Mangrovia / Cetri-Tires

# Distributed Networks & Energy Grids #TRI Toolkit

*Author:*
Alex (acme) D'Elia

*Supervisor:*
Marco (radium) Sachy

# Toolkit Whitepaper

Alex (acme) D'Elia

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# Resilient Communities

# Chapter 1

# Introduction

The aim of this document is to present a vision and a possible path to a "*General Purpose Tech Platform*", a **Smart Decentralized Information, Energy and Logistic Network** for Resilient Communities in the age of the **IoT**, where a new society of Prosumers will be able to use data to easily program their own algorithms to increase productivity and efficiency by reducing the *marginal costs* almost to Zero [7].[1]

We start our study observing the recent shift in society from the economic model based on "ownership" of goods to a model of "collaborative commons", where the access to goods is more fundamental than the property of those goods and where the economy will neither be ruled by the markets nor by the governments, but by *Cooperatives of Social Commons*.

While economists have always welcomed a reduction in marginal costs, they never anticipated the possibility of a technological revolution that might bring marginal costs close to zero, making goods and services priceless, nearly free, and abundant, and no longer subject to market forces. For these reasons, a new infrastructure model has to be easily accessible and manageable by human beings, providing a distributed, collaborative, peer directed solution horizontally and not vertically structured. We need to establish an **Open Network Neutrality** able to manage the big amount of data that will be shared between communities eliminating markup and middlemen which are becoming useless and unsustainable in a world where all things are interconnected directly.

Rifkin describes how the Communication Internet is converging with a nascent Energy Internet and Logistics Internet to create a new technology platform that connects everything and everyone. At the moment we have already reached more than 14 Billion sensors attached to natural resources, production lines, electricity grid, logistics networks, recycling flows, and implanted in homes, offices, stores, vehicles, and even human beings, feeding Big Data into an IoT [8] global neural network. This number is supposed to grow to more than 100 Trillions by the year 2030. So we have to implement a technology where Prosumers can connect to the network and use Big Data, analytics, and algorithms to accelerate efficiency, dramatically increase productivity, and lower the marginal cost of producing and sharing a wide range of products and services to near zero.

Within this document we are not presuming to present a solution for everything since this would not only be impossible, but also it would not represent the scope of our mission. We already know that around 40% of humans are connected to the internet and 25% households are producing their own green energy, thus we are willing to present a solution which can easily and freely help to interconnect those houses with the energy grid, in order to help our society to adapt itself more swiftly to the direction which is being undertaken by world trends.

[1] "*The Zero Marginal Cost Society*",Jeremy Rifkin's new book (2014).

# Chapter 2

# Smart Grids for Smarter Communities

## 2.1 The IoT Revolution

"The Internet of Things (**IoT**) is the interconnection of uniquely identifiable embedded computing devices within the existing Internet infrastructure. The interconnection of these embedded devices (including smart objects), is expected to usher in automation in nearly all fields, while also enabling advanced applications like a Smart Grid"[1].
We believe the IoT will create an Economy of Things where every device, every system should be able to engage in multiple markets, both financial and non-financial and autonomously react to changes in markets. *These capabilities will be crucial to everything from the sharing economy to energy efficiency and distributed storage.*

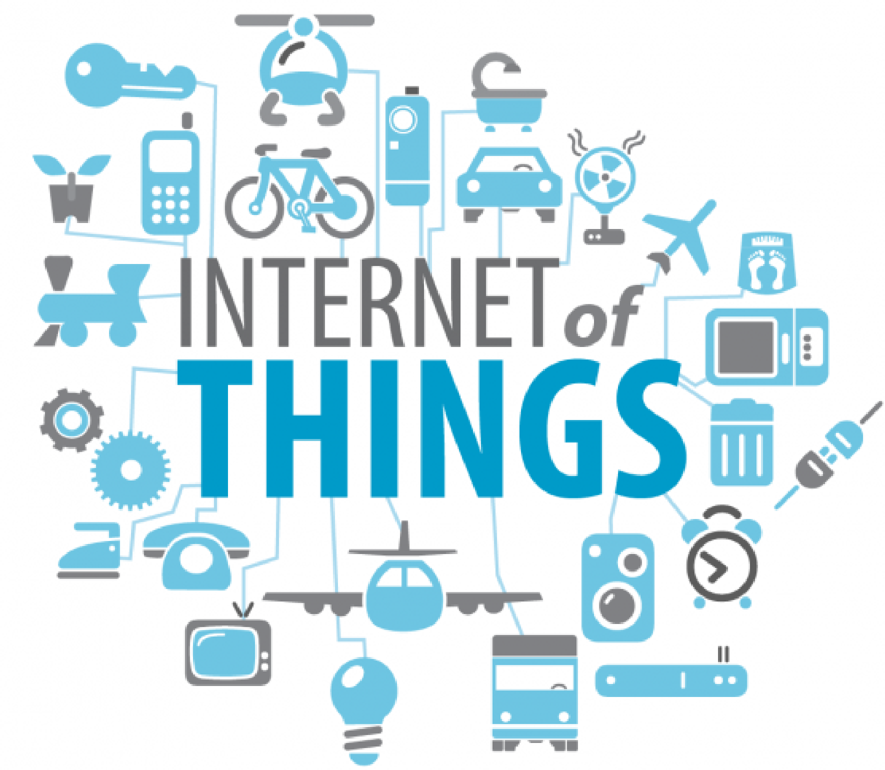



Figure 2.1: The world of interconnected devices.

[1] As described by Wikipedia on the Internet of Things

The growth in IoT will far exceed that of other connected devices. By 2020, the number of smartphones tablets and PCs in use will reach about 7.3 billion units. By contrast, the IoT will reach over 25 billion units, representing an almost 30-fold increase versus 2009 and will generate incremental revenue worth $4 Trillion (Source: IDC[1]), though forecasts range from $300B (Source: Gartner[2]) to $19T (Source: Cisco[3]).

"*The largest growth in the history of humans*" says Bryzek (VP at Fairchild Semiconductor).

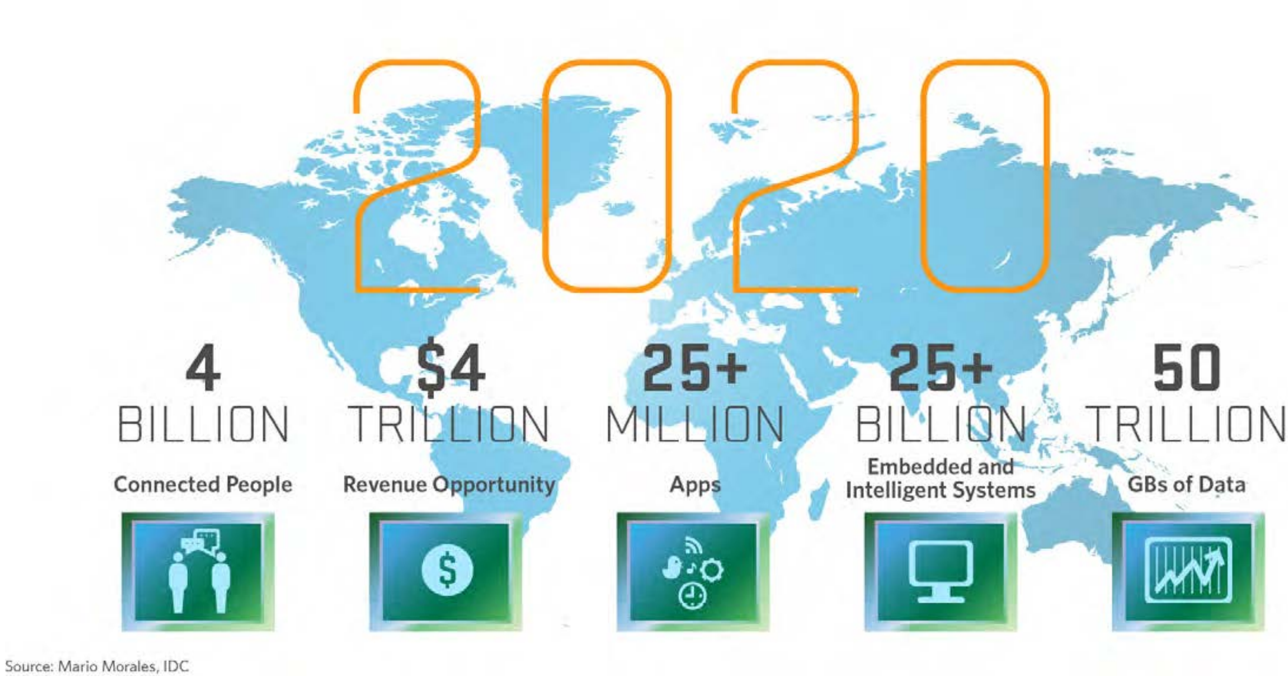


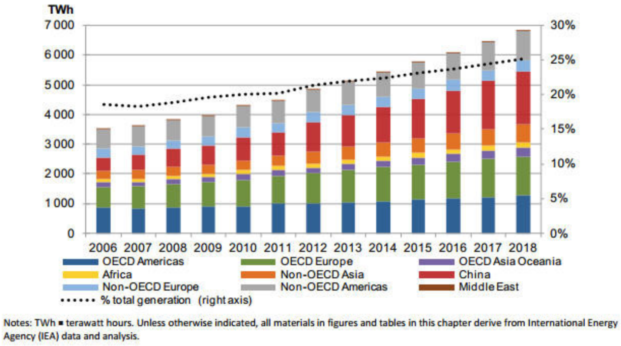

Figure 2.2: Expected growth of IoT market.

IoT is especially relevant to the Smart Grid since it provides systems to gather and act on energy and power-related information in an automated fashion with the goal to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity. Using Advanced Metering Infrastructure (AMI) devices[2] connected to the Internet backbone, electric utilities can not only collect data from end-user connections, but also manage other distribution automation and provide new levels of services.

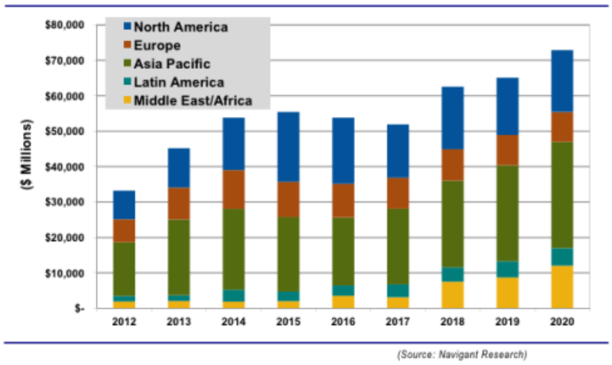
[2]AMI is the new term coined to represent the networking technology of fixed network meter systems that go beyond AMR into remote utility management. The meters in an AMI system are often referred to as smart meters, since they often can use collected data based on programmed logic. Automatic meter reading, or AMR, is the technology of automatically collecting consumption, diagnostic, and status data from water meter or energy metering devices (gas, electric) and transferring that data to a central database for billing, troubleshooting, and analyzing.

## 2.2 The shift to Decentralized Models

The global energy sector is still based on the old-fashioned centralized production/distribution model and large-scale power plants. Over 1.2 billion people (800 million just in Africa and India) still do not have access to electricity! In the places where electricity is not yet available, the approach to extend the central grid is technically and financially inefficient due to a combination of capital scarcity, insufficient energy service, reduced grid reliability, extended building times and construction challenges to connect remote areas.




(a) Global renewable electricity production by region.




(b) Prevision of market revenues from Smart Grid Technologies.

Figure 2.3: The growth of renewable energy production demands for a broader Smart Grid distribution

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In addition, worldwide this approach is facing serious physical and environmental limitations, like the depletion of fossil fuel resources and the threat of climate change. Even the production of renewable energies so far followed pretty much the same centralized production/distribution pattern. In order to meet EU Energy goals "20–20–20"[3], it's necessary a transition to a sustainable paradigm based on distributed models and small-scale power generation technologies that relies on renewable sources and guarantees universal access for all people.

Likewise the big Energy Providers model based on a centralized management of the infrastructures, the present model offered by ISP and Big Carriers faces a number of problems, starting from a bad allocation use of frequencies in wireless technologies (i.e. Spectrum Crunch) to a diminished use of bandwidth and reliability of the whole network infrastructure. Today, while more than 75% inhabitants in developed countries have mobile broadband connection (20% in developing countries), only 27% have fixed broadband connection (6% in developing countries).

In order for IoT potential to unfold, it is mandatory to close the digital divide as per EU Digital agenda[4],[4] providing high reliability/high speed broadband connectivity with improved energy efficiency and distribution. This implies that the devices will utilize an IP address as a unique identifier. However, due to the limited address space of IPv4 (which allows for 4.3 billion unique addresses), objects in the IoT will have to use IPv6 to accommodate the extremely large address space required.

[3]European Agenda on Climate Action

[4]European Digital Agenda

“With an IoT already on our door and 1 Billion people still waiting to connect, it’s time to act. . . to maintain Internet open, not fragmented and reliable”

**Neelie Kroes**[5] reiterates on the problem of digital divide during her final keynote speech as VP of the Digital Agenda at the European Commission. Making a play on words made famous by Elvis Presley, she called for:

“a little less confrontation, a little more action from the sector”

In the following Figure 2.4 we can gasp an overview on how limited actually is the BroadBand connectivity in Europe. Which is already good if compared at a worldwide level as shown in the tables below.

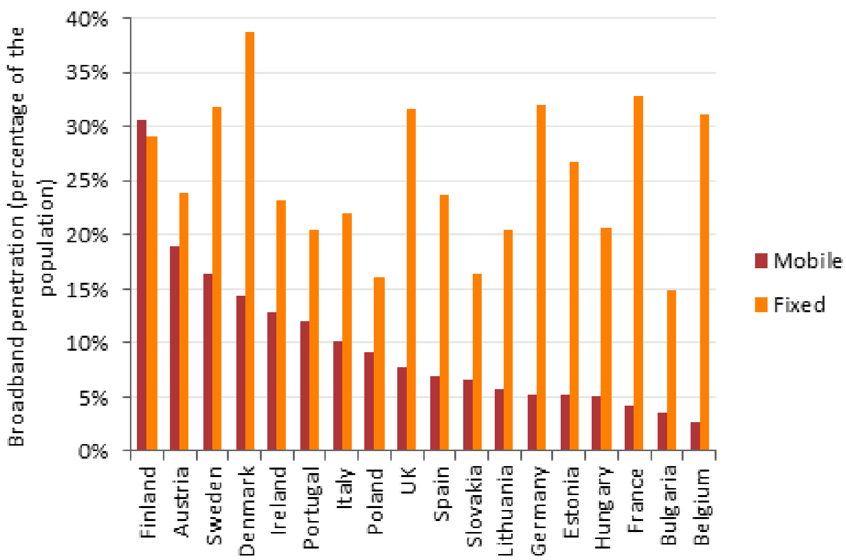


Figure 2.4: EU Broadband penetration based on % of the population per Country.

| **Worldwide broadband subscriptions Per 100 inhabitants** | | | |
|---|---|---|---|
| | 2007 | 2010 | 2013 |
| World population | 6.6 billion | 6.9 billion | 7.1 billion |
| Fixed broadband | 5.2% | 7.6% | 9.8% |
| Developing world | 2.3% | 4.2% | 6.1% |
| Developed world | 18.0% | 23.6% | 27.2% |
| Mobile broadband | 4.0% | 11.3% | 29.5% |
| Developing world | 0.8% | 4.4% | 19.8% |
| Developed world | 18.5% | 42.9% | 74.8% |

Table 2.1: Fixed and Mobile broadband subscriptions

During 1986 and 2009 communication capacity was more unequally distributed than during the time when only fixed-line phones existed. The most recent increase in digital equality stems from the massive diffusion of the latest digital innovations (i.e. *fixed and mobile broadband infrastructures*). While this is good news, the bandwidth divide might well once again re-open with the next digital innovation. While the average member of developed countries counted with 29 kbit/s more than a person in developing

[5]Neelie Kroes, former Vice-President of the European Commission

countries in 2001, **this difference got multiplied by a factor of one thousand** (to a difference of 2900 kbit/s). In relative terms, the fixed-line capacity divide was even worse during the introduction of broadband Internet at the middle of the first decade of the 2000s, when the OECD counted with 20 times more capacity per capita than the rest of the world.[6]

| **Fixed VS Mobile Subscriptions** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2007 | 2010 | 2013 | | 2007 | 2010 | 2013 |
| Africa | 0.1% | 0.2% | 0.3% | | 0.2% | 1.8% | 10.9% |
| Americas | 10.9% | 14.1% | 17.1% | | 6.4% | 22.9% | 48.0% |
| Arab States | 0.9% | 1.9% | 3.3% | | 0.8% | 5.1% | 18.9% |
| Asia and Pacific | 3.2% | 5.5% | 7.6% | | 3.1% | 7.4% | 22.4% |
| Commonwealth of Independent States | 2.3% | 8.2% | 13.5% | | 0.2% | 22.3% | 46.0% |
| Europe | 18.4% | 23.6% | 27.0% | | 14.7% | 28.7% | 67.5% |

Table 2.2: Broadband Subscription by Region, source: ITU

New applications have made it possible for anyone with a computer and an Internet connection to be a creator of content, yet the majority of user generated content available widely on the Internet, like public blogs, is created by a small portion of the Internet using population. Web 2.0 technologies like Facebook™, YouTube™, Twitter™, and Blogs enable users to participate online and create content without having to understand how the technology actually works, leading to an ever increasing digital divide between those who have the skills and understanding to interact more fully with the technology and those who are passive consumers of it.

With the advent of the IoT, Internet technology and renewable energies are beginning to merge to create an Energy Internet that will change the way power is generated and distributed. Companies like IBM™, Siemens™, Cisco™ together with Utilities started to build experimental Smart Grids. However, to support the rapidly expanding distributed power generation, and assure long-term reliability, increased responsiveness, and lowered operational costs, the communication network must be connected with the electricity network, distributing the intelligence on highly interconnected clouds.

[6]Digital Divide is a well known issue on which governments and industries are “discussing” since the last decade, and is widely presented also on Wikipedia.

# Chapter 3

# Toolkit

## 3.1 Tools for a Third Industrial Revolution Community

As the rollout of the IoT becomes widespread, connecting everyone and everything in a neural network raises **privacy issues** and could seriously compromise any personal or corporate **information associated with Internet connected devices**. This is a an important aspect with which we are willing to engage by providing distributed autonomous internet and energy solutions for a **TIR** society. Fostering the adoption of the distributed model with standard protocols, by providing tools that simplify the process of upgrade of actual infrastructures and implementation of Automation and Distribution Systems.

In the IoT age, individuals will have to set their privacy policies for every daily activity. These policies correspond with their counterpart in the distributed network of databases. In this way the entire identity is not needed in order to offer services on a particular activity. As citizens generate the data, they also decide who to sell it to in order to enrich it with, or they can decide to keep it for themselves. *The distributed network of databases forms the next layer of smart connections.* They will be powered by autonomous agents, perform transactions (based on blockchain) and connect to each other via mesh networks. As more of the decision-making moves from the application layer (Web Browser / APPs) down to the agent layer (Back-end), the global system will start becoming smarter. This can only be achieved with a decentralized model based on **distributed p2p networks and smart energy controllers within a decentralized data governance**, while preserving different **levels of privacies** and providing higher standards of security.

The ToolKit is the #TRI/TIR[6][1] ToolBox. A Box filled with all the tools needed to build your own sustainable interconnected life infrastructure.

- It gives you the chance to build your own network of communication, connecting with your neighbours
- With The Energy Kit you can produce energy, store it, use it and start to exchange it with your neighbourhood
- It helps you protect the environment by Monitoring all the local resources available
- It can be used to transform your resources in a profitable and sustainable source for providing services to your community. And help you keep safe the Biosphere!

[1]Third Industrial Revolution, as expressed by "Jeremy Rifkin"

- It keeps your home safe and interconnected, just like preserving the right for your privacy or transparency, giving you the chance to choose how to interconnect through other communities to all the world.

## 3.2 The 5 Pillars

The ToolKit takes its inspiration from the 5 pillars of Jeremy Rifkin's TIR[2] (TRI)[3], and comes to help citizens step into the Third Industrial Revolution era. The 5 Pillars of the Third Industrial Revolution are:

1. Distributed renewable energy sources
2. Active (**NZEB**) buildings
3. Hydrogen and Storage of energy
4. Smart grids
5. Zero Emissions innovative Mobility solutions

## 3.3 3 More Pillars

Following the 5 pillars to build a sustainable living, it fosters human beings to shift from a life style based on consuming resourcing and polluting the environment to a local circular economy based on 3 more essential pillars:

### 3.3.1 Energy efficiency

By producing energy with renewable sources which are by nature distributed equally around the world and exchanging it with our neighbours, by controlling our waste and polluting habits and transforming them into an energy source we help reduce the entropy and protect, respect and share our resources for a sustainable living.
The shift represents the move from a financial based market to a need service exchange society.

### 3.3.2 Product-Service System

Taking its origin from the sharing life style of the Hacker's Communities and the new artisans, the Makers, It influences the behaviour and redefines ideas regarding property and use.
Indeed, it entails the substitution from sale of a product to the sale of its use, that is, the value of a product is its use for the consumer, and hence the benefits that the user can gain from its use in response to a need, and no longer the simple fact of possessing the product.

### 3.3.3 Circular Economy

The circular economy recommends an end to the production of residues other than those that industrial and natural systems are capable of absorbing.
Therefore the challenge is the transformation of waste into raw materials that are reusable and reused in the design of new products or other uses.
The resources are shared between the locals to create a circular economy which increases the rate of man power for jobs which require more cultured people.

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[2] The Third Industrial Revolution; How Lateral Power is Transforming Energy, the Economy, and the World is a book by Jeremy Rifkin published in 2011

[3] TRI = italian form of TIR, we propose the TRI as the label for the TIR, TRI as the number 3, as the TRIangle, etc.

## 3.4 Smart Distributed Community Grids

If, on the one hand, fossil fuels require a centralised management system as a result of the massive investments that they require and their geographical concentration, renewable energies on the other hand, are by nature decentralised as they can be located anywhere on the planet. Their distribution now requires the implementation of a decentralised energy network such as the one that is currently being developed around the world. They are what is known as smart networks or “smart grid”, the development of which has just started.

Consequently, it becomes necessary to review the transport and energy distribution networks towards a model which enables the widespread of autonomous systems locally managed and remotely interconnected, capable of auto-reconfiguring and repairing themselves following the natural growth of the community they are hosting. One to Many Distributed Intelligent Networks on top of the Power Networks, to enter a new dimension of Service provisioning by integrating the communication and information technology in the urban application, in the rural environment, all around the citizens, an Internet Of Everything to build Smart Networked Communities.

A revolution is only an evolution, instead of a 1 solution to fit all, we are willing to provide a box filled with tools to build and maintain the infrastructures reliably and autonomously, because resilient networks need different Smart Grids, smarter devices for smarter people.

# Chapter 4

# Solution

## 4.1 IoT & IoE scenario

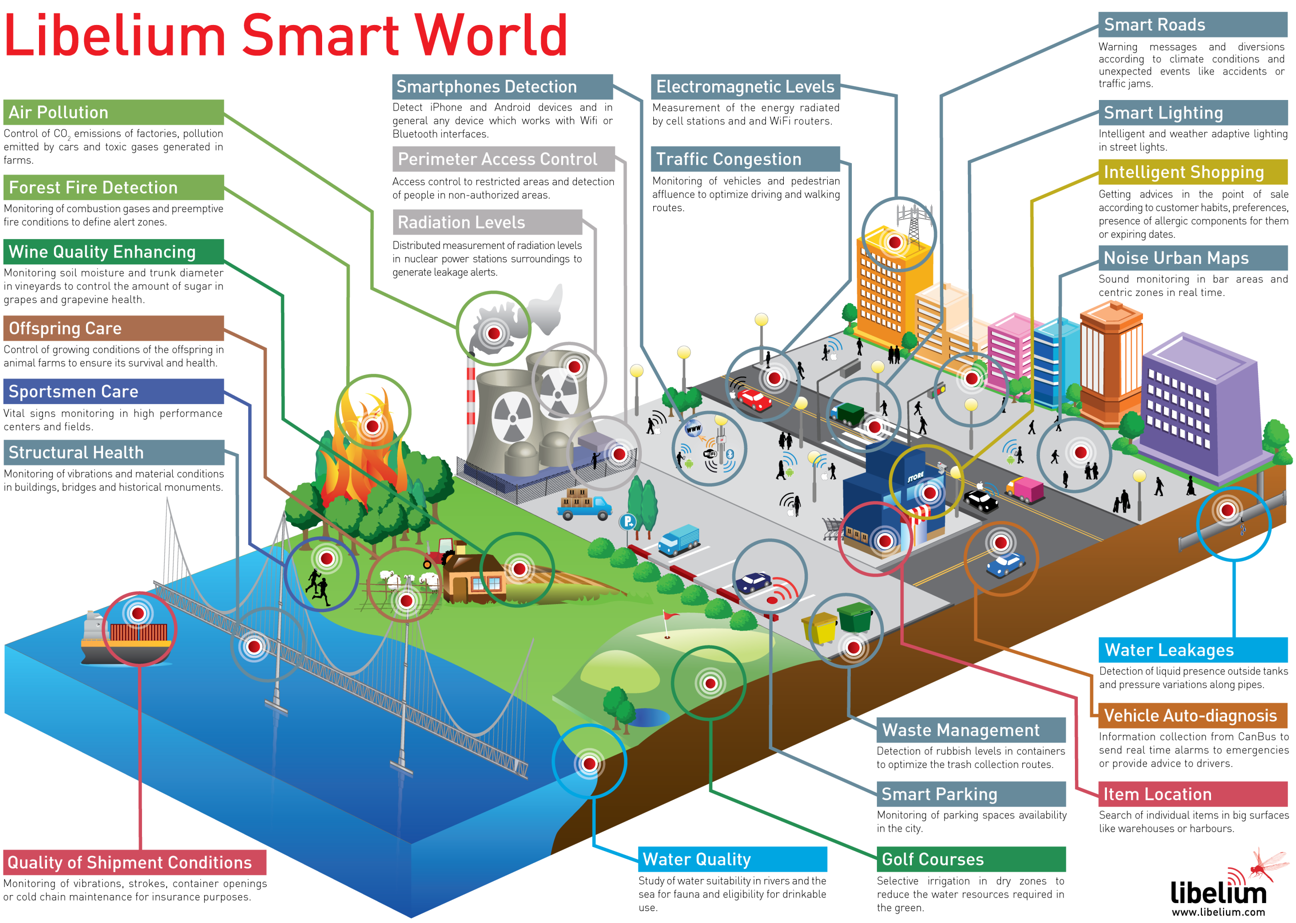


Figure 4.1: An example of IoT/ IoE scenario

The Internet of the Future (FI/FIRE Programs)[1] is one of the most active research topics on which the international communities research and invest.

[1]Future Internet Research and Experimentation (FIRE) is a program funded by the European Union to do research on the Internet, its prospects, and its future, a field known as "future Internet".

Access to the Internet through wireless networks such as 4G/LTE and WiFi are available to an always growing number of Internet users, able to access applications anytime anywhere. Even the objects of our everyday life, such as cars and electric appliances, are getting connected to the Internet increasing our capacity to interact and share tasks with the surrounding environment and neighbours. Many cities as well as many natural resorts will be filled with sensors connected to the net, so to allow us to report and predict hazardous situations or natural disasters or simply to interact directly with the environment. Already we can assist to a revolution of the DIY process, 3D printers, FabLabs and the Maker Community are completelly changing the way we produce and use objects. The management of energy resources will soon be another service of the Internet, becoming the tool to improve efficiency in the generation and consumption of energy to reduce environmental impact. A new social class of Prosumers is growing, but also more conscious and interacting with an Augmented Reality. To support it we need smart, distributed, resilient infrastructures.[2]

The challenge is to comprehensively and consistently address the multiple facets of a Future Internet, with energy efficiency as an important societal concern to implement transparently.

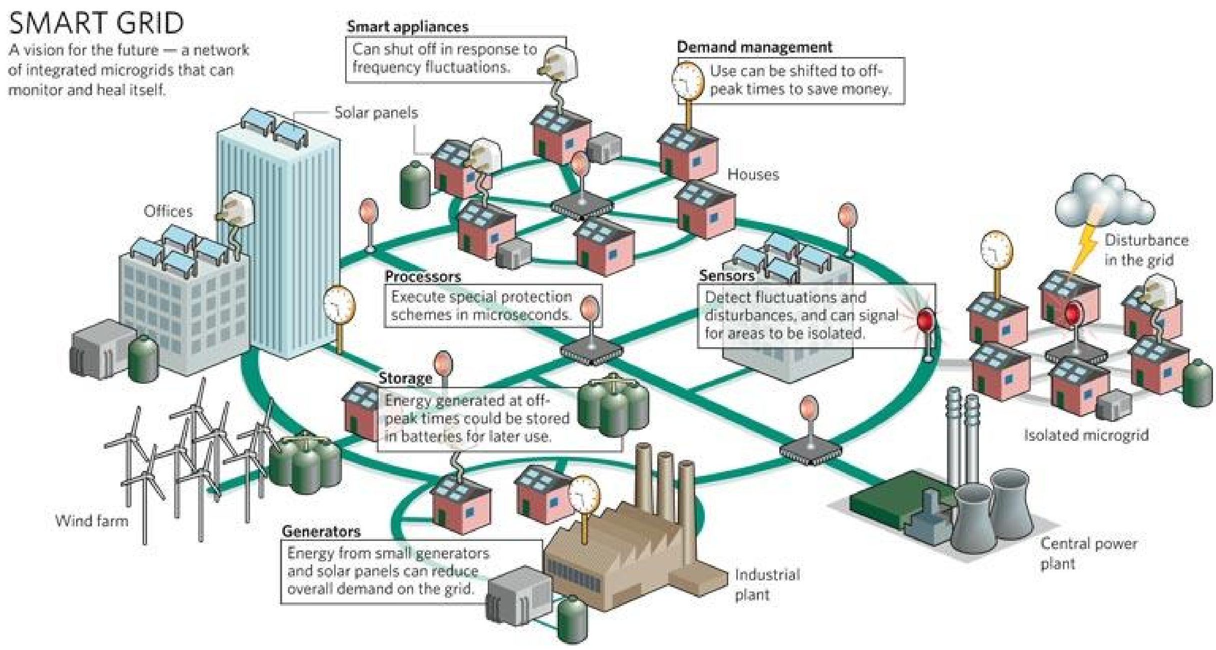


Figure 4.2: a Distributed Smart Grid model

## 4.2 MESH Networks as *BackBone* for the Smart Grids

> The current Internet architecture was not designed to cope with the wide variety, and the ever growing number of networked applications, business models, edge devices, networks and environments that it has now to support. Its structural limitations in terms of scalability, mobility, flexibility, security, trust and robustness of networks and services are increasingly being recognised world-wide.

To prepare ourselves to a future of interconnected communities that exchange energy and data among each other, we need to implement infrastructures where services and resources can easily be integrated without braking down the Internet. It is also extremely important to assure control over

[2]MESH Networks are a valid technology for distributed autonomous networks, as the CETRI-TIRES recognized, and as addressed during some of the workshops of the FIRE Program.

the process of implementation with respect to Net-Neutrality[3] and Data Sovereignty[4] and support to applications of public and social relevance.

That is why we pay attention to how the *Network Layer* is developed, by taking into account these simple principles:

1. Decentralized and Distributed
2. Scalable
3. Evolvable
4. Autonomous
5. Universally Accessible
6. Secure
7. Permanent
8. Censor-proof
9. Fast-enough

MESH Networks are a good example of peer-to-peer networks because of their **decentralized and distributed network architecture**, which removes the *single-point-of-failure* of the actual centralized infrastructure, increasing robustness and autonomy.[5] As more nodes are added and demand increases, the total capacity of the system also increases, and the likelihood of failure decreases. If one node in the network fails, the whole network is not compromised. In contrast, in a typical centralized architecture, clients share only their demands with the system, but not their resources.

On top of MESH Networks we will implement the actual *Energy Distribution Grid* by means of devices able to route traffic of data related to information about the behaviors of suppliers and consumers, in an automated fashion, so to improve sustainability, efficiency, reliability and economics of the production and distribution of energy. In the *Prosumer* age, where a "**neighbour first**" model is adopted, reducing the distance and the loss of energy by sharing first the resources in the local area, can overcome the problem through which actual energy grids go through nowadays, **a good % of loss of power and a "less smart" centralized system**.

Of course, to be able to develop such networks and demonstrate their reliability, we have to keep in mind *Openness* and adopted *standards*.[6] And to implement those infrastructures without upsetting existing ones, we will build step by step distributed autonomous networks with the ease of modifying software administering routing services on standard UNIX like systems, and substituting routing hardware managing backbones in crucial exchange points.
Furthermore, by interconnecting the different networks with proper "**Smart Meters**" and "**Sensors**" which disseminate the energy main exchange nodes to local areas and territories, we will be able to lead the path to a well **distributed Smart Grid**.

[3] An overview about: Network Neutrality
[4] What is Data Sovereignty
[5] Mesh Networking
[6] The OLSR protocol is a widely adopted OpenSource Mesh Protocol

### 4.2.1 Network Solution

MESH Networks can easily be implemented on top of actual fiber, cable or wireless networks by simply substituting part of *BackBone Routers* which manage interconnection to different **LAN** and **WAN** networks with **Mesh Routers**, like the ones previously provided by Mangrovia. And installing new nodes where critical *POF* (Point Of Failure) of the actual network are incurring. As stated in the **??** of this document, the goal is to interconnect the different infrastructures which provide the services and resources distribution, thus the new nodes implementation has to occur in strategic points where the services of the community have to be exchanged and offered. We try to show an example in Figure Figure 4.3.

Once all the different infrastructures are connected, the system complexity has to be administered easily, and has to be prepared to communicate with neighbour peers. Although the effort for this task is mainly dependent on how well organized are the networks and on the software choosen to keep track of the nodes and the **Name Service**[7] system. This can easily be implemented with the integration of our Tools for a Third Industrial Revolution Community (as shown in Figure Figure 4.6) and the CONFINE Project.

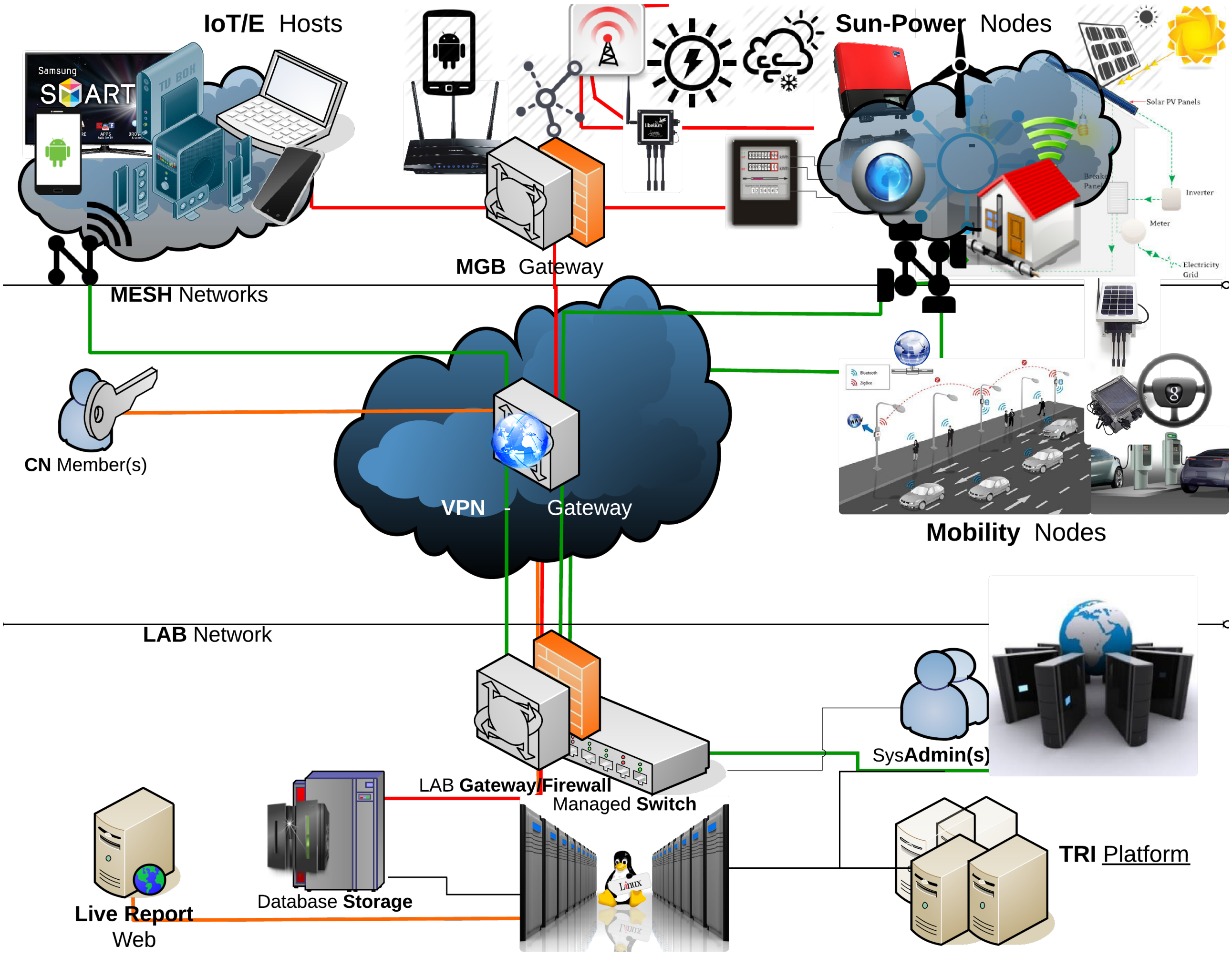


Figure 4.3: Solution Description: it shows different Use Networks interconnected to each other, and administered through Platforms

[7]DNS Name Service

This is possible because the Internet was developed not to relay on a hierarchical system, but around its **Protocol Suite**[8] and the provision of an easy accessible AS (Autonomous System) model.[9]

### 4.2.2 Architecture

The Architecture here shown in Figure Figure 4.5 represents how the **Home Router** (here called **MGB**) or a **Smart Meter** communicates with the **Databases** delivering sensible data not only about the connection status, but mostly about **energy** related events and tasks. All the information contained in the data transferred is accessible from remote by the **owner** of the data. The Router communicates also autonomously with the neighbour peers, but it still needs to keep privacy and control over the data transferred. For this reason the software installed on the devices has to be reliable, secure and trustworthy. For this purpose, thanks also to the collaboration with the Dyne Foundation, we have choosen to implement the Dowse software suite.[9]

We are presenting here a schema of the **Architecture** of the system, but we are not getting deeper in the argument because this is mostly defined by the CONFINE Project for the "**NODE Database**", and because this paper is meant to provide a simple description of how we are going to realize *Smart Grids*, by narrowing the gap between Networks and Energy Grids with the implementation of a mixture of tools ranging from **Mesh Routers** with secure F.L.O.S.S. software, **Smart Meters** & **TRI-directional Power Counters**[10], and **Platforms** built around DLTs for the monitoring and governance of networking and energy distribution.


(a) Confine FP7 Project (b) Mangrovia.Net Gateway Box (c) Dyne.Org F.L.O.S.S. Foundation

Figure 4.4: Software + Hardware Adoptions

[8] The Internet Protocol Stack

[9] AS Guidelines, RFC-1930

[10] The TRI-directional Power Counter takes its origins from the Cetri-Tires Technical Table and is actively being developed by Mangrovia.Net

### 4.2.3 Architecture of the Platforms

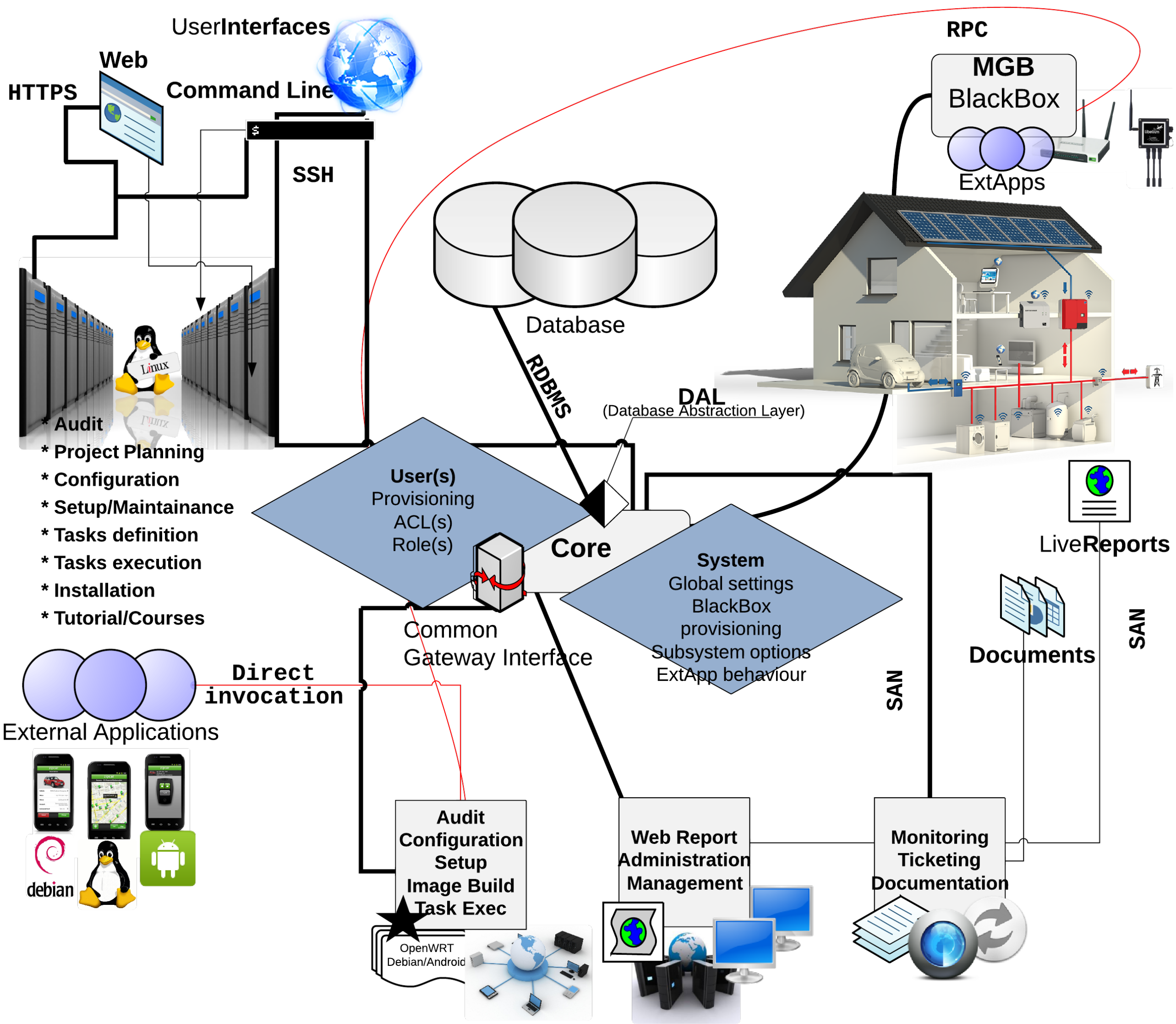


Figure 4.5: Architecture of the System Described

## 4.3 *Smart Grids*: Distributed & Decentralized Grids

### 4.3.1 Sustainable Energy Grid

To roll-out a well implemented *Smart Grid* technology, it is necessary to do a fundamental re-engineering of how the industry is providing electricity services. Nowadays we face a reality of different technologies of communication which are not uniform, neither fully integrated. To make an example, some industry standards are offering the possibility to monitor the services over Power Lines, but this technology, like standard modem connectivity are not suitable for *Broadband* communication. On the other side, actual *data acquisition* systems[11] are not easily integrable with standard network connectivity.
Until now there is still no universal definition of what features represent a *Smart Grid*, but we can agree upon some basic characteristics which are enablers for an integrated communication model allowing information and data exchange and real-time control, necessary prerequisites for an higher **system reliability**, **security** and better **assets utilization**:

1. Sustainability (a better distributed model can make better use of renewable energy source)
2. Efficiency (a better *Load Balancing*, and faster *Demand/Response* action can help in reducing losses and wasted resources)
3. Reliability (technologies which improve *Fault Detection* and *Self-Healing* of the grids)
4. Flexibility (infrastructures which handle better the always changing energy flaws determined by the *distributed generation* nature of renewables which influence an always changing **network topology**)

For these reasons, for the nature of distributed networks and for the fact that **Broadband Connectivity** is becoming widely adopted world-wide, we are confident upon the union of **Network** technologies and **Smart Devices** applied to the **Energy Grid** for a rapid, reliable and successful implementation of **Smart Grids**. An example is provided in Figure Figure 4.6.

[11] ie. SCADA

### 4.3.2 Smart Grids for Smart Cities

In the figure below we show the process needed to retrieve the value of energy produced by a single unit if connected to the local community once the services are connected to a *Smart Grid* which serves as a distribution infrastructure for the energy produced and consumed in the territory, but which has to be distributed among the peers so to establish a decentralized infrastructure and regain what normally gets lost within a *Circular Economy* model.
For this value we call it **CC, Community Credit** and represents the value of production from the single stake holder. The same model applies to any other "service" or "solution" produced and shared in the community.

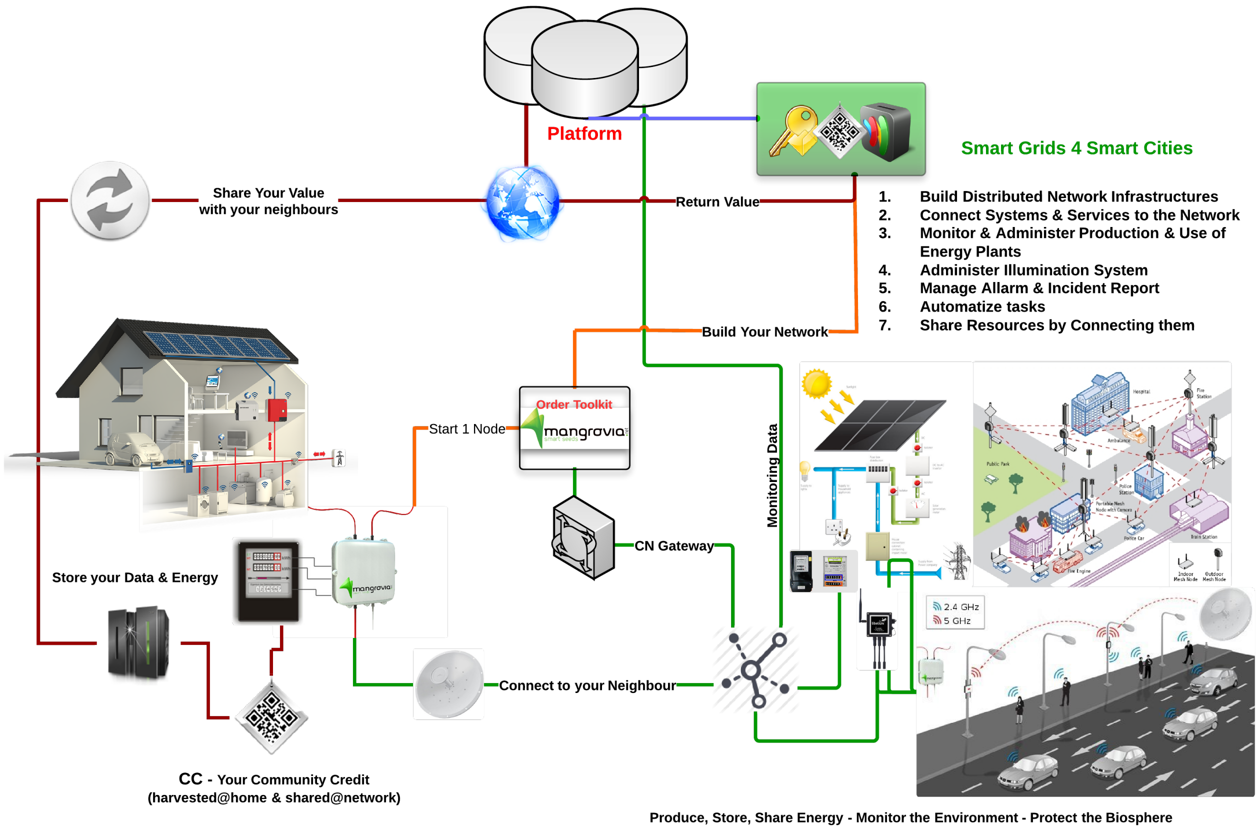


Figure 4.6: Networks & Energy Grids for a *Smart Grid*

#### 4.3.3 Production & Distribution

#### 4.3.4 Smart Meters

#### 4.3.5 DLTs

# Chapter 5

# Adoption

Taking into assumption what expressed in the previous *Smart Grids*: Distributed & Decentralized Grids chapter, and taking into account the fact that we already are active on projects that try to implement the different aspects of the presented scenario[1], we propose the Tools for a Third Industrial Revolution Community ToolBox[10] as a solution which can easily be adopted and propagate around thanks to its multi purpose function.
Right now, technology has reached great quality standards. The relative fair costs of production and the higher accessibility diffusion together with a stronger support to the implementation of **network connectivity** and **smart devices**, surfing the wave of the newly growing IoE market (as shown in Figure 5.1), can lead to a great path of widely distributed smart grids.

Local Autonomous Smart Communities interconnected each other, living a more sustainable life where the ecosystem is in balance with the local entropy produced by the community, protecting the BioSphere while profiting from it.
Due to our main activity and experience, we are proposing a model where **CN**[2] Community Networks can be seen as a fast enabler for *Smart Grids* around **Smart Communities**.

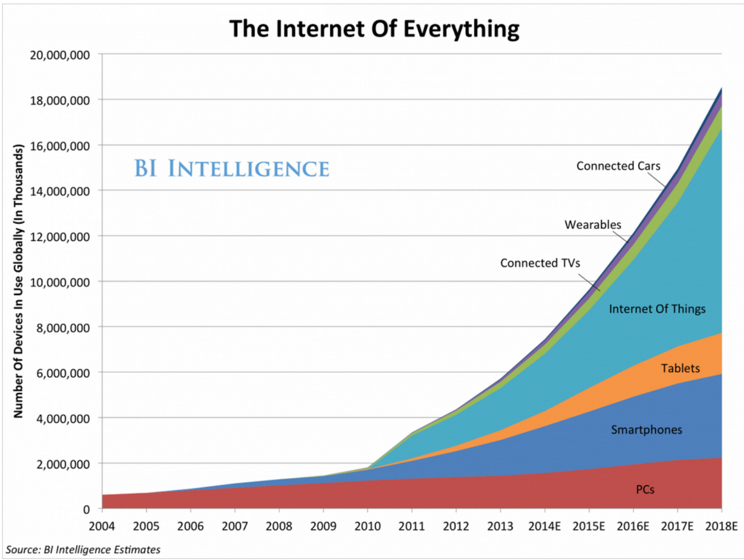


Figure 5.1: IoE market prevision

In the Figure 5.2 shown on next page we present a standard model where 1000 families, 100 local activities and 1 municipality, sticking together can already implement the enabling Broadband Network Infrastructure by savings from their actual 3 years expenses for lame ADSL/ DSL connectivity solutions. Of course it is not needed to start from the "Internet Connectivity Service" to implement such kind of smart grids. Depending on the requests and needs of the communities, the process could start from the installation of Renewable Energy Plants, or by a process of efficiency of public illumination. But anyway, only through the

[1]We are installing Mesh Networks, we are opening them to the communities they relate to; we are installing systems to manage the energy distribution and their monitoring in locally distributed area; we are building platforms to manage those services which get connected; and we are developing a *crowdsourcing/ crowdfunding* and *marketplace* support solution for the communities.

[2]Wireless Community Networks but any Community Network in general can be considered thanks to the ToolKit solution.

adoption of a **Smart Distributed Community Grid** we can assure that all the assets of a local community and the value of each single member (ie. citizen) can equally and securely be shared between all the shareholders.

## 5.1 Example of a Smart Distributed Community: CN Process

In the figure here below we present an example of one project developed following the model proposed. We start from the step related to building the connectivity as "Internet Common Good" because, even if "Smart Grids" are the 4th Pillar of the TIR[6], it is the 1st step need to be able to enable the services to be shared between the neighbours in the Community. Once established the common goal to get together and connect the services to the network, the process begins by acquiring the 3.1Toolkit for the MESH Networks, and connecting to it the services needed. The next step will be the Toolkit for the Energy Grids, because is the 1st Pillar of the TIR, and because is the service which mostly influences the economy of the locality.

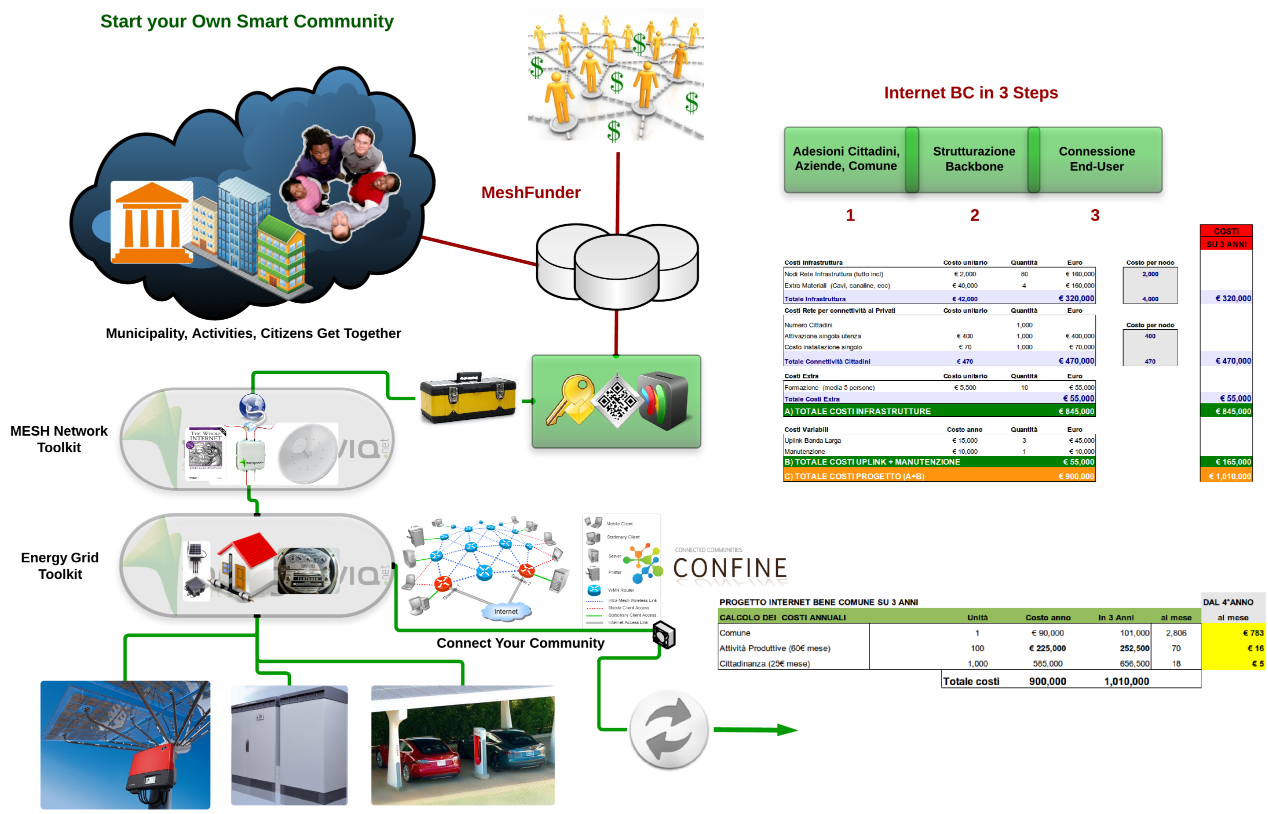


Figure 5.2: Smart Distributed Community Grid

# Chapter 6

# Acknowledgments

After many years of experience matured in the fields of *Networking* & *Routing*, following the happenings around the **Community Networks**[11] projects developed in different European Countries, and the collaboration with the activists from the **CETRI-TIRES** no-profit Organization, in year 2014 Alex (acme) D'Elia has written this document which was originally conceived as the Tools for a Third Industrial Revolution Community solution.
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## 6.1 License of this document

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