be very expensive to operate from a financial perspective.

As a result, it could be more advisable that instead of copying the GÉANT model, EuWireless would be integrated into the existing GÉANT structure. This would remove the need for a separate post-project entity to be established, thus proving a more feasible solution from both a legal and financial perspective. Obtaining radio spectrum usage rights could then be achieved through the NREs participating in GÉANT. These could either look at the primary market – possibly Member States could in the future reserve some radio spectrum for research purposes – or negotiate a leasing agreement on the secondary market. Existing initiatives in which 5G test beds are being developed could provide a first step, from which a more durable and wider solution could be developed. However, this solution requires thorough negotiation with GÉANT to facilitate such integration and may be less attractive to the future EuWireless operators.

Alternatively, it could be proposed to establish EuWireless as a permanent research infrastructure, separate from the GÉANT model. This deliverable has analysed a number of legal form options available for such endeavour and has found that the figure of the European Research Infrastructure Consortium is the best suited legal form for the purposes of EuWireless. Setting up such ERIC requires the approval of the European Commission and is therefore not the easiest or most straightforward procedure. Nevertheless, several of the projects funded under the Horizon 2020 INFRADEV call, under which EuWireless was funded as well, are taking this road. There is, therefore, precedent in further developing such a project into an ERIC. Follow-up work after this project would then be oriented at setting up such an ERIC.

7 References

- [1] Dumortier J. (Ed.) D1.2 - Analysis of Regulations in Europe. EuWireless; 2018.
- [2] Merino P. (Ed.) D2.1 - Initial EuWireless Architecture. EuWireless; 2018.
- [3] Panizo L., Merino P. (Ed.) D2.2 - Final EuWireless Architecture. EuWireless; 2020.

Annex A. Bylaws

This Annex shows an example of the Bylaws of the EuWireless entity, whichever legal form it takes, to define the fundamental principles which would govern the Entity's operation. These Bylaws will be refined according to the precise requirements of the eventual legal form of the entity.

ARTICLE I. NAME

Section 1.1 Name.

The name of this entity is <Name of the EuWireless entity> (hereinafter referred to as the "Entity")

Section 1.2. Location.

The Entity shall maintain a continuous location in <place of the Entity headquarters> plus additional locations that the Board of Directors may determine (*places should be listed here*).

ARTICLE II. PURPOSE

The purpose of this Entity is to provide a pan-European mobile network to the research community.

- To validate new networked services and mobile applications at full scale and within the mobile e-infrastructure environments that such new capabilities require.
- To provide an integrated and seamless access to telecom or other e-infrastructure facilities that are traditionally part of the "wired" network, such as wired internet resources or compute and storage datacenters, that are integral to emerging mobile applications.
- To provide a holistic development and testing environment at scale, and with advanced software-driven virtualization services that are able to establish and manage these experimental environments quickly, flexibly, and cost-effectively.

ARTICLE III. MEMBERS

All Members are required to abide by these Bylaws to become and remain members of the Entity, as well as any other policies and rules defined by the Entity. Members shall meet the requirements for their specific class of membership as defined below.

All members shall execute a Membership Agreement, which is defined by the Board of Directors, and pay the corresponding fees according to their class of membership.

Section 3.1. Classes of Membership

The Entity will have the following classes of Membership: Contributor Members, NREN members and Sponsor Members. The Board of Directors may expand or reduce the classes of Membership in the future.

- Contributor Members: Provide their technology to design, deploy or maintain the EuWireless infrastructure, or to take part in the management and/or operation of the infrastructure.

- NREN members: National Research and Education Networks provide high performance global end to end transport capabilities.
- Sponsor Members: Share interest with the Entity and support the Entity in different ways. In the same way, they get advantages and priority for the use of the Entity infrastructure as well as other advantages.

ARTICLE IV. ORGANISATION.

Section 4.1: Board of Directors

The Entity shall be managed by the Board of Directors. The number of members of the Board of Directors shall be between a minimum of two (2) and a maximum of the total number of Contributor Members plus one. The duties of the Board of Directors include:

- Define the Entity policies within the limits of these Bylaws.
- Modify, repeal or amend these Bylaws.
- Control, supervise and direct the Entity.
- Establish the future strategy of the Entity.
- Approve or reject of new Contributor members and/or NREN members.
- Approve or reject of the Entity's Annual budget.
- Promote the Entity's purpose.

The Board of Directors shall be composed of the following voting members: Chair, Secretary-Treasurer, immediate-past chair, and <n> regular members. (Note: <n> will depend on the size of the EuWireless Entity).

Section 4.2: Nominating Committee

The Nominating Committee shall be composed of four regular members. The purpose of this committee is to recommend candidates for the Board of Directors. Members of this Committee are ineligible for the Board of Directors.

Section 4.3: Other Standard Committees

The Board of Directors may establish committees to serve the purpose of the Entity.

Section 4.4: Election

Each member of the Board of Directors is elected for three years. The new Board of Directors will take its role immediately after the next Annual meeting performed after the election. When a period is about to expire (usually three months before a regular face-to-face meeting) or a seat of the Board is going to be left vacant, a Nominating Committee will recommend a list of candidates for the new Board of Directors (or for an individual seat). The voting members may propose additional candidates. The results of the election, which will be performed at least one month before the Annual Meeting, shall be published before fifteen days after the election.

ARTICLE V. MEETINGS.

Section 5.1: Regular face-to-face meetings

One Regular meeting will be hold annually. The Board of Directors will set the date and place for the meeting. The Board of Directors and all Contributor members are requested to attend. Other members' attendance is optional, though attendance is recommended.

Section 5.2: Special meetings

The Board of Directors may hold special meetings to deal with specific topics. The Board of Directors may invite other members and / or committees to the meeting at their own discretion. The date and place of the meeting shall be set at least one week before the start of the meeting.

These meetings may be hold face to face or through the use of a conference telephone or other communications means.

ARTICLE VI. QUORUM

Quorum shall be constituted by a majority of the voting members of the Board of Directors at a meeting (regular or special).

ARTICLE VII. AMENDMENTS

These Bylaws may be amended, repealed or modified, or by a two-thirds vote of the Board of Directors in any meeting (regular or special).