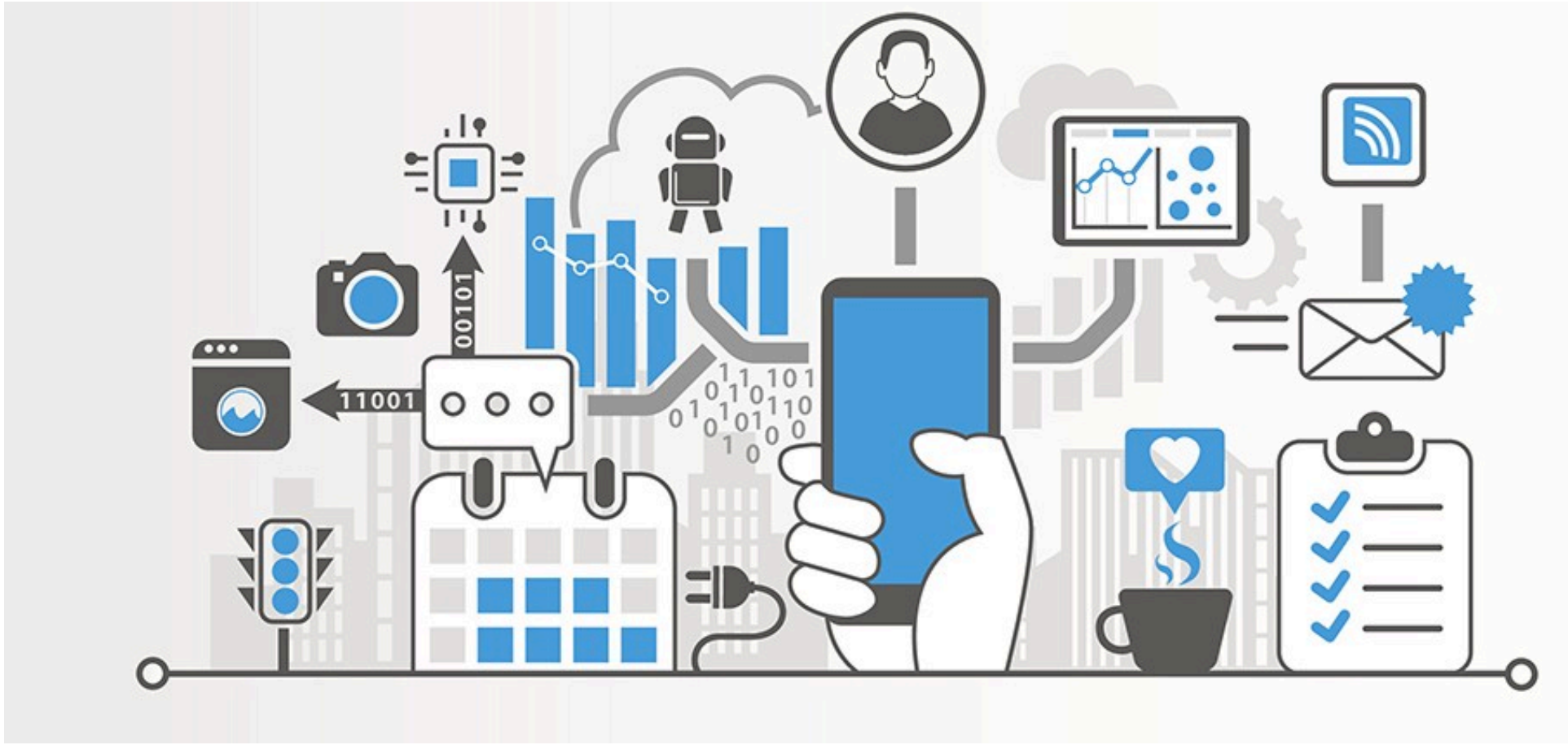
Programming for IoT Applications

Edoardo Patti

Lecture 12



SERVICES LIFE CYCLE

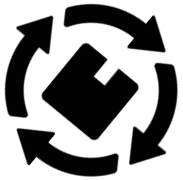
What is a **Service**?

The International Telecommunication Union (ITU)[1] defines Smart Sustainable City as *"an innovative city that uses ICT to improve quality of life, efficiency of urban operation and services…"*

The British Standards Institution (BSI) describes this innovative smart city as *"an effective integration of physical, digital and human systems in the built environment to deliver a sustainable, prosperous and inclusive future for its citizens".* The integration of physical and digital/cyber systems is widely known as *"Internet of Things"* or *"Cyber Physical Systems"*

[1] http://www.itu.int/en/Pages/default.aspx

What is a **Service**?



A smart city platform is an ecosystem composing of people, process, tools and technologies.

It can also be viewed as a system of systems, where individual, heterogeneous, functional systems are linked together *to realize and deliver novel services* (features/functionalities) *to end-users*.

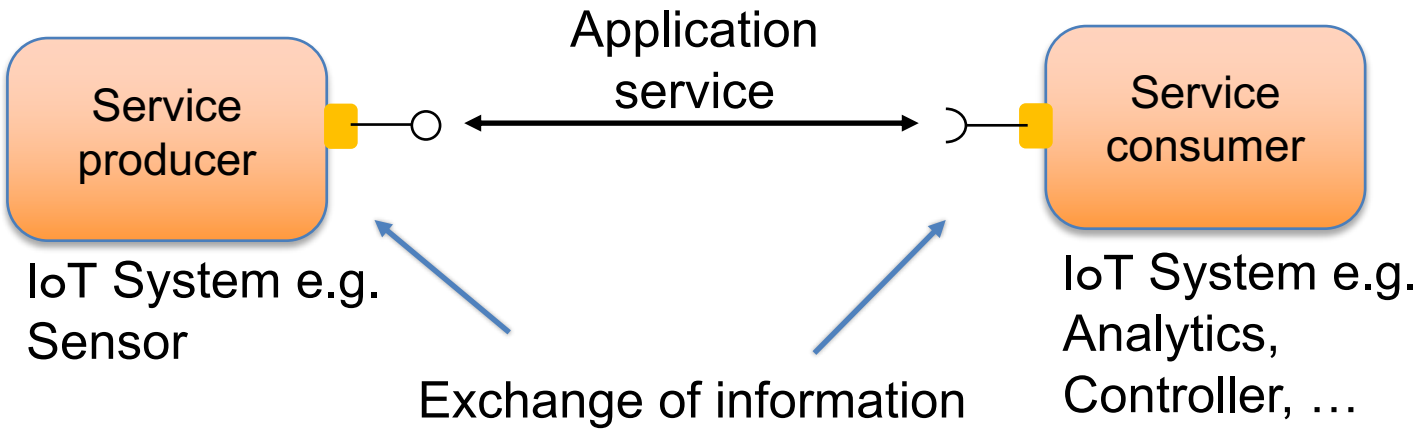
Such services are bound to a specific context and stakeholders' requirements.

What is a **Service**?

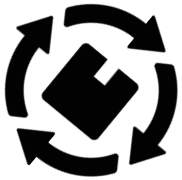
The Organization for the Advancement of Structured Information Standards (OASIS) defines a service as *"a mechanism to enable access to one or more capabilities, where the access is provided using a prescribed interface and is exercised consistent with constraints and policies as specified by the service description"*.

What is a **Service**?

- The term **Service** refers to a software functionality or a set of **software functionalities** with a purpose **that different clients can reuse for different purposes**.
- A **Service** can exchange information with other Services through communication interfaces over the Internet



Domains



Services for Smart City can be applied in many application domains that can be grouped and categorized when stakeholders have domain-specific and cross-domain concerns. For example:

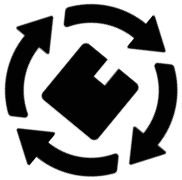
- Health
- Energy
- Transportation
- Environment
- Disaster recovery
- Agriculture
- Education
- Infrastructure utilities
- and many more…

Stakeholders

The ITU Focus Group on Smart Sustainable Cities categorizes smart city stakeholders into the following macro-groups:

- Municipalities, City Council and city administration
- National and regional governments
- City services companies
- Utility providers
- ICT Companies (Telecom Operators, Start-ups, Software Companies)
- NGOs
- International, Regional and Multilateral Organizations
- Industry associations
- Academia, research organizations and specialized bodies
- Citizens and citizen organizations
- Urban Planners
- Standardization bodies

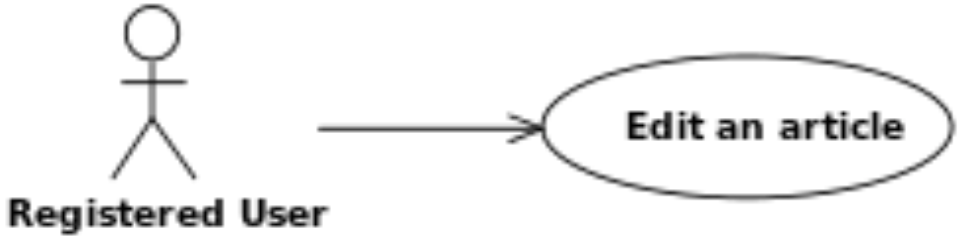
What is a Use Case?



In software and systems engineering, a **use case is a list of actions or event steps, typically defining the interactions between an actor and a system, to achieve a goal**.

The actor can be a human or other external system (either hardware or software).

Use case analysis is an important and valuable **requirement analysis technique** that has been widely used in modern software engineering.



Services life cycle

IoT-enabled services can vary in properties and level of complexity, based on the applicable use case.

The lifecycle aspect of these services has to be modelled.

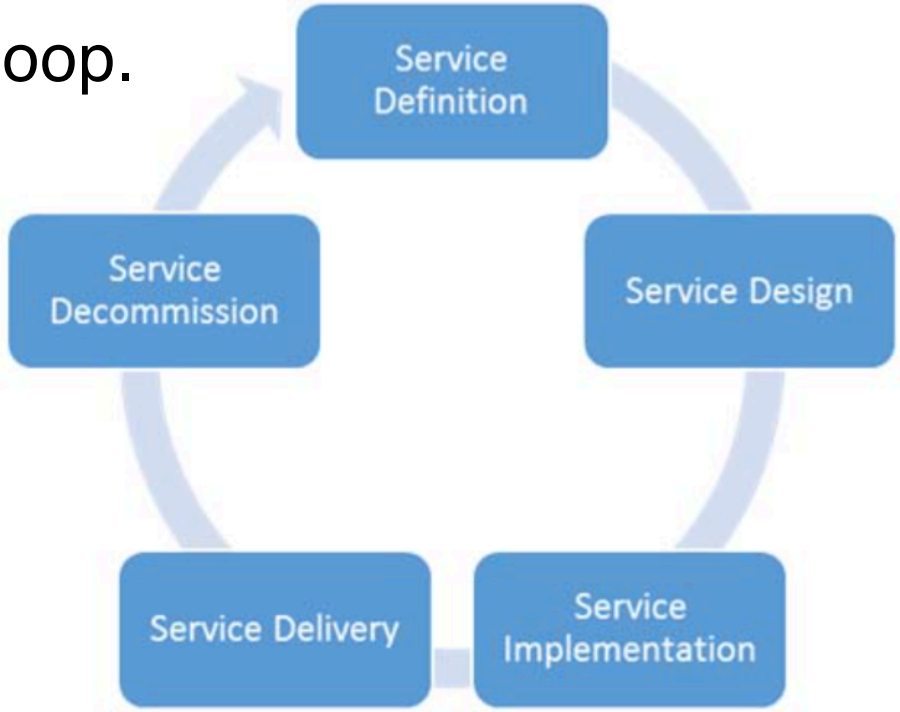
Services life cycle

IoT-enabled services can vary in properties and level of complexity, based on the applicable use case.

The lifecycle aspect of these services has to be modelled.

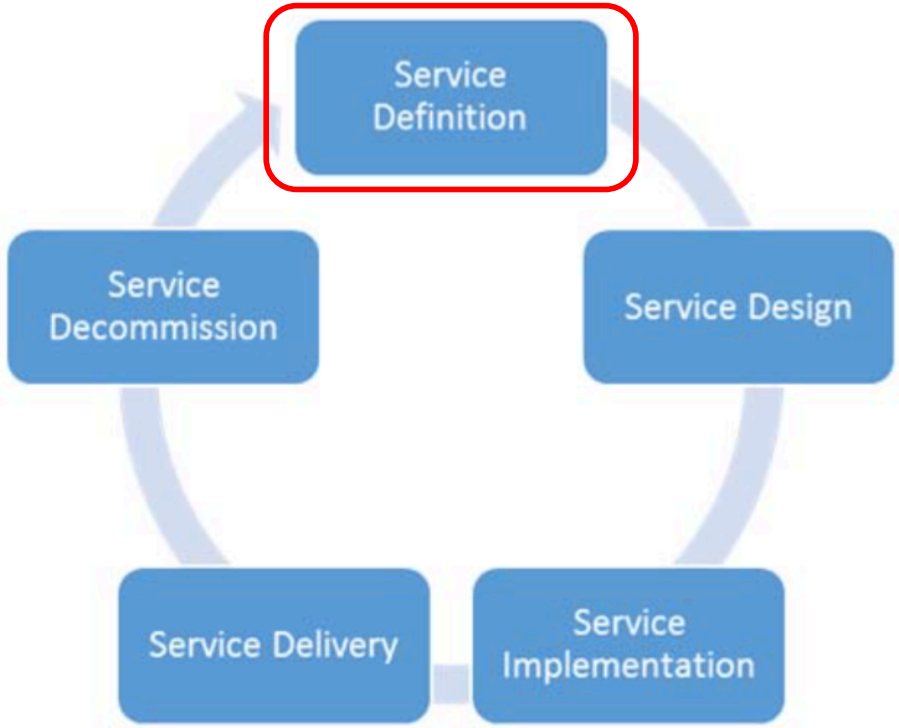
General Service Lifecycle is a loop.
The main phases are:

- Service Definition
- Service Design
- Service Implementation
- Service Delivery
- Service Decommission



Service Definition

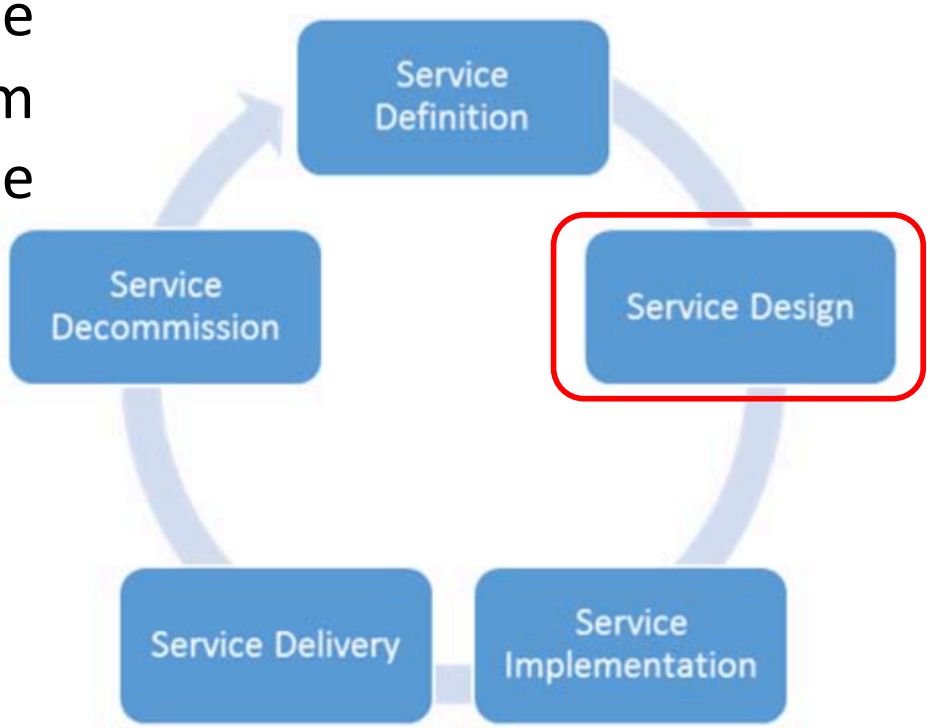
In the **Service Definition** phase, the service is described highlighting the main features and functionalities.



Service Design

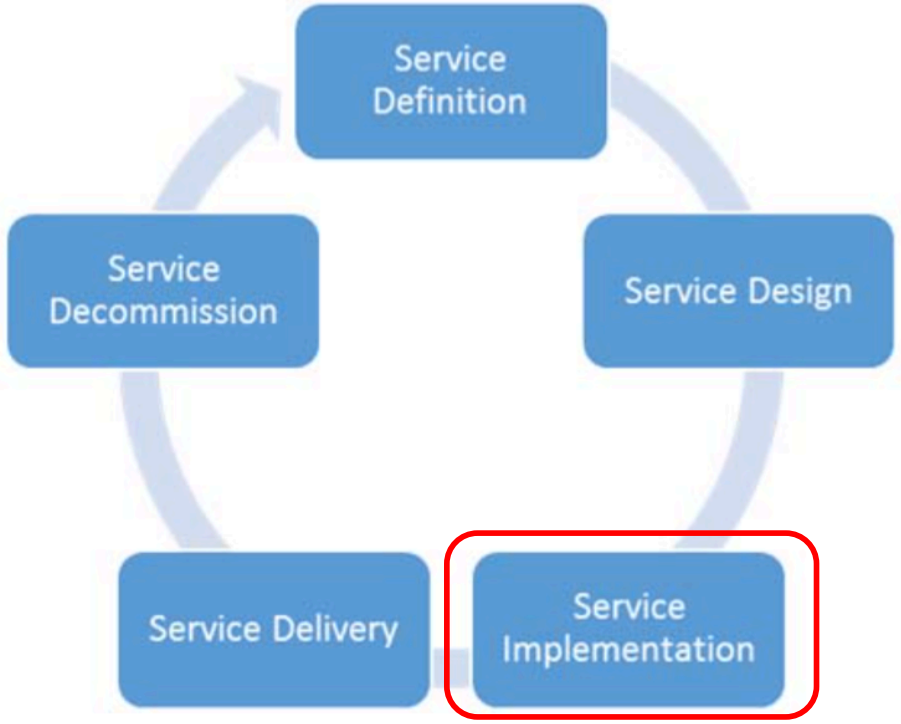
In the **Service Design** phase, **requirements are analysed** and functions, features, interoperability with other entities are identified.

Then, different service functions and requirements should be allocated to different system entities by modelling concrete use cases under different scenarios.



Service Implementation

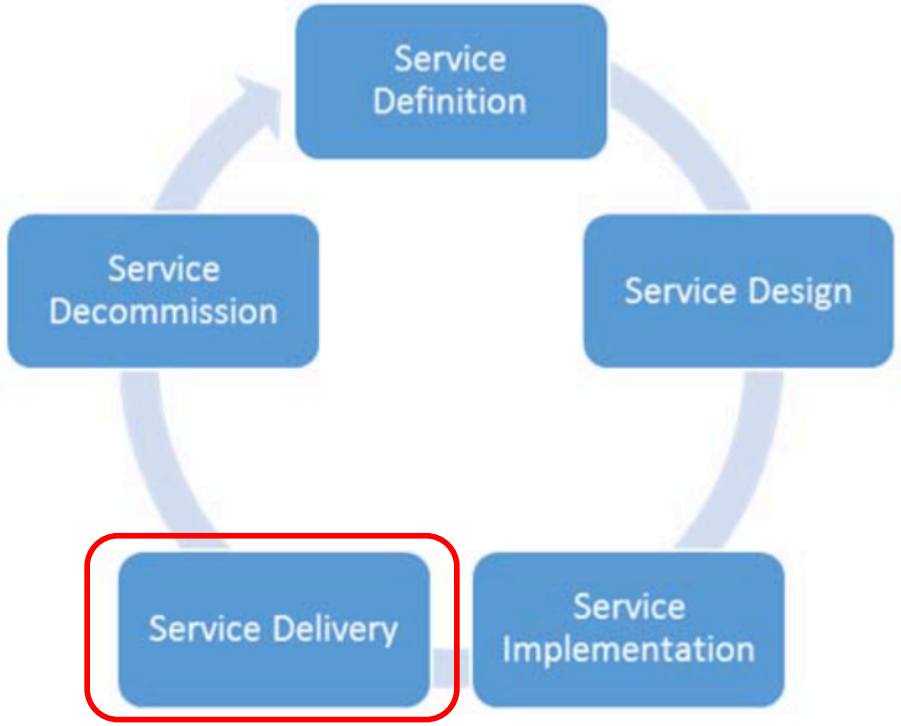
In the **Service Implementation** phase, **information exchange and interactions among system entities are ensured** through service integration, verification & validation and proper testing methodologies.



Service Delivery

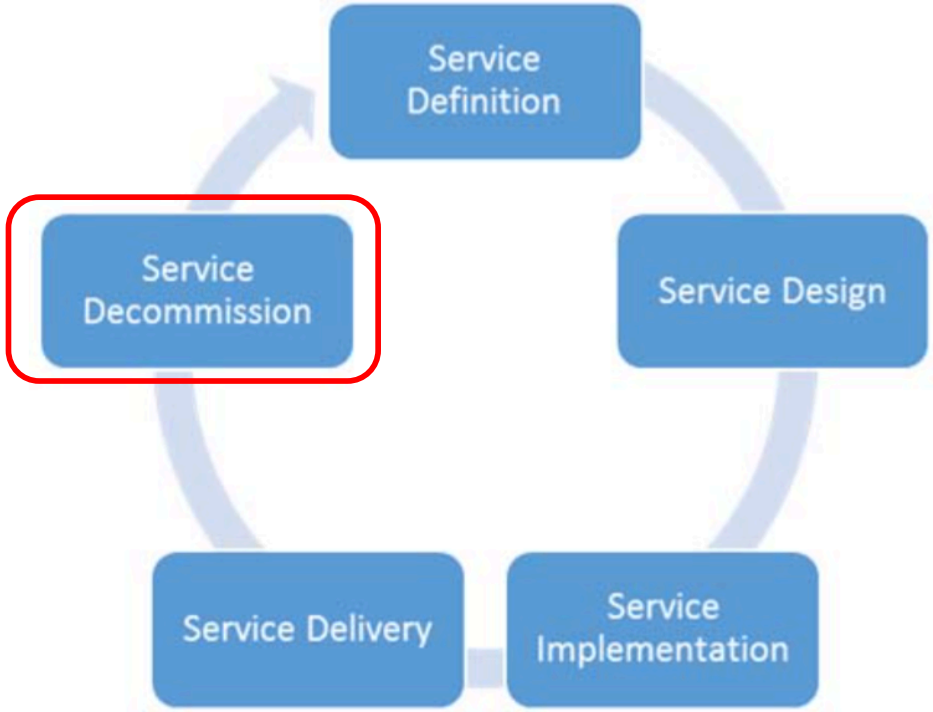
In the **Service Delivery** phase, service is continuously monitored to ensure meeting pre-set KPIs (Key indicators of performance).

Potential service improvements are identified that can enhance the service itself or become new service(s).



Service Decommission

The **Service Decommission** phase includes activities related to disposal or replacement of service or service components



Service (re-)Definition

The Lifecycle loop starts again for updating the service.

A re-definition of the service could be needed based on potential improvements resulting from previous phases.