Fusing new energy with green mobility

For our 5th newsletter, we talked to Shanshan Jiang, Technical Manager of the GreenCharge project based at SINTEF in Norway.

The underlying concept behind GreenCharge is smart and green charging that is built upon cross sectorial collaboration, involving businesses and technical systems from three sectors:

- Transport – to support users' mobility needs and electric vehicle (EV) charging demands

- Electric energy supply – to manage smart energy use and its storage

- Buildings – to coordinate energy use across consumptive activities in neighborhoods

Electric vehicles, charge management and local energy management need to work together – this is essential to facilitate smart EV charging with green energy. The integration of the three sectors is highly complex as many stakeholders with different motivations and concerns are involved. In many instances there are legacy systems with different scopes to be integrated. Yet currently there is a lack of standards to support such integration. This is what GreenCharge has been exploring and trying to overcome the challenges for the past three years.

A "reference architecture" for complex smart and green EV charging systems

The RA is generic and holistic, describing a possible architecture open to different specific underpinning technologies. The Reference Architecture serves as a blueprint for the planning and construction of GreenCharge demonstrators in the pilot sites, and at the same time, supports deployment and further exploitation outside the project.

The term "reference architecture" means that the focus is on the integration of logical services, from different providers. The detailed realisation of the physical system which contains these software services is not emphasised and

To cope with the complexity and bridge the different sectors, we need a full-fledged specification for the ecosystem for smart and green charging. In GreenCharge, what is known as a Reference Architecture (RA) provides such a specification. It contributes to a common understanding of the GreenCharge concept and supports the integration of legacy systems into the ecosystem in a well-defined way.

may differ from system to system, depending on the provider. However, they must be compliant with the RA.

To understand the role of the GreenCharge RA and its intended use, we will give a brief description of its content with some examples and show how GreenCharge uses the RA in the demos on the following pages.

Keep in touch with GreenCharge for further information.

Shanshan Jiang, SINTEF

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The role of the GreenCharge Reference Architecture

The GreenCharge RA is a reference architecture for a system of systems as it provides a well-defined way for the integration of three sectors – transport, electricity, and buildings - and the integration of legacy systems.

Our approach to realising the GreenCharge concept is to extend the functionality of and the collaboration between these already existing systems.

In GreenCharge, each of the demonstrations being run in the GreenCharge pilot cities of Barcelona, Bremen and Oslo involves local businesses with their own existing systems and technologies. Each demonstration thus implements a subset of the GreenCharge concept according to the local needs and context. Each aims to adapt the selected technologies to comply with the specification of the RA, which ensures that these systems are able to collaborate and function smoothly together.
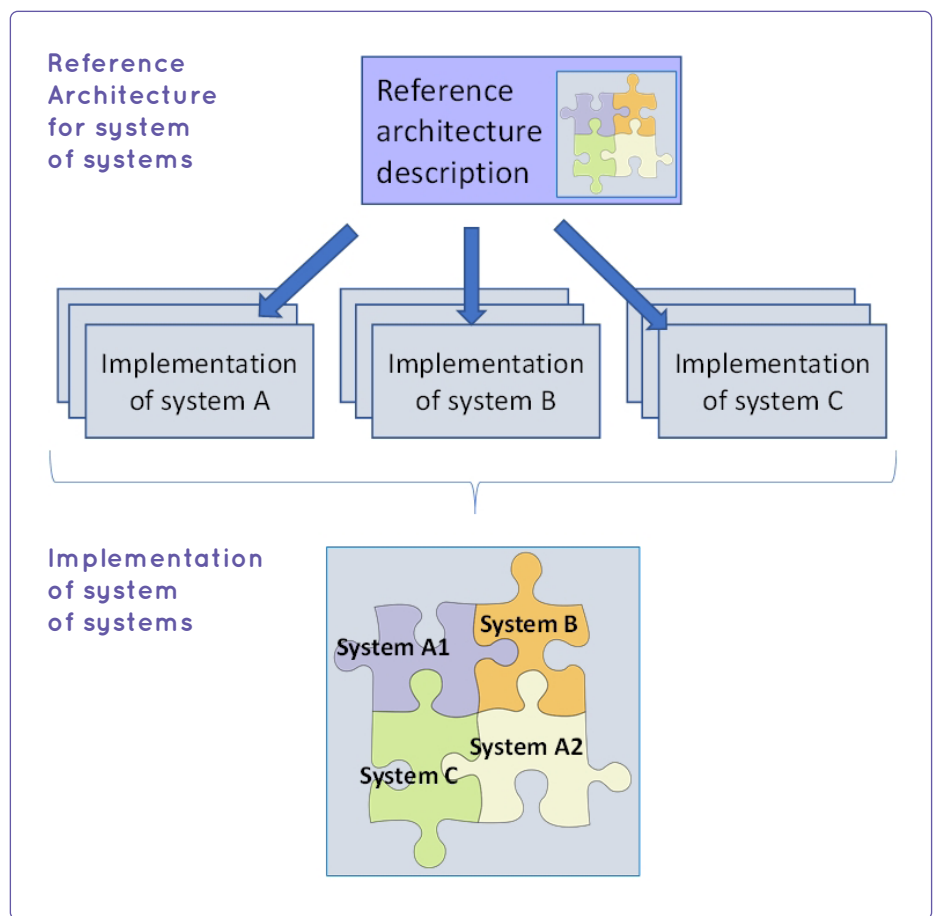
The Reference Architecture specifies:

- the new and/or added responsibilities,
- adapted/extended functionality,
- new collaboration patterns, and
- new/changed interfaces for realizing the "system of systems".

The role of the GreenCharge Reference Architecture

Intended readership and content of the RA

The content of the RA is categorised according to the required technical competence to understand it. Some diagrams describe the GreenCharge concept without requiring technical knowledge (the below green and yellow categories), for example, motivation diagrams describing the stakeholder concerns and use case diagrams describing functionality in the context view.

For stakeholders who are interested in a deeper insight into smart and green charging, the RA provides an overview of the GreenCharge concept.

For example, policy makers can benefit from this understanding and get a better position to influence the transition towards sustainable eMobility. Commercial actors within eMobility can get a better understanding of the role they can play and obtain input on the requirements to their system components and services/products.
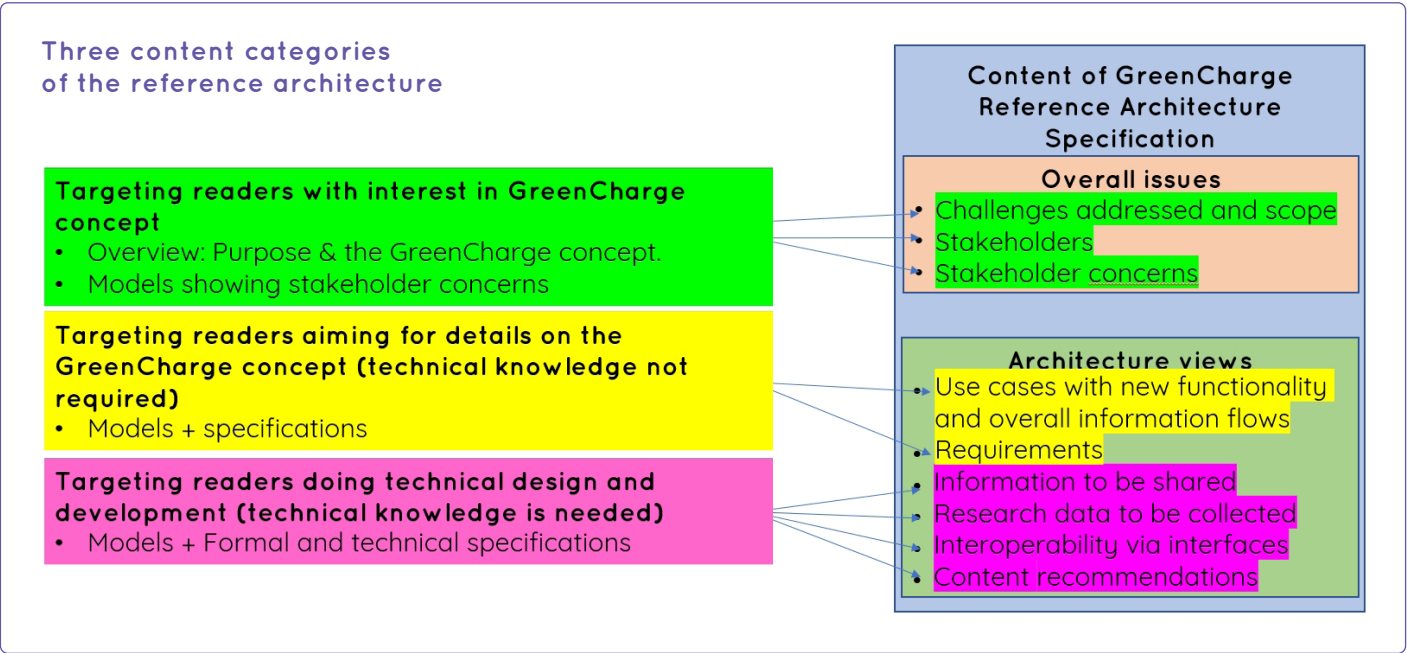
From a cities' perspective, we believe most transport and mobility officers will be concerned with the overall issues and basic architecture views. However, trusted suppliers and partners local authority officials work with and rely on will need to understand the technical specification ("architecture views") for designing such a smart and green charging system.

Such "architecture views" are comparable to architecture drawings of a building with different views and models using diagrams with standard software modelling notations and various technical details.

The most advanced diagrams are formal technical specifications with details for software implementation (the red category), for example, component view with system information model specifying information to be exchanged, system component and interface model as well as collaboration model for interoperability via interfaces.

For technology providers who plan to design and implement smart and green charging, the RA provides specifications that can serve as input to their software engineering processes.

Details and more information can be found in project deliverables D4.1 and D4.2 at: **www.greencharge2020.eu/deliverables**

Three content categories of the reference architecture

Targeting readers with interest in GreenCharge concept
- Overview: Purpose & the GreenCharge concept.
- Models showing stakeholder concerns

Targeting readers aiming for details on the GreenCharge concept (technical knowledge not required)
- Models + specifications

Targeting readers doing technical design and development (technical knowledge is needed)
- Models + Formal and technical specifications

Content of GreenCharge Reference Architecture Specification

Overall issues
- Challenges addressed and scope
- Stakeholders
- Stakeholder concerns

Architecture views
- Use cases with new functionality and overall information flows
- Requirements
- Information to be shared
- Research data to be collected
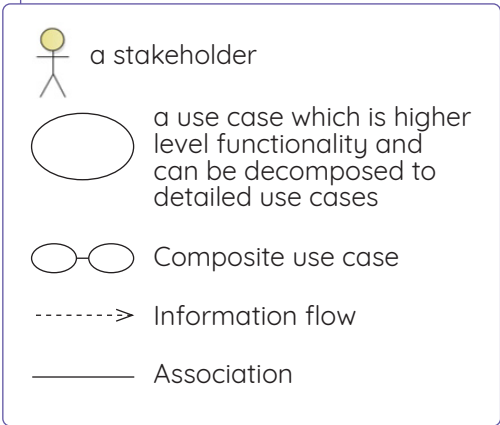- Interoperability via interfaces
- Content recommendations
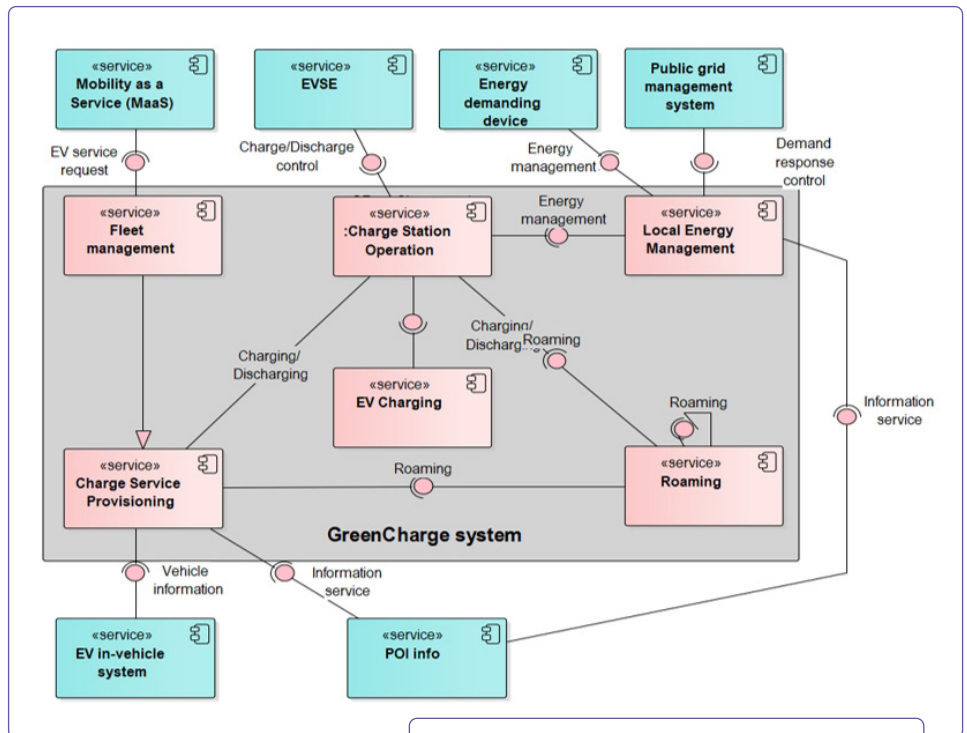
The role of the GreenCharge Reference Architecture

Communicating the systems
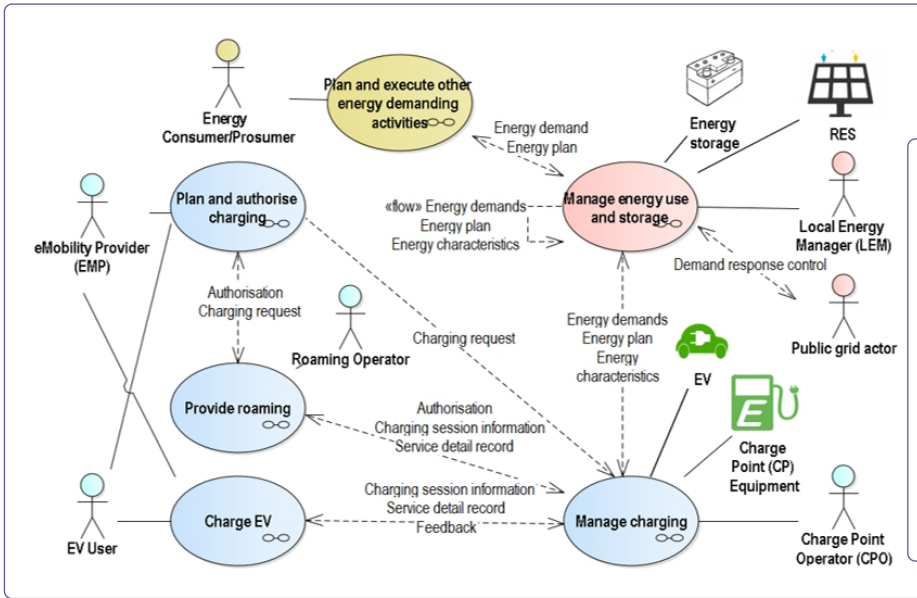
An overall diagram describing new functionality and overall information flows in the charging system.

Legend:
- a stakeholder
- a use case which is higher level functionality and can be decomposed to detailed use cases
- Composite use case
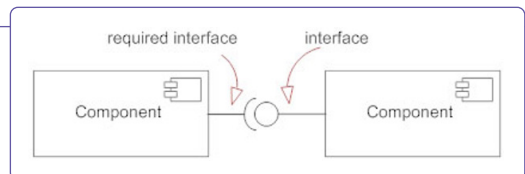- Information flow
- Association

A more advanced diagram showing logical services providing functionality and interoperability via interfaces.

Further information on graphics used in diagrams:

www.smartdraw.com/use-case-diagram
www.smartdraw.com/component-diagram
www.sparxsystems.com/enterprise_architect
_user_guide/14.0/model_domains/generalize.html

The role of the GreenCharge Reference Architecture

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To illustrate the use of the RA, in the following table we show the relationship between the "logical services" defined in the RA and the physical components/systems realising them in 3 of the 7 demos in the GreenCharge pilot sites. Each demonstration implements a subset of the features of the RA, in this case, electric car charging at different contexts (charge at home or at work).

Each RA service is realised by one implementation (software system or component provided by project partners) in each demo, either through new development in the project or by adapting / extending existing systems or components.

You can find out more background to the GreenCharge demonstrations by visiting the democards on the website: **www.greencharge2020.eu/ pilot-overview**

Service (stakeholder role providing the service) defined in the RA	GreenCharge Demo (implementation of system of systems)		
	Energy smart housing cooperative in Oslo	Charging at work in Bremen	Energy smart workplace in Barcelona
Charge service provisioning – EV charging app (EMobility Provider)	ZET.charge APP (new)	PMC "GreenCharge" App (new)	Eurecat Booking App (new)
Charge station operation & EV charging (Charge Point Operator)	Fortum charge & drive management system (adapt / extend) ZET charge algorithm (new)	PMC gridctrl.ENCORE (adapt / extend)	Eurecat charge management system (new)
Local energy management (Local Energy Manager)	eSmart Connected prosumer platform (adapt / extend)	PMC gridctrl. aggregator (new)	Eurecat SEM scheduler and forecaster (adapt /extend)

GreenCharge Uptake Cities – What's up in Porto?

Up to 12 Uptake Cities will learn from the three pilot GreenCharge cities, through site visits and an advanced webinar programme. The included cities are still at early stages of their electric mobility journey, who seek to learn from our GreenCharge pilots and demonstrations. In this issue we hear about electric vehicle strategies from our friends in Porto, Portugal.

Electric charging stations are set up and running in Porto

Porto already provides 12 electric charging stations (PCE) for automobiles, in eight different locations within the municipality. This measure is part of the municipal strategy to promote an increasingly less polluting city. Ten spots are already in place, out of 15 estimated charging stations.

Following the setup of two electric vehicles charging stations last February, one in the Rua de Leonardo Coimbra and the other in the Avenida do Parque, the setup of the new PCE in the city has accelerated over the past months with the implementation of another 10 charging stations, namely at the Praça Francisco Sá Carneiro (2), at the Avenida do Conselho da Europa (2), at the Rua do Doutor José António Marques (1), at the Rua de Henrique Medina (1), at the Rua do Jornal de Notícias (2), and the Rua de Nove de Abril (2).

The operators for the ten electric charging stations for automobiles are in place, following the **draw** held among the candidates. Permits were dispensed, alongside the respective public space license. Electric charging stations are now operating, with the estimates pointing that by October all equipment should be installed.

EDP Comercial, Horizondistance, Kilometer Low Cost and Mobiletric are the operators in charge of managing the ten car Electric charging stations, distributed throughout the city. The type of voltage is 50 kilowatts DC (direct current) and 43 kilowatts AC (alternate current).

The tender to implement electric charging stations was launched in the end of 2019 and the application deadline was held throughout the first two months of the year.

As regards the setting up of electric charging stations (PCE) in car parking, it will be implemented this year, with the Empark Company already expressing interest in the issue.

The Municipality of Porto has been pioneering electric mobility both by purchasing an entire municipal fleet of electric vehicles and promoting policies of positive discrimination and educational guidance in municipal parking.

See **here** the location of all the PCE already running in the city.

www.porto.pt/en/news/ electric-charging-stations-are- set-up-and-running-in-porto

Used with permission from the City of Porto.

Image: Filipa Britto / City of Porto

In Brief

EV News - EU Projects updates

USER-CHI project videos
4 episodes on emobility challenges from Barcelona, Turku, Murcia and Berlin now available:
www.youtube.com/watch?v=a0 fYC64ioqU&list=PLvzHLhum83v tT6cpfssA85GBh3489MM7H

Visit USER-CHI for further resources:
www.userchi.eu/products

CleanMobilEnergy new digital seminar series
Introduction event on 28 September 2021:
www.nweurope.eu/ projects/project-search/ cleanmobilenergy-clean- mobility-and-energy-for-cities/ events/cleanmobilenergy- digital-seminar-series-an- introduction-to-cme

EV Energy final conference materials
Presentations from event in June 2021 available for download:
www.interregeurope.eu/ evenergy/library/#folder=2968

Other EV News and updates

How to fit EVs into UK transport policy
Some still think electric cars are no panacea. Read more at:
https://theecologist.org/2021/ feb/23/electric-cars-are-no- panacea

Procuring EV infrastructure?
New handbook for public authorities on how to design tenders for e-charging infrastructure. Read more at:
https://ec.europa.eu/transport/ themes/urban/news/2021-02- 15-stf-handbook_en

GreenCharge in Brief

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Re-purpose. Re-charge. Re-think. Heritage and e-mobility at the crossroads

**Mark your calendars:
9th Informed Cities Forum to take place 26-28 October 2021!**

To celebrate the return of our popular interactive "un-"conference, not one, but two topics will be explored through the 9th Informed Cities Forum. Organised under the title: "Re-purpose. Re-charge. Re-think. Heritage and e-mobility at the crossroads", the Forum will cast light on cultural heritage and electric mobility.

Through a series of interactive sessions, we will explore how these topics align, and how problem solving, or specific processes might be addressed differently. Themes explored through the joint sessions include: How do experts from the different fields respond to the same administrative hurdles, how do they interact with interest groups and the public? How do we approach new technology? Do we see similar patterns, or different ones?

In addition, participants will be able to explore the individual topics of cultural heritage and electric mobility in more depth through deep dive sessions.

Unlike other online conferences, Informed Cities Forum is an interactive, collaborative event, which makes use of innovative formats, and is willing to explore unconventional topics. Active participation by the audience is not just encouraged, but is required, and will be rewarded with lively and energetic discussions.

Interested?
Join us on 26-28 October 2021 for this unique experience.

The 9th Informed Cities is co-organised by the **GreenCharge**, and **OpenHeritage** projects.

www.informedcities.eu/events/9th-informed-cities-forum

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Missed a copy?
See our previous newsletters at:
www.greencharge2020.eu/newsletters

Issue 1:
Introduction to Pilots

Issue 2:
Business Models

Issue 3:
Simulation of Impacts

Issue 4:
Roaming

Project Partners

SINTEF
Coordinator

eSmart SYSTEMS

HUBJECT

PNO

ICLEI
Local Governments for Sustainability
EUROPE

motil

pmc
personal mobility center

Fortum charge & drive

V: Università degli Studi della Campania Luigi Vanvitelli — Scuola Politecnica e delle Scienze di Base Dipartimento di Ingegneria

UiO : University of Oslo

Freie Hansestadt Bremen

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Due Spring 2022!
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