

SYNCHRONICITY



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Executive Summary

This report constitutes Deliverable 1.9 (Monitoring framework template 4) of the SynchroniCity project. The Monitoring Framework (WP1, Task 1.3) of the SynchroniCity project is intended to gather information from the Reference Zones on an ongoing basis in order to support the delivery of the project. Four templates for the Monitoring Framework are planned for delivery throughout the course of the project. These templates have changed based on the needs of the project. The fourth and last template is presented in this report.

Abbreviations

AAA	Authentication, Authorization and Accounting
API	Application Programming Interface
CB	Context Broker
D	Deliverable
DoA	Description of Action
EC	European Commission
FCC	Future Cities Catapult
GPRS	General Packet Radio Service
IdM	Identity Management
IoT	Internet of Things
LSP	Large-scale Pilot
OASC	Open & Agile Smart Cities
OAuth	Industry-standard protocol for authorization
RZ	Reference Zone
WP	Work Package
WT	Work Task

Contents

1	Introduction	6
1.1	Links to other SynchroniCity deliverables	6
1.2	Previous templates	7
1.3	New template for Monitoring Framework	7
2	Status of the Reference Zones:.....	8
2.1	Status of SynchroniCity Framework in RZs	9
2.2	Status of Atomic Services and Applications in RZs	12
2.3	Status of Context Information Management	14
2.4	Status of Historical Data Access.....	16
2.5	Status of Security framework	18
2.6	Status of Data Models	20
2.7	Status of Ecosystem Transaction Management (Marketplace).....	22
3	The view from WP2/3/4 leaders and the Reference Zones	23
3.1	Feedback from WP2 leader	23
3.2	Feedback from WP3 leader	24
3.3	Feedback from WP4 leader	24
3.4	Feedback from Antwerp.....	25
3.5	Feedback from Eindhoven.....	28
3.6	Feedback from Carouge	31
3.7	Feedback from Helsinki	34
3.8	Feedback from Manchester	37
3.9	Feedback from Milan	40
3.10	Feedback from Porto	43
3.11	Feedback from Santander	46
	References	49

List of Figures

Figure 1: Themes, applications and readiness of SynchroniCity Framework in RZs in Feb 2019 [10].....	10
Figure 2: Themes, applications and readiness of SynchroniCity Framework in RZs in Nov 2019 [10].....	11
Figure 3: Status of implementation of applications in RZs in Jan 2019 [10].....	12
Figure 4: Status of implementation / integration of applications in RZs in Oct 2019 [10].....	13
Figure 5: Status of Context Information Management in RZs in July 2018 [8]	14
Figure 6: Status of Context Information Management in RZs in Nov 2019 [22]	15
Figure 7: Status of Historic Data Access in Feb 2019 [11].....	16
Figure 8: Status of Historic Data Access in Nov 2019 [22]	17
Figure 9: Status of Security Framework in RZs in Feb 2019	18
Figure 10: Status of Security Framework in RZs in Nov 2019	19
Figure 11: Status of Data Models in RZs in Jan 2019	20
Figure 12: Status of Data Models in RZs in Nov 2019	21
Figure 13: Snapshot of SynchroniCity IoT Data Marketplace web page	22
Figure 14: Snapshot of Milan's IoT Data Marketplace web page.....	22

1 Introduction

The Synchronicity project will transform the IoT environment within and across a number of cities and pilot areas (Reference Zones). To achieve this, it is necessary to monitor the developments in these Reference Zones systematically. The Synchronicity project proposal calls for this in Task 1.3 on the 'Monitoring and synchronization of the reference zones' (Technical Annex v2.1, Sections 1- 3, page 48):

The main objective of this task is to set-up a monitoring framework that enables us to synchronize the different reference zones with each other in a periodic way. As the reference zones are constantly evolving (changing ecosystems, policies, and infrastructures) it is important to keep track of these changes. This is necessary to align the activities in WP2 on the architecture and WP3 on the development and piloting of the base applications. The monitoring will be used to provide an updated description of each of the reference zones at the launch of the open call. For the monitoring we will create a reference zone monitor in which we status and its evolutions is listed in a systematic, consistent way. We will focus on the following dimensions and assets: (IoT) hardware, (real-time) data, technology, regulatory and policy context, deployed applications, ecosystem... We will update the status biannual by means of input of the reference zone liaison officer.

This document outlines the scope of the new iteration of the Synchronicity Monitoring Framework. The Monitoring Framework (hereafter MF) is required to gather data on the Reference Zones in order to support the project. As different work packages are in progress throughout the project duration, this means that the MF will change over the course of the project. These changing needs will be reflected in changes to the MF template, which will be updated three times after the initial template.

This report constitutes the 4th and final template for the monitoring framework and contains the latest status of the cities in M33. During the piloting phase cities have made a lot of changes. In many cases more than one API is provided to pilots, so Synchronicity team have needed to change the validator structure to adapt it to how cities have changed their instances. In any case, the minimum requirement for a SynchroniCity is providing an NGSI interface.

1.1 Links to other SynchroniCity deliverables

The data demonstrated in this document is derived from the following main sources:

- D2.3: Catalogue of OASC Shared Data Models for Smart City domains [1]
- D2.4: Basic data marketplace enablers [2]
- D2.5: Advanced data market place enablers [3]
- D2.8: Report on Basic Reference Zones platform deployment and operational plan [4]
- D2.10: Reference Architecture for IoT Enabled Smart Cities, Update [5]
- D3.5: Customized IoT service prototypes for lead ref. zones – basic [6]
- D3.7 Pilot deployment plan [7]
- D4.2: Technical Validation (Phase 1) [8]
- D4.3: Technical Validation (Phase 2) [18]
- D4.5: Technical Validation of SME projects [22]

Other sources are working shared documents in WP2 [9], WP3 [10], [20] and WP4 [11], [19].

1.2 Previous templates

Template 1 (D1.6) [12] of the Monitoring Framework was designed and submitted in M4. Using Template 1, from M5 to M8 all Reference Zones, except one (Milan), provided data on Basic data on the Reference Zones, Core technology review, and Ecosystem. Their completed templates can be found in [13].

Template 2 (D1.7) [14] was designed by modifying Template 1, based on monitoring requirements provided by all the Work Package leads. Main updates in the template 2 data in the following categories: Pilot area geography and current infrastructure; Impact metrics; Data ownership; Monitoring of co-creation activities; and Ecosystem for pilot applications. It is available at [15].

1.3 New template for Monitoring Framework

In 1st and 2nd iterations, all Work Package Leads were asked on different stages of the project to provide feedback on the MF templates and supply their monitoring requirements. The MF was constructed around these requirements as an instrument for gathering data from the cities in a managed and coordinated way. In practice, however, it was apparent that the quantity and complexity of the information being requested became a challenge for the Reference Zones. On further investigation the following issues were identified:

- Other Work package and Task leads had developed their own custom monitoring/data collection tools which were more responsive and able to adapt to the dynamic conditions of the project than the monitoring framework being delivered in fixed intervals. This led to a perception of overlap and duplication of information requests in the MF.
- Cities highlighted that from their point of view, spreadsheet tools were not an efficient way to receive (in some cases) complex information requests. They highlighted the need to be given more direct support from the partners requesting the information.
- Given limited resources the cities had rightly prioritised support for the technical work packages as these were more directly related to readiness for the open call.

FCC, in conjunction with the WP1 lead, the project coordinator, and with input from the first interim review, agreed that a new approach was necessary to ensure the MF continued to deliver value to the project.

In modifying the approach, we paid particular attention to this feedback from the first interim review:

- “Improve the collection and dissemination of results coming from the cities, especially the anecdotal evidence and cost to make a city “SynchroniCity compliant”. You should better identify the most important results to monitor and align the KPIs to this and/or capture as testimonials and guides.”

The main changes to this iteration of the MF are:

- Improved curation and communication of the key city data being collected by the work packages: currently this information is distributed in different locations and documents, so we have consolidated this and employed data visualisation tools to communicate the status more clearly. This will largely focus on the key interoperability points of the Synchronicity framework, including:
 - o Context Information Management
 - o Shared data models
 - o Integration with Marketplace
 - o Security
- Focused questions on obtaining more 'anecdotal' insights from the cities. This is intended to address the issue outlined above i.e. cities were struggling to fulfil more complex, analytical information requests via this tool. We also foresee that these insights can be of more benefit to the new cities entering via the open call, which was not envisaged in earlier MF templates
- Included input from WP6 on collecting KPI results

The combined effect we hope is to make the information both more relevant and readable by all partners, but with a renewed focus on the SynchroniCity experience by the cities.

This deliverable (D1.9) follows the same templates presented in D1.8 and compares the progress that reference zones have made since D1.8.

This deliverable is not for public dissemination, but consortium members provided in particular, reference zones, Open Call winners and new cities joining the SynchroniCity project can benefit from the information provided in this document. The aim is to provide a demonstrate the latest status of each reference zone among other cities in various domains such as hardware, data, technology, regulatory and policy, deployed application and ecosystem and keeping track of the cities during the project. This document is also relevant to anyone who is participating on the design and implementation of the SynchroniCity platform and its components. Other audiences who provide design services and applications using relevant standards and the recommendations of standards bodies.

2 Status of the Reference Zones:

The SynchroniCity project has eight Reference Zone cities (core pilot cities) across Europe: Antwerp in Belgium, Carouge in Switzerland, Eindhoven in Netherlands, Helsinki in Finland, Manchester in the UK, Milan in Italy, Porto in Portugal and Santander in Spain. These cities are adopting OASC principles to build IoT ecosystems based on open standards and existing datasets to build integrated services. In this section, we present the current SynchroniCity framework components deployed on each Reference Zone, as well as the status of the validation.

The validation process is explained in detail in D4.2 [8]. and D4.3 [18] In the next sections “Passing validation” indicates that the component/Interface satisfactory passed the corresponding validation process, with very minor remarks (if any). The “Partial validation” indicated the component/Interface is present/reachable but failed the corresponding validation process because of required mismatched functionalities and/or not SynchroniCity compliant. In any case, these reported issues are feasible to be rectified [8].

2.1 Status of SynchroniCity Framework in RZs

Figure 1 and Figure 2 primarily visualise 1 the readiness of the SynchroniCity framework in each reference zone, along with the thematic priorities and where there is convergence in the thematic use cases across this emergent sector, and how themes map to specific applications in Feb and Sep 2019 respectively. Data have been extracted from the “Services and applications tracking sheet” at [10] This may be of particular value to the new companies and cities entering the project as the deployments unfold. (We have included for completeness an outline of the three broad themes below.)

This visualisation in these figures highlights that seven out of the eight reference zones have successfully implemented the framework (i.e. the required Synchronicity components in each RZ such as Context Data Management, IoT Management, Data Storage Management, etc. are implemented, deployed and running), while work in Helsinki is ongoing. In sections below we have asked the cities to comment on the experience and challenges of implementing the framework.

Reference zone themes:

- Human-Centric traffic management: The initial application data-driven bicycle mobility aims to improve bicycle mobility in cities by leveraging and combining data from different IoT systems. Also, it aims to improve the overall cycling experience, safety, infrastructure planning and policy making for the future.
- Multi-modal transportation: A multimodal assistant application that will inform citizens about their mobility options and will facilitate their use in a multimodal way. Citizens will be able to plan and use public transport, bike, and other sharing services and transport modes.
- Community policy suite: The objective is to enable local authorities implement an approach to develop innovative IoT-based solutions that leverage more agile in their management and policy making processes.

¹ The figures in this document are not colour coded and colours have been used for better visualisation only.

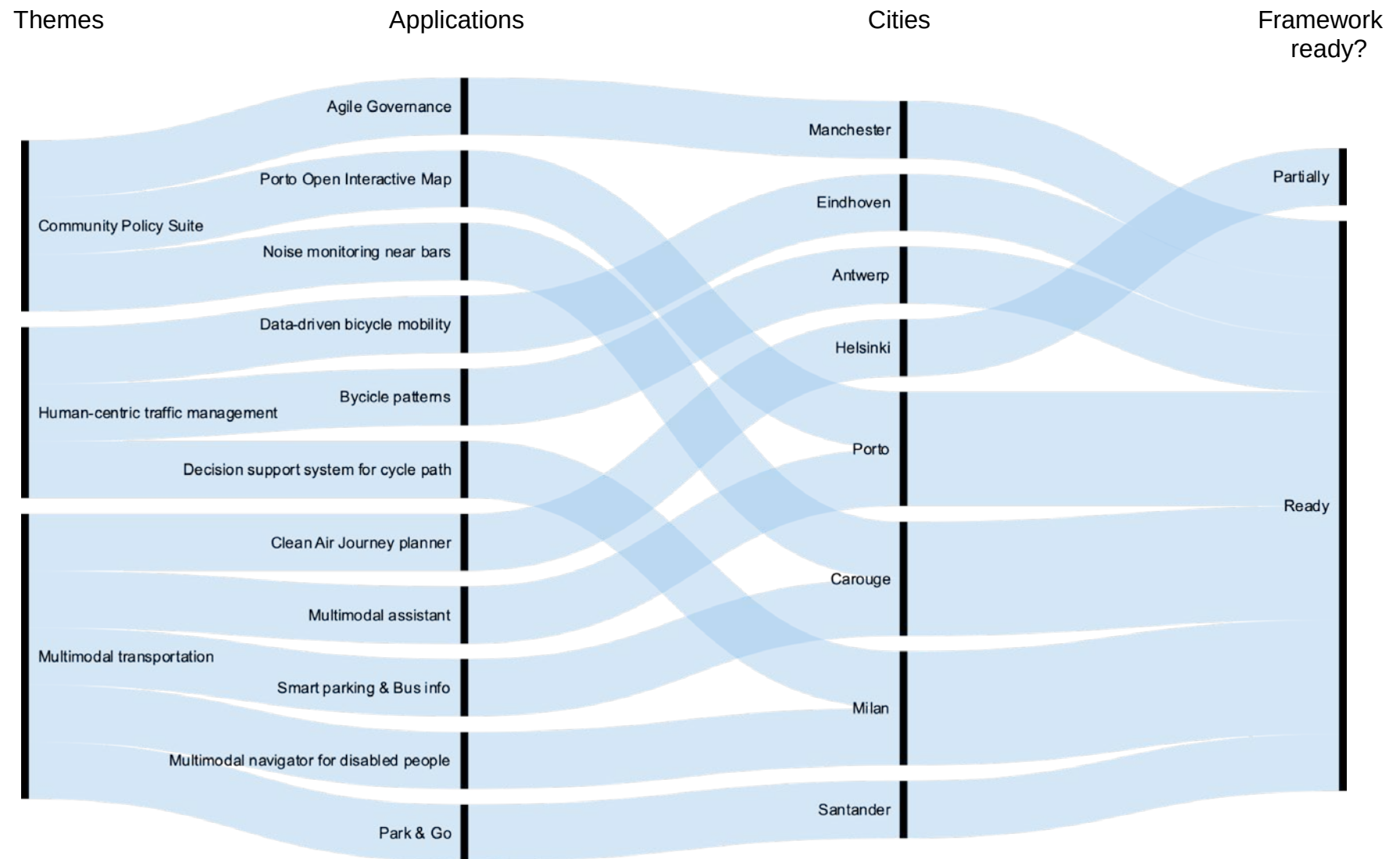


Figure 1: Themes, applications and readiness of SynchroniCity Framework in RZs in Feb 2019 [10]

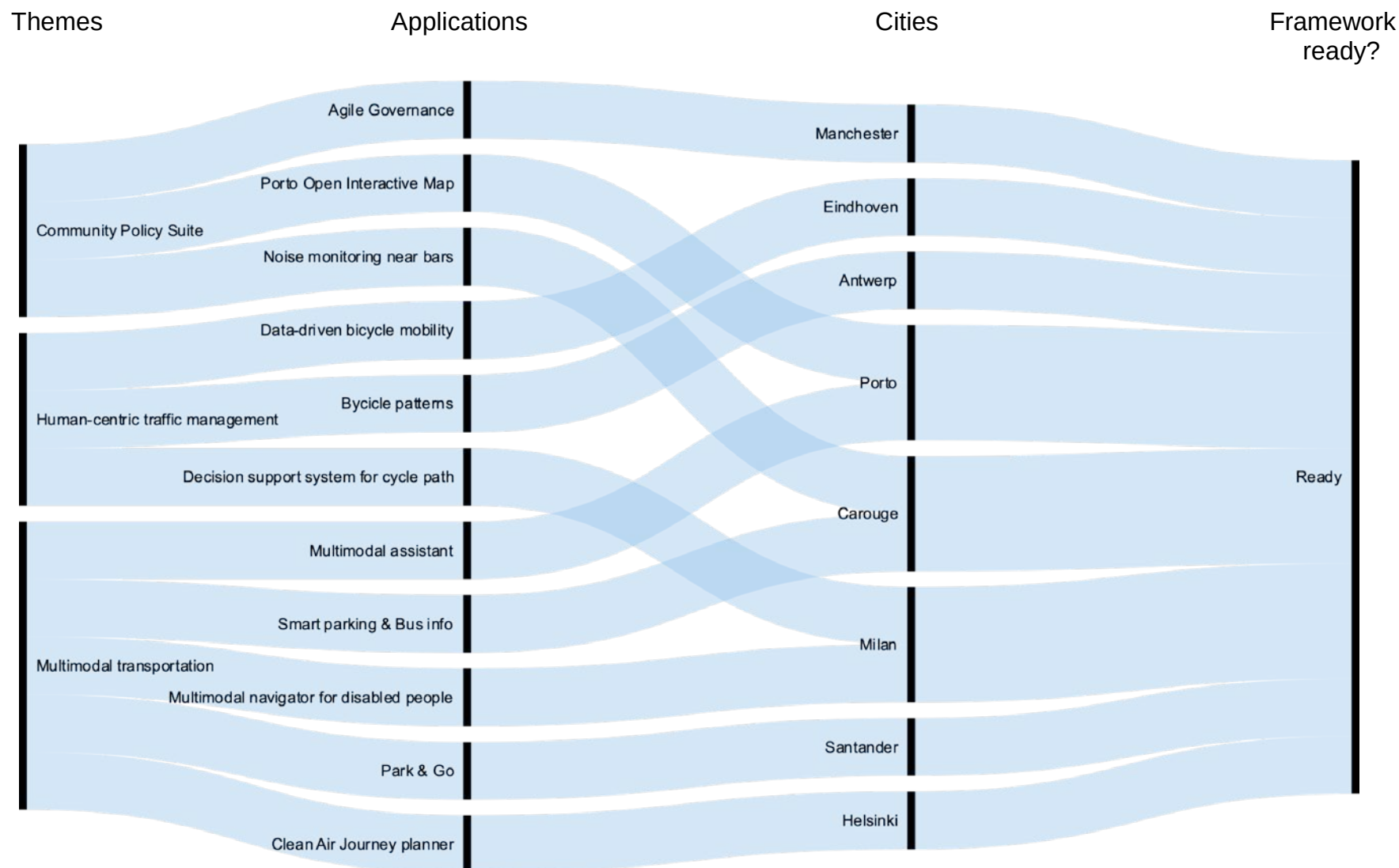


Figure 2: Themes, applications and readiness of SynchroniCity Framework in RZs in Nov 2019 [10]

2.2 Status of Atomic Services and Applications in RZs

Figure 3 and Figure 4 show the progress in implementation and integration of different applications in the reference zones in Jan 2019 and Oct 2019 derived from [10].

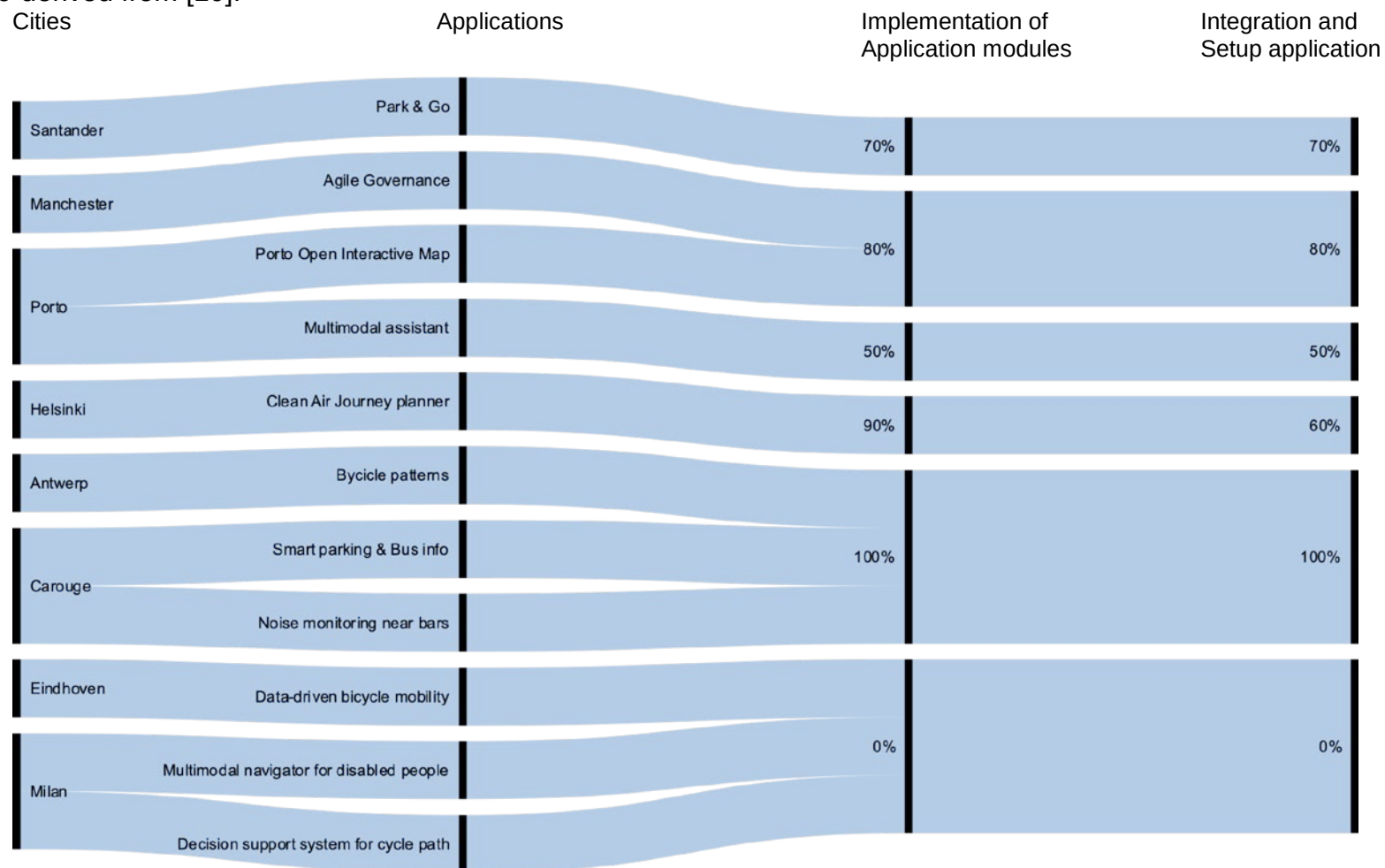


Figure 3: Status of implementation of applications in RZs in Jan 2019 [10]

The visualisation highlights the range of results has a wide spread. Comparing Figure 3 with Figure 4 clearly presents the progress in Manchester, Milan, Porto and Eindhoven from integration and implementation of applications perspectives.

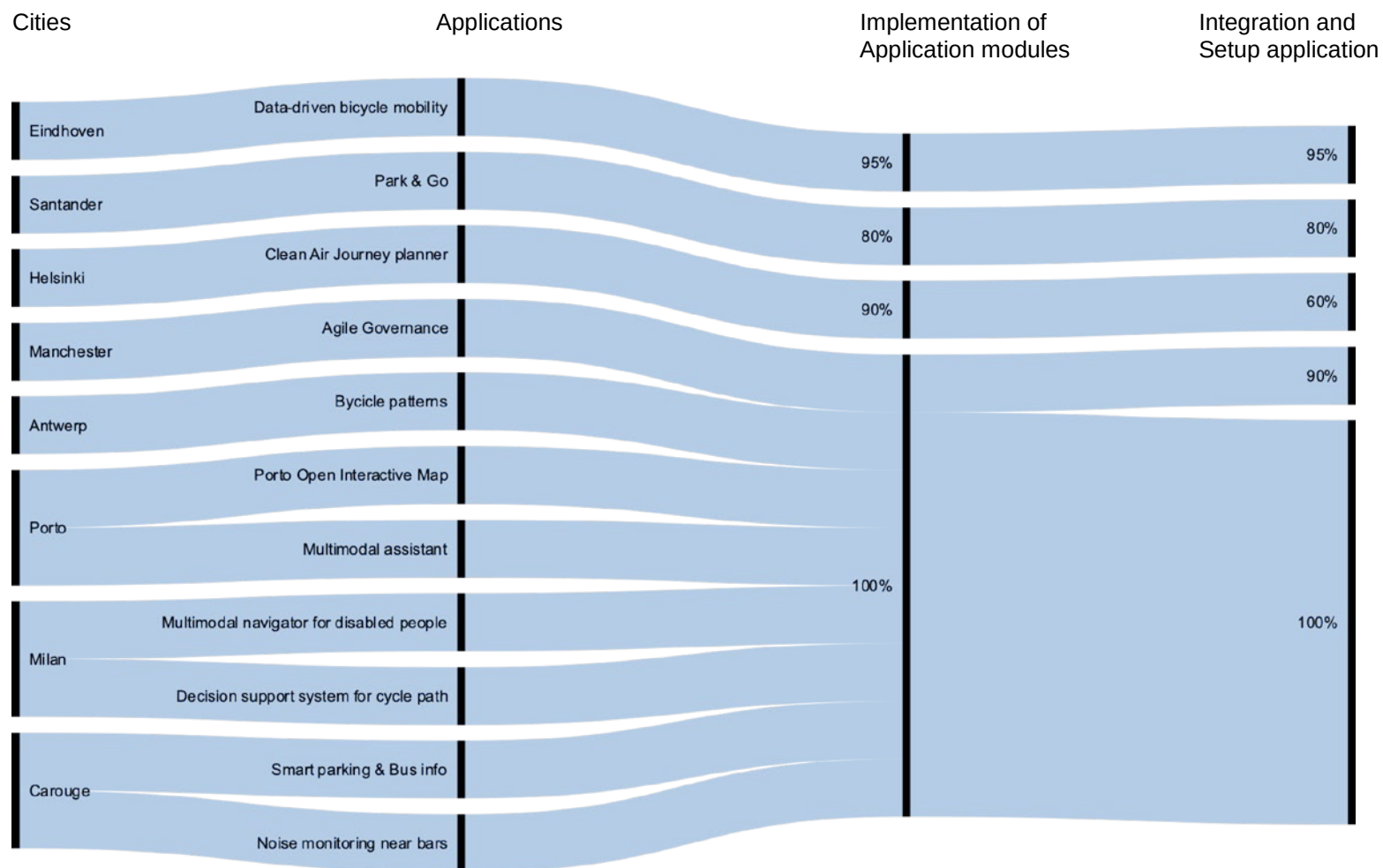


Figure 4: Status of implementation / integration of applications in RZs in Oct 2019 [10]

2.3 Status of Context Information Management

Context Management is responsible for managing the context information received from IoT devices compliant with the data models and data formats accepted by the SynchroniCity Architecture. Figure 5 and 7 show the status of all RZs July 2018 and Nov 2019.

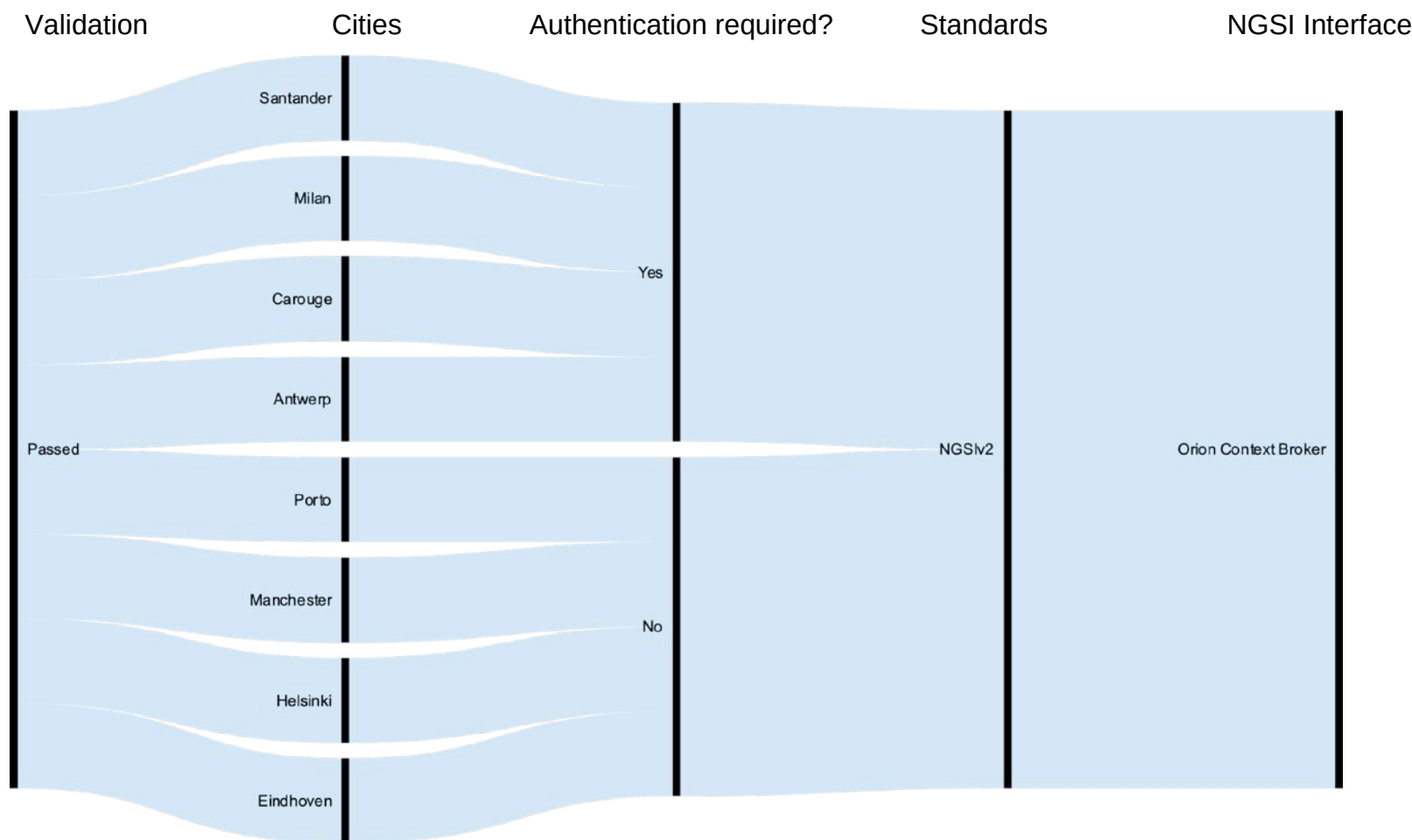


Figure 5: Status of Context Information Management in RZs in July 2018 [8]

The validation results derive from the NGSI interface interoperability point implementation achieved on all 8 Reference Zones through Orion Context Broker (D4.2) [8] and D4.5 [22]. This ensures a common approach to context information management, based on the NGSIv2 protocol.

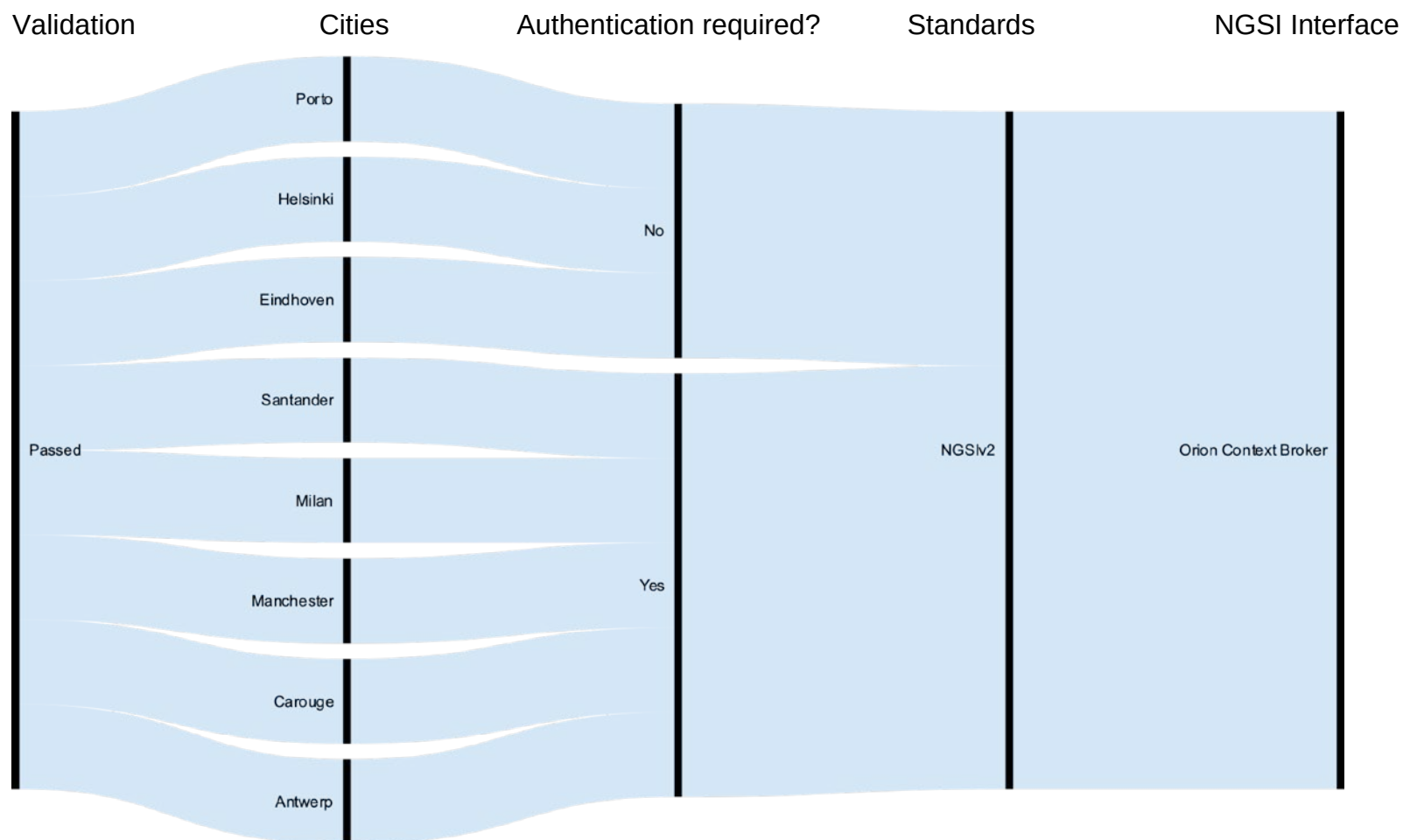


Figure 6: Status of Context Information Management in RZs in Nov 2019 [22]

2.4 Status of Historical Data Access

The SynchroniCity Historical Data API allows access to historical data related to an attribute of an entity [16]. As illustrated in Figure 8, the majority of cities (six out of eight) have adopted SynchroniCity proposed Historical API to retrieve historical data from context entities and successfully passed the validation process.

Passed validation?	Cities	Authentication required?	Description	Standard
Partially	Porto	No	Quantum Leap	SynchroniCity Historical API
	Manchester		Proprietary	
	Antwerp		Comet	
	Santander	Yes	Comet	
	Milan		Cygnus	
	Carouge		Mongo	
Not yet	Helsinki	N/A	N/A	N/A
	Eindhoven		N/A	

Figure 7: Status of Historic Data Access in Feb 2019 [11]

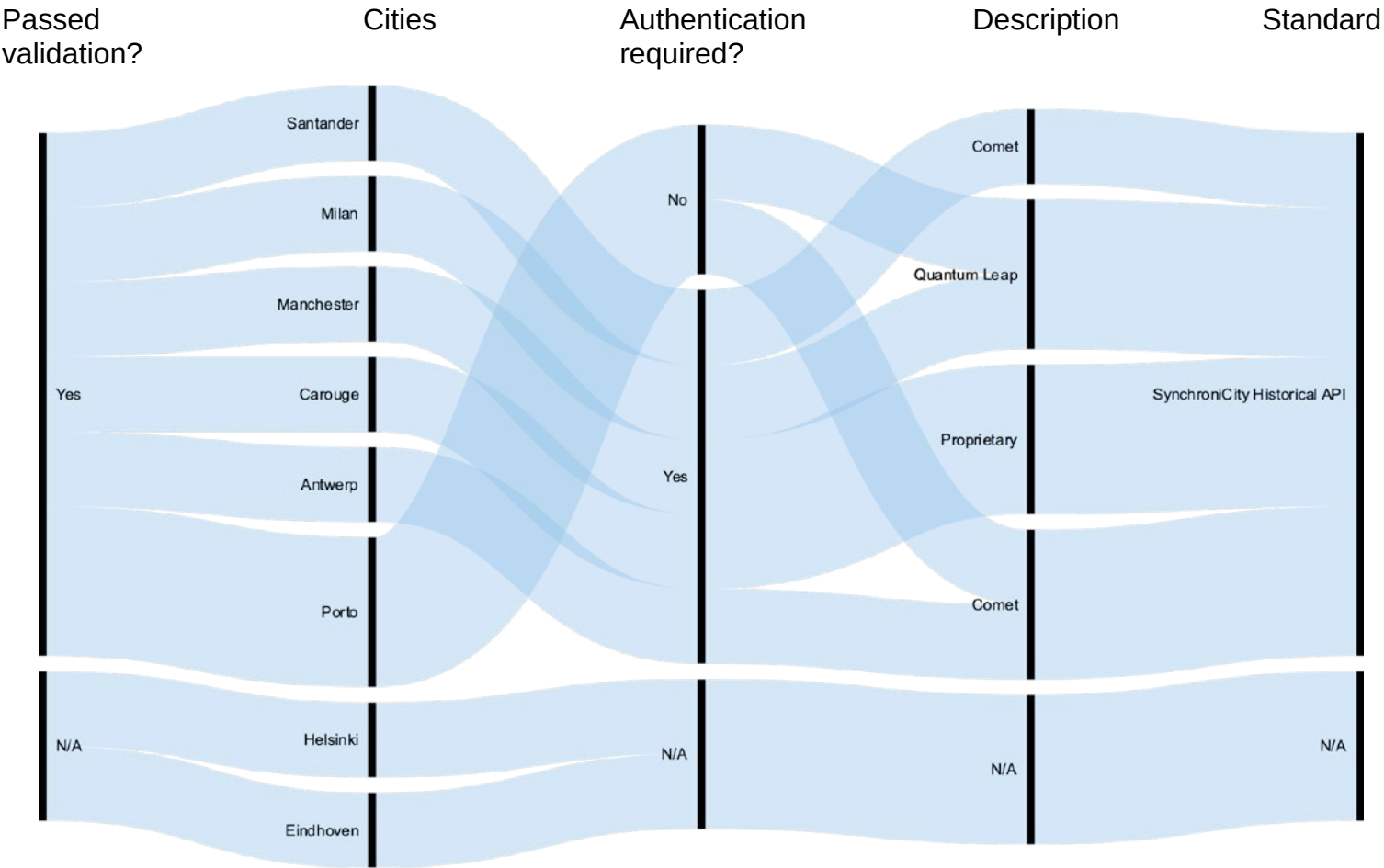


Figure 8: Status of Historic Data Access in Nov 2019 [22]

2.5 Status of Security framework

Security includes three sub-components (D4.2) [8]: 1) Identity management system to store and organize the identities of users; 2) Authentication component that regulates access to the platform; 3) Authorization component that grants access to the functionalities and digital assets. SynchroniCity Security API proposes an OAuth 2.0 interface to grant access mainly to context and historical information, either to read it or to provide it.

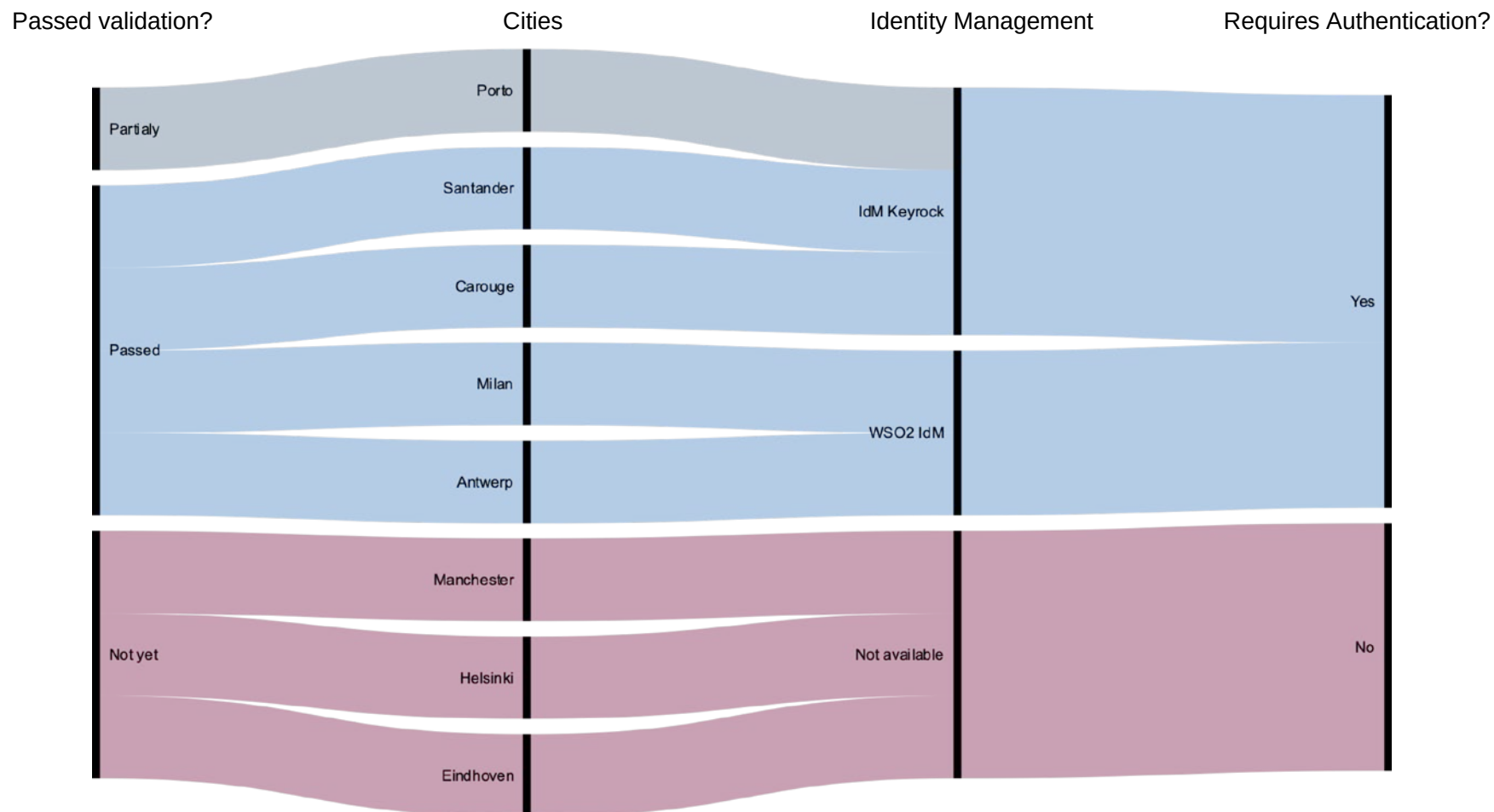


Figure 9: Status of Security Framework in RZs in Feb 2019

Figure 9 and

Figure 10 visualises the status of each RZ in terms of different Identity management and result of the validation in Feb 2019 [11] and Nov 2019 [22] respectively.

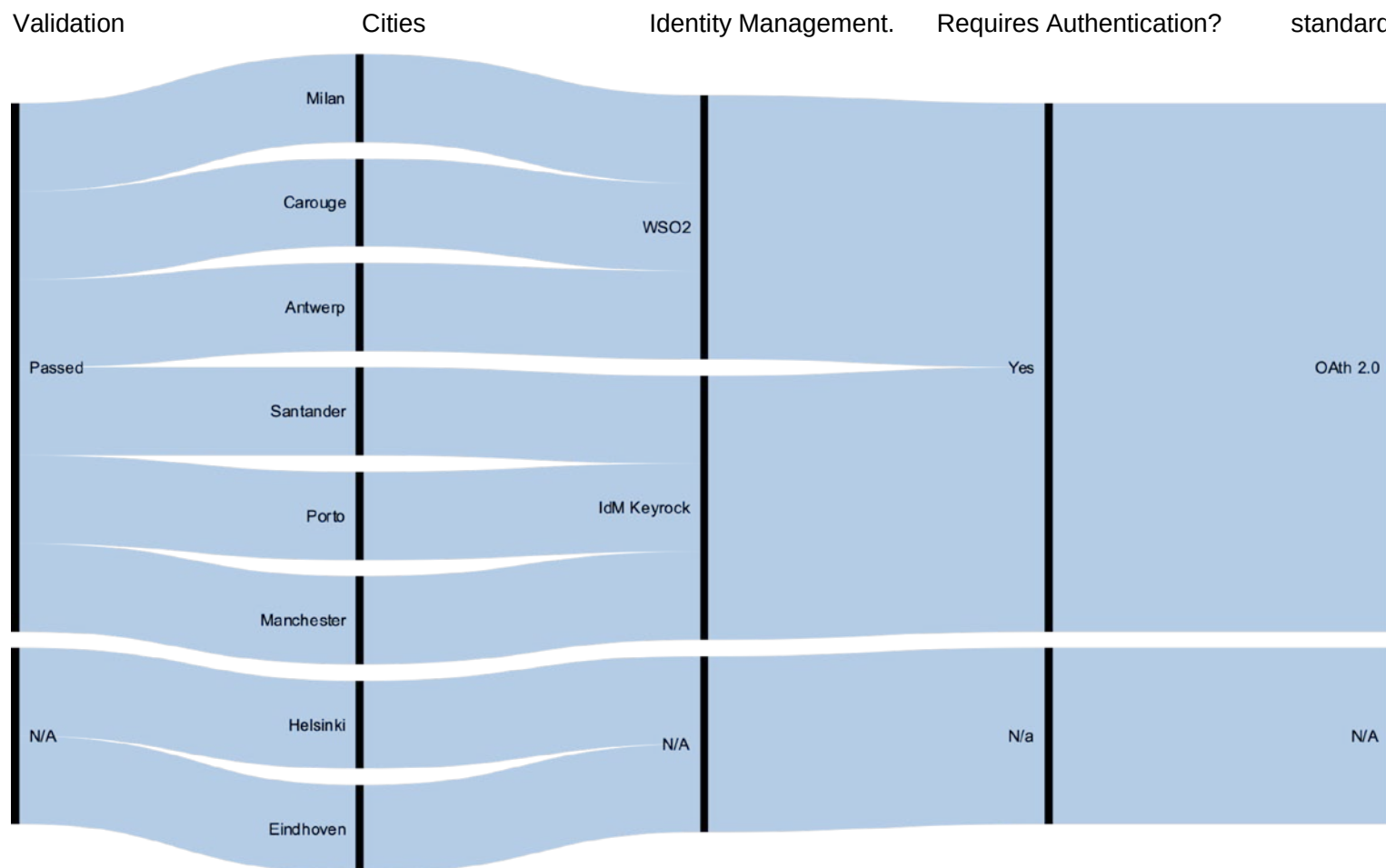


Figure 10: Status of Security Framework in RZs in Nov 2019

2.6 Status of Data Models

Figure 11 represents the status of different Data Models in the Reference Zones. It is an extract from a working document in Jan. 2019 [11] and Sep 2019 [19]. “Ready” indicates that the RZ has already implemented the Data Model in their SynchroniCity instance:

- “Planning” indicates that the RZ intends to use the Data Model for data publication
- “Studying” indicates that the Reference Zone is considering the inclusion of instances of the Data Model

Figure 12 shows a considerable increase in the number of data models and number of the total data sets in different reference zones in Nov 2019 [22] in comparison to that of Jan 2019 in Figure 11 [11].

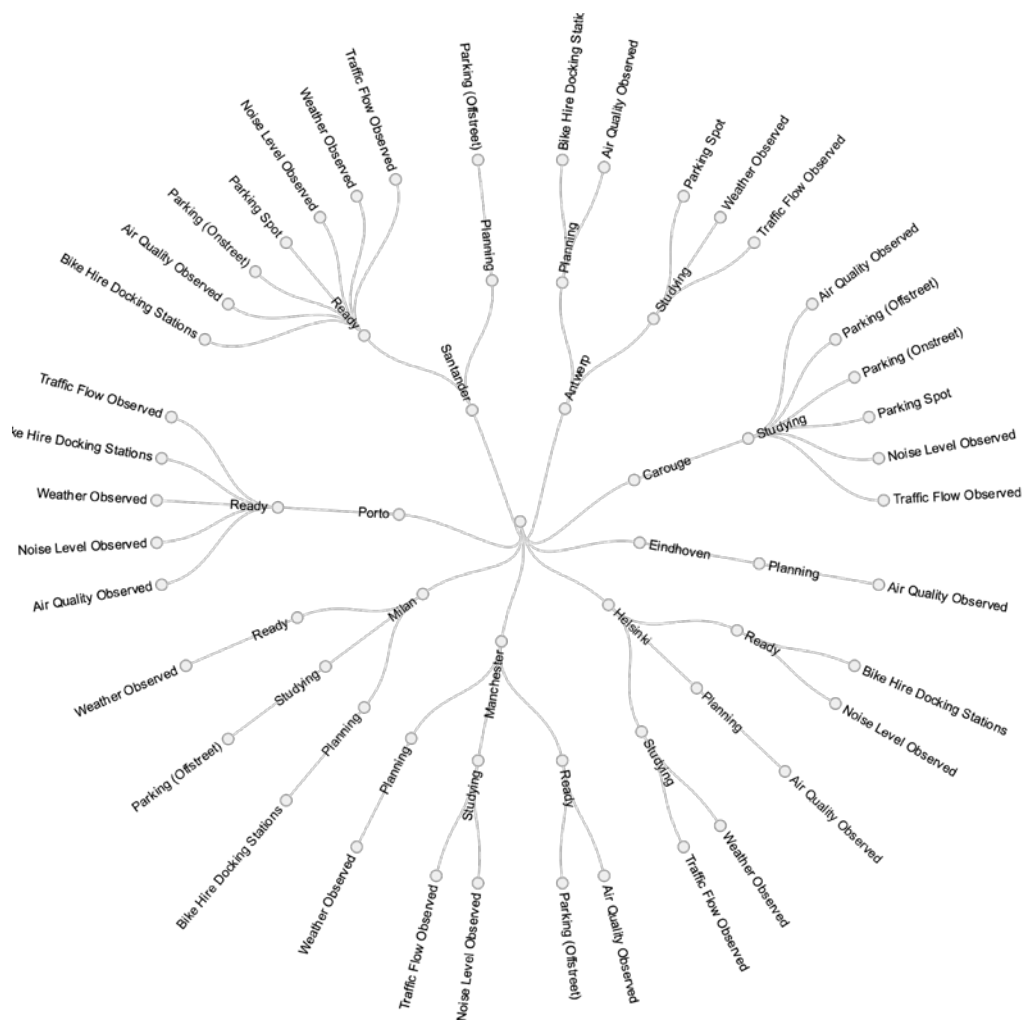


Figure 11: Status of Data Models in RZs in Jan 2019

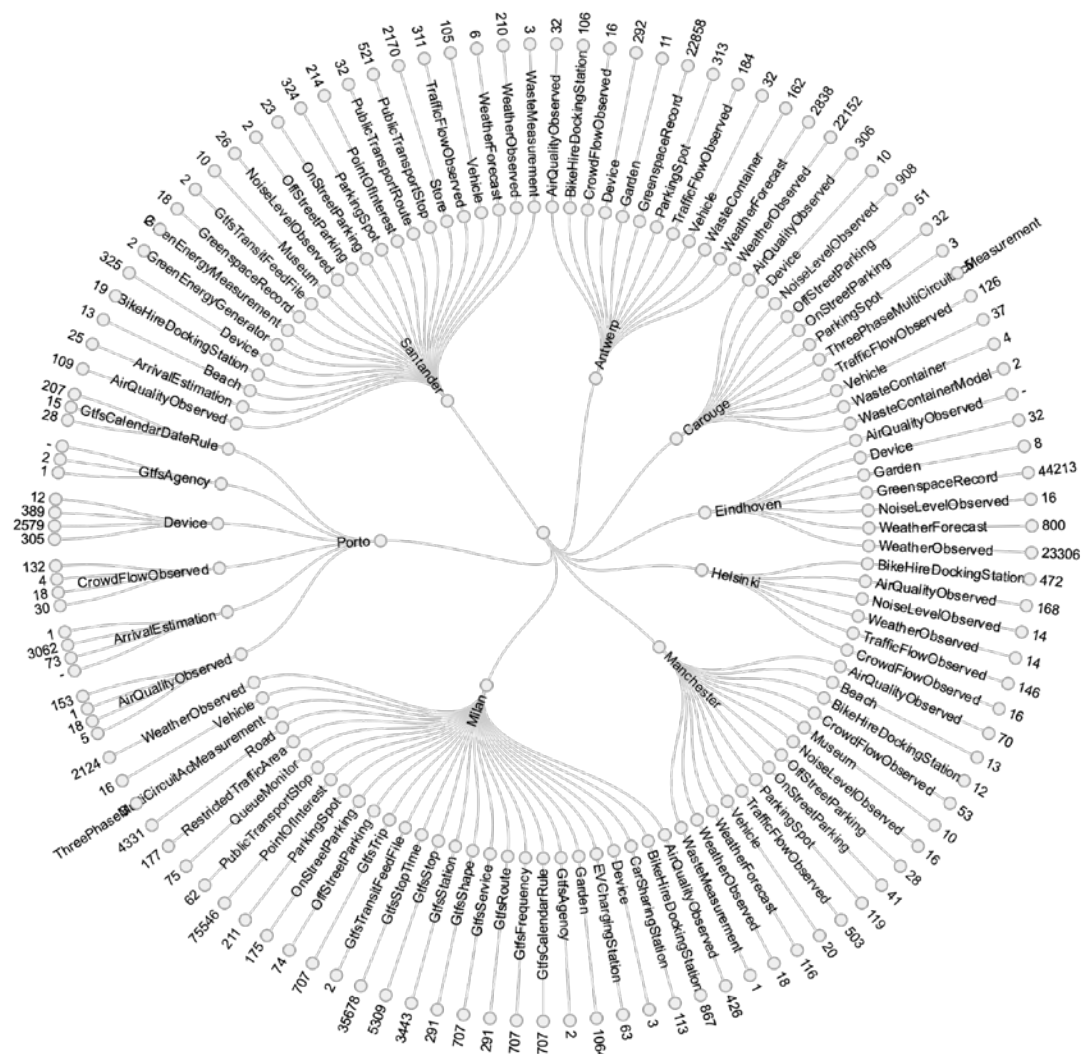


Figure 12: Status of Data Models in RZs in Nov 2019

2.7 Status of Ecosystem Transaction Management (Marketplace)

IoT Data Marketplace exposes functionalities such as catalogue management, ordering management, revenue management, SLA, licence management etc. Synchronicity IoT Data Marketplace (which is accessible at [17] and [21]) provides a harmonised access to data sources in the cities. Figure 13 shows the snapshot of the web page for SynchroniCity IoT Data Marketplace. Some cities such as Milan [23] and Antwerp have developed their own data platforms, and the rest of the cities intend to deploy the Synchronicity marketplace (Figure 14).

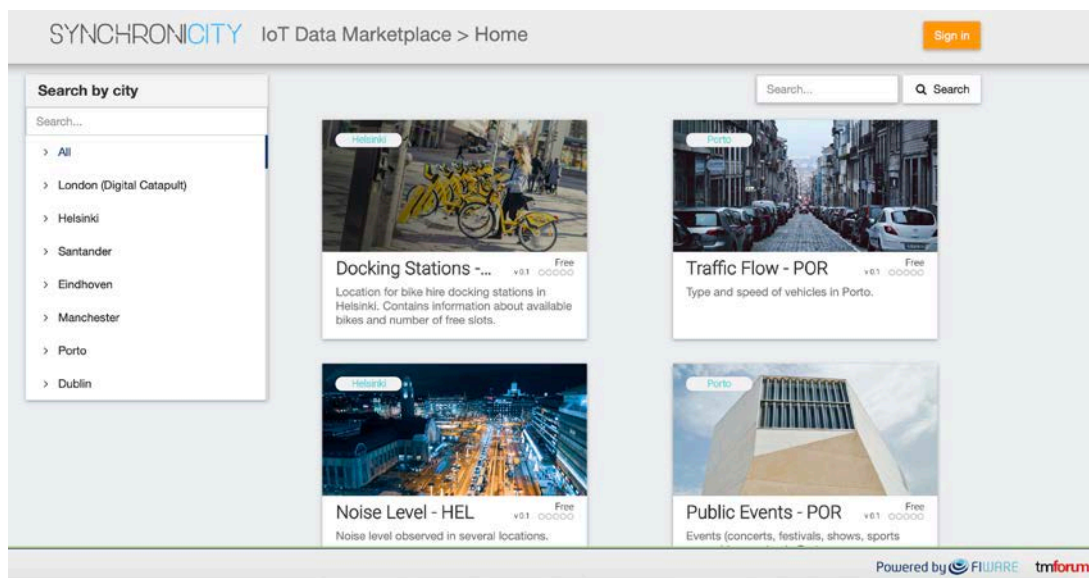


Figure 13: Snapshot of SynchroniCity IoT Data Marketplace web page

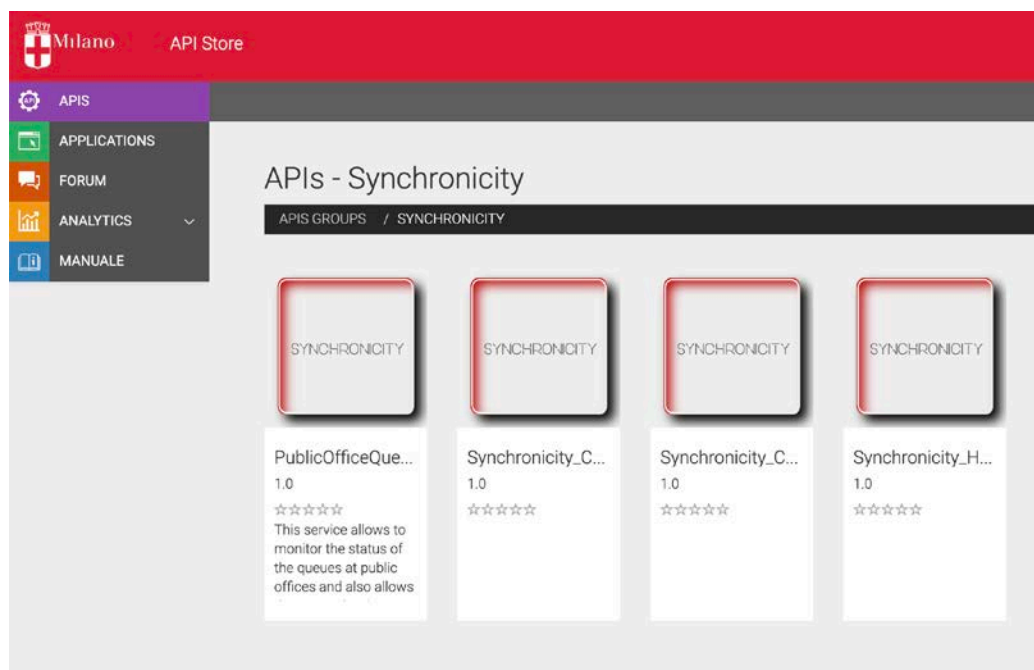


Figure 14: Snapshot of Milan's IoT Data Marketplace web page

3 The view from WP2/3/4 leaders and the Reference Zones

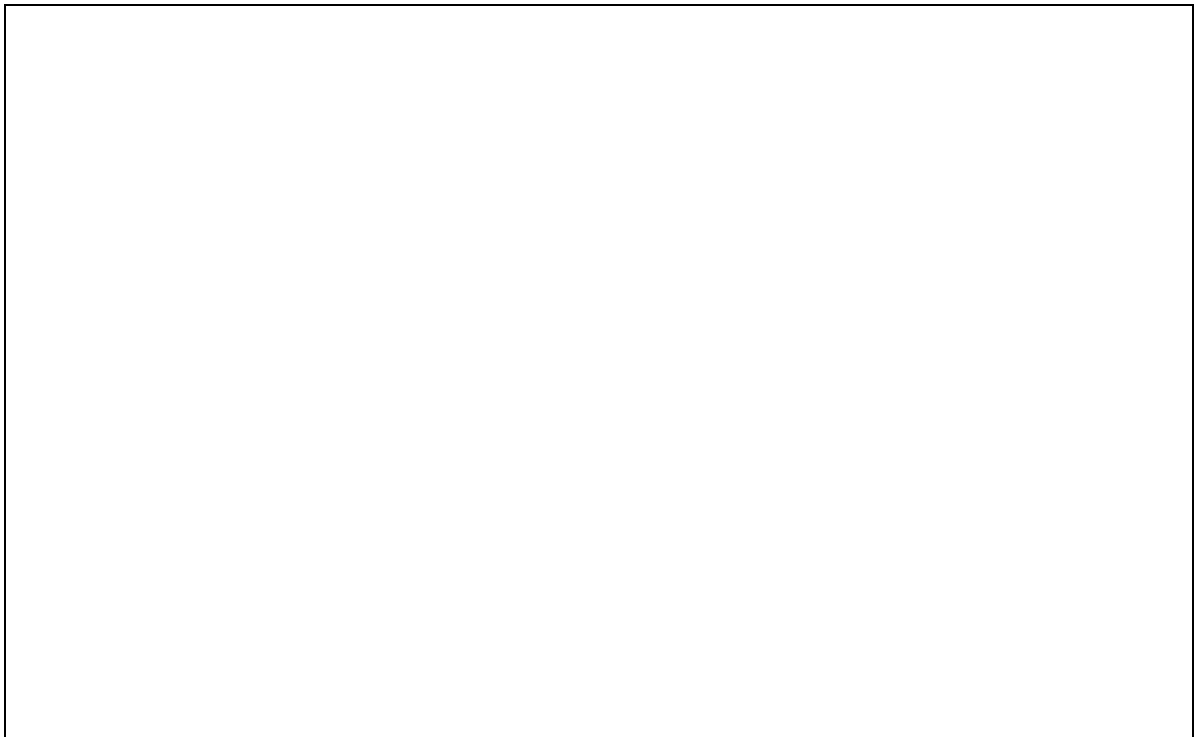
The main message from the project coordinator at the recent CSCC19 conference was that smart cities and communities is not a 'sector', "it's all of us." We want to reflect that holistic perspective in this section by asking each of the core cities to provide their insights and experience both on the practical implementation of the SynchroniCity framework, but also reflecting on the bigger question: How do we ready ourselves for a global market of IoT- and AI-enabled services for cities and communities?

On subjects from trust to tech, green to financing, or the standards-based approach to innovation in general, the aim of this section is to capture the insights and experiences on the ground in the cities and in dialogue with the global movers and shakers in this emergent market.

As mentioned above, in requesting the information in this section we are mindful of the comments from the interim review report which asked the consortium to "Improve the collection and dissemination of results coming from the cities, especially the anecdotal evidence, to make a city "SynchroniCity compliant".

3.1 Feedback from WP2 leader

Figures 1 to 9 (above) represent the implementation of Synchronicity Framework, Application Services, Context Information Management, Historical Data Access API, Data Sets, Data Models, Security API, and Marketplace respectively. We can infer from the visualisations that different aspects of the framework represented different levels of challenge in each reference zone. Do you have any comments on these from your perspective? What works well in the RZs? What worked less well? and suggestions for improvements? etc.





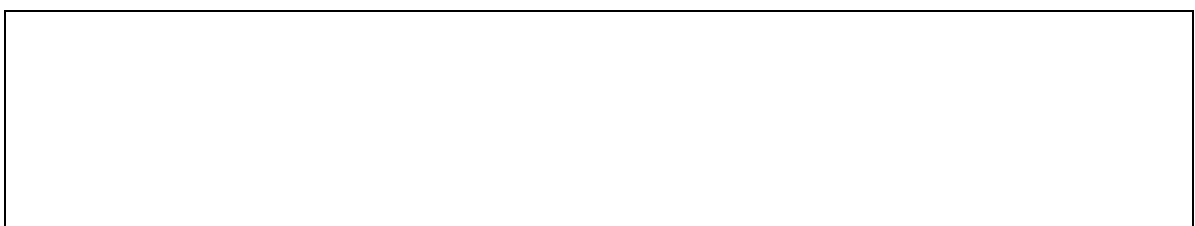
3.2 Feedback from WP3 leader

Figures 1 to 9 (above) represent the implementation of Synchronicity Framework, Application Services, Context Information Management, Historical Data Access API, Data Sets, Data Models, Security API, and Marketplace respectively. We can infer from the visualisations that different aspects of the framework represented different levels of challenge in each reference zone. Do you have any comments on these from your perspective? What works well in the RZs? What worked less well? and suggestions for improvements? etc.



3.3 Feedback from WP4 leader

Figures 1 to 9 (above) represent the implementation of Synchronicity Framework, Application Services, Context Information Management, Historical Data Access API, Data Sets, Data Models, Security API, and Marketplace respectively. We can infer from the visualisations that different aspects of the framework represented different levels of challenge in each reference zone. Do you have any comments on these from your perspective? What works well in the RZs? What worked less well? and suggestions for improvements? etc.



3.4 Feedback from Antwerp

- *As we are about to conclude the Synchronicity project what are your overall thoughts and observations about Synchronicity, pilot deployments, and becoming a SynchroniCity-compliant city? What has worked well and less well? How do you see the impact of the work in the future (economically? Socially? Environmentally?)*

- *What are the main challenges you have faced on the project to date in your city, from different perspectives:*

E.g. technology/technical user experience:

E.g. legal and policy frameworks; financing; engagement; stakeholder; experimentation; providing relevant services; other?

What would you do differently next time?

- *How has Synchronicity helped tackle barriers to growth, innovation and market adoption in your city? (You might consider in particular the main challenges identified at the outset of the project: vendor lock-in; city lock-in; citizens' needs and buy-in; siloed business models and achieving return on investment; quantifying the socio-economic and environmental impact; the availability of high value data sets beyond open data; enabling agile policy-making in cities; procurement models and innovation culture in city departments.)*

- *What experiences or learnings would you share with new companies and cities joining the project through the open call?*

- *With current APIs and platforms varying greatly between cities, SynchroniCity seeks to find the balance between the heterogeneity of these legacy systems and a minimum interoperability to allow for a single market to develop. How do you think this has worked in practice?*

- *Please use this space to provide any other comments, insights, or learnings from the project:*

General questions / observations from the cities:

- *Figures 1 to 9 (above) represent the implementation of Synchronicity Framework, Application Services, Context Information Management, Historical Data Access API, Data Sets, Data Models, Security API, and Marketplace respectively. We can infer from the visualisations that different aspects of the framework represented different levels of challenge in each reference zone. Do you have any comments on these from the perspective of your city?*

Key Performance Indicators (KPIs)

On behalf of the KPI task in WP6, please can you provide information on the following questions?

- *Based on your experience with SynchroniCity, to what extent has the project improved interoperability between infrastructures? With a scale of 1 (=low) to 5 (=high), how would you evaluate the improvement? Please also include your comments.*

- *With a scale of 1 (low) to 5 (high), how would you evaluate the value of SynchroniCity for the local government and decision makers in your RZ? Please also include your comments on what was the main value for your RZ*

- *Any changes with PIA implementation since the last round of Monitoring Framework? For example, PIA implemented during the pilot phase?*

3.5 Feedback from Eindhoven

- *As we are about to conclude the Synchronicity project what are your overall thoughts and observations about Synchronicity, pilot deployments, and becoming a SynchroniCity-compliant city? What has worked well and less well? How do you see the impact of the work in the future (economically? Socially? Environmentally?)*

- *What are the main challenges you have faced on the project to date in your city, from different perspectives:*

E.g. technology/technical user experience:

E.g. legal and policy frameworks; financing; engagement; stakeholder; experimentation; providing relevant services; other?

What would you do differently next time?

- *How has Synchronicity helped tackle barriers to growth, innovation and market adoption in your city? (You might consider in particular the main challenges identified at the outset of the project: vendor lock-in; city lock-in; citizens' needs and buy-in; siloed business models and achieving return on investment; quantifying the socio-economic and environmental impact; the availability of high value data sets beyond open data; enabling agile policy-making in cities; procurement models and innovation culture in city departments.)*

- *What experiences or learnings would you share with new companies and cities joining the project through the open call?*

- *With current APIs and platforms varying greatly between cities, SynchroniCity seeks to find the balance between the heterogeneity of these legacy systems and a minimum interoperability to allow for a single market to develop. How do you think this has worked in practice?*

- *Please use this space to provide any other comments, insights, or learnings from the project:*

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- *Any changes with PIA implementation since the last round of Monitoring Framework? For example, PIA implemented during the pilot phase?*

3.6 Feedback from Carouge

- *As we are about to conclude the Synchronicity project what are your overall thoughts and observations about Synchronicity, pilot deployments, and becoming a SynchroniCity-compliant city? What has worked well and less well? How do you see the impact of the work in the future (economically? Socially? Environmentally?)*

- *What are the main challenges you have faced on the project to date in your city, from different perspectives:*

E.g. technology/technical user experience:

E.g. legal and policy frameworks; financing; engagement; stakeholder; experimentation; providing relevant services; other?

What would you do differently next time?

- *How has Synchronicity helped tackle barriers to growth, innovation and market adoption in your city? (You might consider in particular the main challenges identified at the outset of the project: vendor lock-in; city lock-in; citizens' needs and buy-in; siloed business models and achieving return on investment; quantifying the socio-economic and environmental impact; the availability of high value data sets beyond open data; enabling agile policy-making in cities; procurement models and innovation culture in city departments.)*

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- *Please use this space to provide any other comments, insights, or learnings from the project:*

General questions / observations from the cities:

- *Figures 1 to 9 (above) represent the implementation of Synchronicity Framework, Application Services, Context Information Management, Historical Data Access API, Data Sets, Data Models, Security API, and Marketplace respectively. We can infer from the visualisations that different aspects of the framework represented different levels of challenge in each reference zone. Do you have any comments on these from the perspective of your city?*

Key Performance Indicators (KPIs)

On behalf of the KPI task in WP6, please can you provide information on the following questions?

- *Based on your experience with SynchroniCity, to what extent has the project improved interoperability between infrastructures? With a scale of 1 (=low) to 5 (=high), how would you evaluate the improvement? Please also include your comments.*

- *With a scale of 1 (low) to 5 (high), how would you evaluate the value of SynchroniCity for the local government and decision makers in your RZ? Please also include your comments on what was the main value for your RZ*

- *Any changes with PIA implementation since the last round of Monitoring Framework? For example, PIA implemented during the pilot phase?*

3.7 Feedback from Helsinki

- *As we are about to conclude the Synchronicity project what are your overall thoughts and observations about Synchronicity, pilot deployments, and becoming a SynchroniCity-compliant city? What has worked well and less well? How do you see the impact of the work in the future (economically? Socially? Environmentally?)*

- *What are the main challenges you have faced on the project to date in your city, from different perspectives:*

E.g. technology/technical user experience:

E.g. legal and policy frameworks; financing; engagement; stakeholder; experimentation; providing relevant services; other?

What would you do differently next time?

- *How has Synchronicity helped tackle barriers to growth, innovation and market adoption in your city? (You might consider in particular the main challenges identified at the outset of the project: vendor lock-in; city lock-in; citizens' needs and buy-in; siloed business models and achieving return on investment; quantifying the socio-economic and environmental impact; the availability of high value data sets beyond open data; enabling agile policy-making in cities; procurement models and innovation culture in city departments.)*

- *What experiences or learnings would you share with new companies and cities joining the project through the open call?*

- *With current APIs and platforms varying greatly between cities, SynchroniCity seeks to find the balance between the heterogeneity of these legacy systems and a minimum interoperability to allow for a single market to develop. How do you think this has worked in practice?*

- *Please use this space to provide any other comments, insights, or learnings from the project:*

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3.8 Feedback from Manchester

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What would you do differently next time?

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3.9 Feedback from Milan

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3.10 Feedback from Porto

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3.11 Feedback from Santander

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