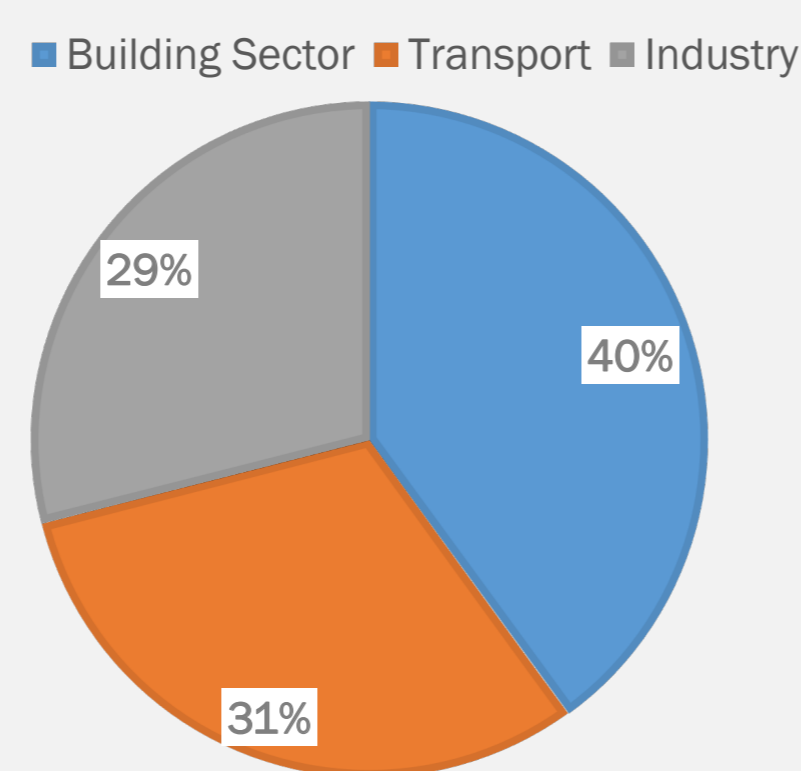


# IoT for Energy-Efficiency: connecting a serious game with energy metering in the EnerGAware project

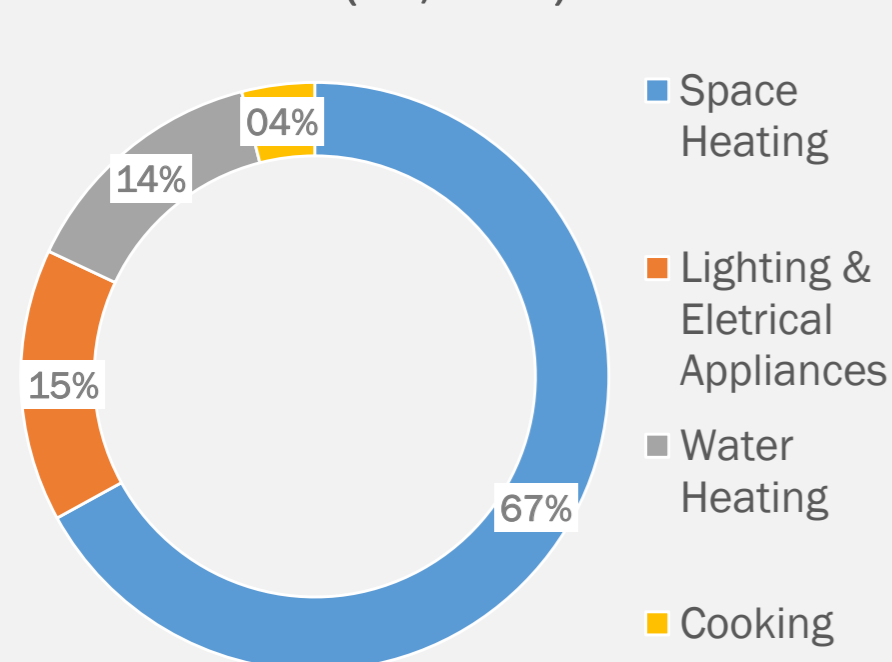
## Context

- About 40% of energy consumption in EU is in houses, offices, shops and other buildings
- According to the EU Council, the greatest saving potential is in buildings

ENERGY CONSUMPTION PER SECTOR (EU, 2011)



HOUSEHOLDS' ENERGY CONSUMPTION (EU, 2011)



- Energy in residential homes: 67% for space heating, and 15% for lighting & appliances
- Consumers have a key role reducing buildings' energy consumption

## Goals

- The goal of EnerGAware is to promote energy efficiency, enhancing users' behavioural change through serious games
- The project addresses existing houses, with an explicit orientation to the rational use of energy in buildings
- In the IoT domain, the goal is to develop a high-performance, scalable and interoperable SOA infrastructure to connect energy metering with the EnerGAware game

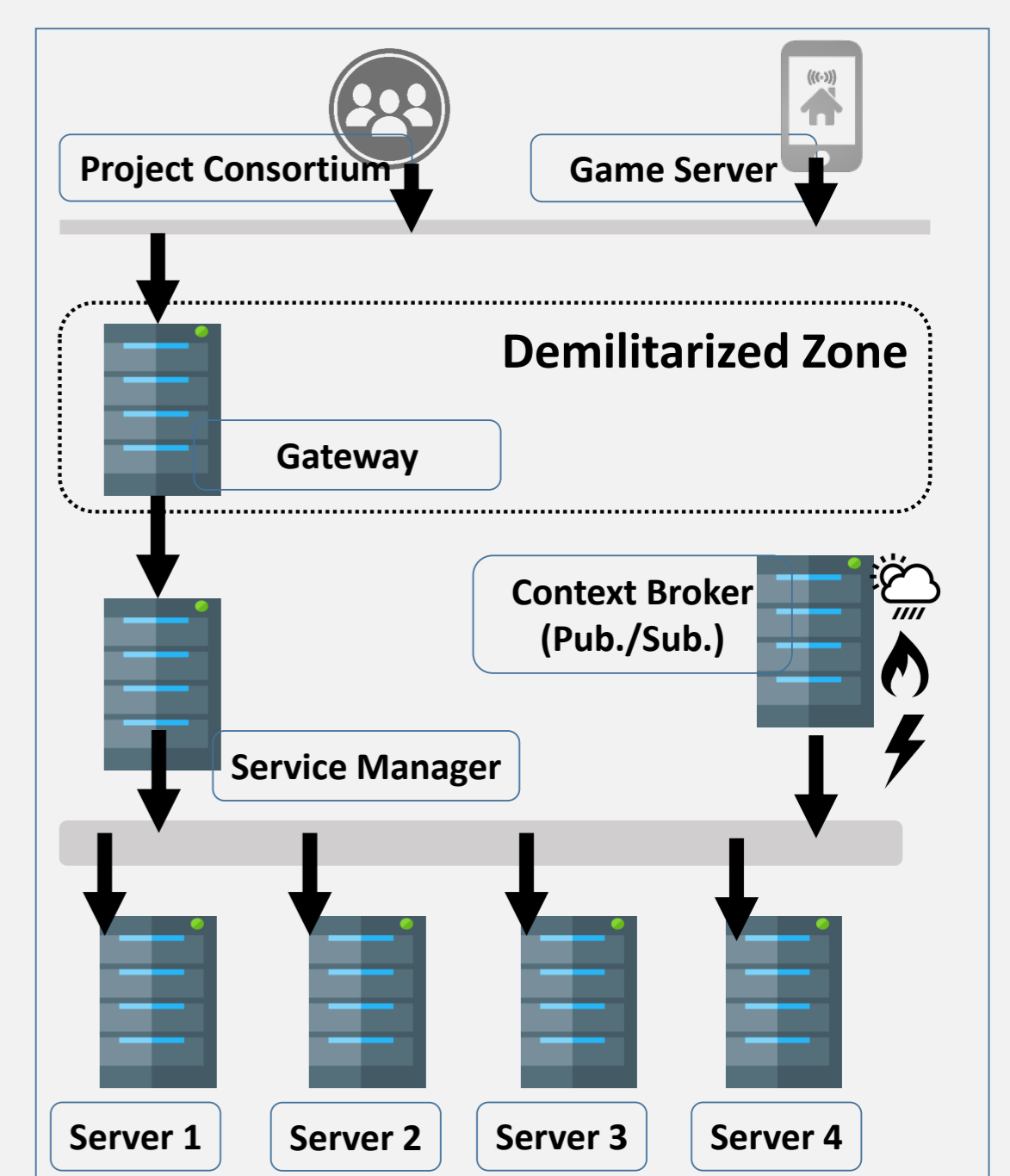
## EnerGAware Project

- EnerGAware is a serious game, playable in Android devices, which rewards its users depending on their real energy savings
- Users take the role of the Energy Cat, a cat, who has to keep an eye on the behavior of his humans and correct multiple energy non-sense while ensuring their well-being (e.g.: turn off appliances in standby mode)



## EnerGAware Middleware

- The middleware manages all services through core modules, Gateway and Service Manager, to provide a high performance, scalable infrastructure
- The Gateway's validates and filters requests to avoid any exposure of security vulnerabilities from the other applicational and core modules
- The Service Manager aggregates application modules, and distributes requests for load balancing
- The Context Broker publishes the updated energy metering to all server nodes, game statistic and weather info



## Results

**74** houses in the current project pilot, in Plymouth, UK, with the middleware managing their energy metering since 2015



The last performance tests indicate that the middleware scales linearly, up to the limit of full occupancy of the service manager server hardware capacity

**3%-10%** of electricity savings. Earliest results of houses that played the game show that in the period (in relation to a pre-game baseline), electricity savings range from 3% to 10%

## Conclusions

- The EnerGAware middleware was proven to be a scalable service-oriented system, and generic, allowing easy extension of different services
- Initial findings of the project are promising in terms of energy saving and set the basis of an investment that capitalizes the potential of IoT to develop solutions that reduce the environmental footprint