IES-City Framework: a consensus framework for fostering interoperability in the context of the Smart City applications

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IoT-Enabled Smart City Framework (IES-City)* is an international initiative launched by NIST and several partners (ENEA, ETSI, ANSI, USGBC, FIWARE, MSIT, TIA) aiming to:

- create a **reference framework** for the development of architectures for incremental and modular Smart Cities
- facilitate convergence and encourage harmonization among the many standards and consortia

* [https://pages.nist.gov/smartcitiesarchitecture/](https://pages.nist.gov/smartcitiesarchitecture/)
Summary

• The context and the problem

• The approach of IES-City initiative

• Conclusion
The current scenario

• The Smart City is happening
  ➢ Smart City technologies and solutions are being developed and deployed at a rapid pace, becoming part of the real life of cities and citizen

• New opportunities are opening up
  ➢ New services can be activated combining and exchanging data collected by several and heterogeneous systems and applications

• New priorities
  ➢ To conceive Smart City applications as a part of complex ecosystems, with subsystems and components able to interact each other, and to change over time
  ➢ To make the applications able to speak each other directly
Criticalities

3 primary barriers are preventing widespread deployment of effective, powerful smart city solutions:

- **Inadequate information and knowledge transfer**
  - custom solutions unable to exchange information with each other, and therefore, neither replicable and reusable

- **Wide range of standards**
  - a number of architectural standardization efforts are underway worldwide but have not yet converged

- **Poor scalability**
  - insufficient interoperability and scalability of underlying Internet of Things (IoT), and Cyber-Physical Systems (CPS) technologies that provide the foundation for many 18 smart cities applications
Divergent CPS/IoT Technology Landscape

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The approach

Starting point:

• Traditional approach to achieve interoperability, adopting standards, it is not always possible
  ➢ absence of adequate standards, divergence between several standard specifications, too much generic specifications

IES-City focus (a new approach):

• Identifying a set of principles for common interfaces (PPI, Pivotal Point of Interoperability) to ensure interoperability also in case of absence of standards or misalignment of available standards
1) To collect a set of existing architectures/frameworks

2) To define a set of “Aspects” (ex: Functional, Business, Data,…)* being relevant in order to evaluate architectures/frameworks for Smart City

3) To analyse the selected architectures/frameworks respect the identified “Aspects” in order to detect common approaches

4) The intersections coming from step 3 are the PPIs

*based on the NIST Cyber-Physical Systems (CPS) Framework
Open API as example of PPI

Independent technology deployments

Potentially large distance to interoperability

With Pivotal Points of Interoperability

Minimize distance to interoperability

PPI

e.g. REST APIs

PPI
e.g. TLS 1.2

PPI

e.g. IPv6 address

Composable Smart Cities

e.g. Convert XML to JSON
Results

A Framework Document

Set of Artifacts
The Framework document

Summary
Elaboration of the Challenge
A look at two use cases – a day in the life; usage of IES-City
What the IES-City Framework provide

Use of this document
Guidance on the use of the framework for cities, policy makers and regulators, vendors/integrators, and standards development organizations

Smart City Application Framework
Study of the breadth of Smart City applications for: concerns, readiness, and benefits

Discovering Pivotal Points of Interoperability
Discussion of Pivotal Points of Interoperability (PPI), Zones of Concern (ZofC), and the NIST CPS Framework
## Elements of the Application Framework Tool

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description</th>
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<tbody>
<tr>
<td>Breadth: List of applications and related metrics</td>
<td>It consists of both a framework (metrics + tool) for evaluating the breadth (elaborated on the basis of existing models) and the list of evaluated applications</td>
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<tr>
<td>Readiness: A framework for assessing City’s Readiness</td>
<td>A List of Metrics + a tool to Assess the Readiness of Cities to Absorb Smart City Applications (elaborated on the basis of existing maturity models)</td>
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<tr>
<td>Benefits: A Framework to Measure Benefits</td>
<td>Metrics + tool for measuring benefits that can be derived from Assimilated Applications</td>
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Conclusions

• IES-City Framework provides a set of tools to aid stakeholders in lowering the barriers to integrating IoT and smart city features

• There is an Application Framework Tool that can speed initial studies on the potential for deploying technologies in cities and communities

• There is a technical methodology that simplifies comparing complex systems of technology currently deployed from different sources

• These tools can be ever-green adding more applications to the application framework tool and more analyses of technology suites for comparison
References

• IES-City Framework
  ➢ https://pages.nist.gov/smartcitiesarchitecture/

• IES-City Framework Draft Document for Review

• IES-City Framework Community
  ➢ https://pages.nist.gov/smartcitiesarchitecture/community/

• NIST Framework for Cyber-Physical Systems
Thanks for your attention!

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