CASE STUDY

Hamburg (Germany) – Toronto (Canada)

IURC - NA

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INTERNATIONAL URBAN AND REGIONAL COOPERATION

HAMBURG– TORONTO

IURC – CASE STUDY

Leveraging Open-Source Tools and Centralized Governance to Automate Urban Data Workflows and Advance Smart City Innovation

EXECUTIVE SUMMARY

As part of the International Urban and Regional Cooperation (IURC) North America programme, Toronto (Canada) and Hamburg (Germany) engaged in a mutual learning exchange focused on automating and standardising data provision through urban data platforms. Hamburg brought their robust Urban Data Platform (UDP_HH), which integrates data across multiple agencies whilst transitioning from commercial software like FME toward open-source solutions. Toronto demonstrated how Apache Airflow, a modular Python-based open-source workflow orchestration tool, can automate data publishing pipelines.

The collaboration provided both cities with practical tools and strategic insights: Hamburg gained an understanding of scalable open-source automation, whilst Toronto found a model of centralised data governance and open standards. This case study highlights how city-to-city cooperation can unlock innovation, reduce vendor lock-in, and foster sustainable digital transformation.

CHALLENGES AND SOLUTIONS

Modern cities generate vast amounts of data daily, ranging from traffic patterns and public health monitoring to environmental sensors and infrastructure management. The challenge lies in making this data available in timely, accurate, and standardised formats that support both internal decision-making and public accountability.

Urban data platforms serve as critical infrastructure for smart city initiatives, consolidating and sharing information across departments whilst enabling public access. However, developing these platforms presents complex challenges: data pipelines must be automated and yet flexible, scalable yet secure, with underlying tools that adapt to rapidly evolving technological and policy requirements.

Many municipalities face vendor lock-in due to their reliance on commercial software tools, such as FME (Feature Manipulation Engine). Whilst these tools deliver functionality, they create significant long-term costs beyond licensing fees. Vendor dependency limits municipal autonomy over updates and customisations, whilst proprietary architectures restrict flexibility and interoperability.

This aligns with the "Public Money, Public Code" philosophy, which states that publicly funded software should prioritise open, transparent, and reusable solutions. Hamburg has embraced this concept, recognising that proprietary tools generate recurring costs whilst limiting the ability to share solutions or collaborate effectively with other cities.

Hamburg's data provision traditionally relied on FME, with each dataset requiring custom-designed ETL (Extract, Transform, Load) processes that limited scalability, were time-consuming to maintain, and demanded specialised knowledge. Recognising the need for greater efficiency and the constraints of vendor lock-in from expensive commercial tools, Hamburg began exploring open-source alternatives. The exchange through IURC NA introduced Hamburg to Toronto's Apache Airflow implementation. This modular, Python-based open-source workflow orchestration tool automates complex workflows through reusable Python scripts, enabling scheduling and monitoring with greater transparency. On the other hand, Toronto recognised in Hamburg's data platform a successful model of centralised governance with standardised interfaces, open-data principles, and APIs serving city departments, researchers, developers, and the public. Both cities discovered that modularity, reusability, and openness were key principles for developing sustainable data platforms. Hamburg's emphasis on open standards and geospatial APIs inspired Toronto to strengthen similar principles in its enterprise data platform development.

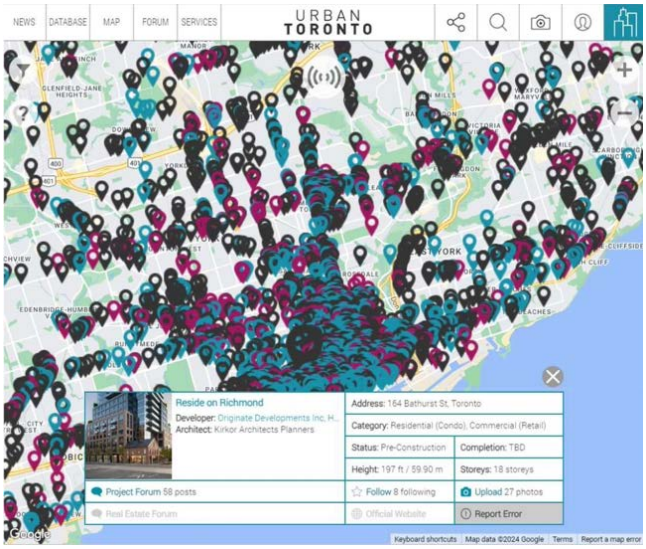

Figure 1. Toronto Open Data Platform. From presentation IURC Technical Exchange: Open Data Program Technology Services Division

RESULTS AND IMPACT

The Toronto-Hamburg collaboration generated substantial advancements in both cities' data strategies and urban innovation capacities.

In Hamburg, Apache Airflow exploration has become central to their Data Automation Project, with the city actively assessing how to integrate this tool while reassessing its dependency on FME. Airflow has emerged as a viable open-source alternative offering greater adaptability and cost-effectiveness. Hamburg's teams are developing modular, Python-based automation pipelines with enhanced flexibility. Significantly, neighbouring municipalities have begun implementing exchange insights, demonstrating the scaling potential of these lessons and creating regional momentum toward open-source, interoperable urban data systems.

Toronto has drawn inspiration from Hamburg's centralised model and open-source values to shape its enterprise data platform, continuing to advance with enhanced focus on consistency and accessibility across 40+ departments. The exchange reinforced Toronto's "Public Money, Public Code" commitment whilst validating their strategic decision to prioritise open-source tools like Apache Airflow and Apache NiFi.

Toronto's Open Data Portal represents a tangible manifestation of this philosophy in practice. The portal now provides access to over 470 datasets comprising approximately 2.000 data files. In 2023 alone, the platform facilitated 174.593 user sessions, averaging about 500 dataset visitors daily, not including automated API usage. Significantly, half of the catalogue is now published through automated or semi-automated processes, demonstrating the practical success of the city's automation initiatives.

The portal incorporates several innovative features that enhance usability and accessibility: dynamic data conversion to multiple formats (both tabular and geospatial), comprehensive data quality scores for every dataset, dataset preview functionality that enables informed selection, access through both download and API methods, and data storytelling capabilities that make technical information more accessible to diverse audiences.

These improvements have catalysed broader civic engagement by activating technology communities, enhancing government transparency, and reducing manual workload for municipal staff. The practical impact of open data becomes visible through public-facing applications such as "RocketMan," which provides real-time transit tracking capabilities, and "Waste Wizard," an intuitive tool that helps residents navigate recycling and waste management requirements. These applications utilize the city's open datasets to deliver daily utility to residents, demonstrating how strategic data management can generate practical community benefits.

The combined results from both cities illustrate how international cooperation can accelerate digital transformation initiatives. The Toronto-Hamburg exchange not only catalysed internal policy developments but also contributed to building ecosystems where public data becomes accessible, actionable, and beneficial to society broadly.

An additional outcome of the cooperation of the two cities is the access of Toronto to the DIN SPEC, a preliminary standard developed collaboratively by a consortium of experts and stakeholders under the German Institute for Standardization (DIN).

It provides a reliable and transparent framework that promotes interoperability, reduces complexity, and accelerates the implementation of digital twin solutions for cities and municipalities while paving the way for future national and international standards. The city of Hamburg has worked on the translation of the DIN SPEC 91607, making it available at: https://www.dinmedia.de/de/technische-regel/din-spec-91607/384414386

Figure 2. UDP KUNDERPORTAL Hamburg Data Platform. From Hamburg presentation: DP KUNDERPORTAL - DATA AUTOMATION 18.11.2024.

KEY FIGURES

45+
datasets and approximately 2.000 data files available through Toronto's Open Data Portal

175.593
user sessions recorded in 2023 (approximately 500 dataset visitors daily)

50%
of Toronto's open data catalogue is published through automated or semi-automated processes

40+
city divisions contributing data to Toronto's integrated open data platform

85%
of Hamburg's Urban Data Platform content is accessible via standardized APIs

Multiple
neighbouring municipalities in the Hamburg region are implementing exchange insights in their own data projects

2
flagship public applications in Toronto (*RocketMan* and *Waste Wizard*) powered by open data

1
comprehensive Data Automation Project initiated in Hamburg, directly inspired by Toronto's approach

LESSONS LEARNED

Process sharing generates more value than product sharing. The Toronto-Hamburg exchange demonstrates that cities benefit most when they share not only outcomes but also methodologies and decision-making processes. Understanding how another municipality approaches a problem often proves more valuable than simply adopting their specific technical tools or solutions.

Open-source tools enhance municipal autonomy and scalability. Tools like Apache Airflow provide cities with greater independence, flexibility, and growth capacity compared to commercial platforms. The shift toward open-source solutions enables municipalities to customize functionality, control upgrade timelines, and collaborate more effectively with other cities facing similar challenges.

Federated governance models can inspire the development of platforms. Hamburg's Urban Data Platform demonstrates how centralized coordination can coexist with distributed data ownership, providing a valuable model for cities in early stages of data platform development. This approach strikes a balance between standardization and departmental autonomy, while maintaining system coherence.

"Public Money, Public Code" principles advance multiple municipal objectives. The commitment to open-source development serves to promote transparency, cost efficiency, and collaboration simultaneously. Cities that embrace these principles not only reduce long-term costs but also contribute to broader public benefit through shared technological development.

International cooperation catalyses systemic transformation. When cities approach collaboration with openness and genuine curiosity, the outcomes extend beyond knowledge exchange to encompass tangible organizational and technological transformation. The Toronto-Hamburg partnership demonstrates how strategic city-to-city learning can generate lasting change that benefits both municipal operations and civic engagement.

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THE INTERNATIONAL URBAN AND REGIONAL COOPERATION PROGRAMME IN NORTH AMERICA

The International Urban and Regional Cooperation program in North America (IURC NA), funded by the European Union, partners European cities with Canadian and USA cities to facilitate knowledge exchange through online tools, face-to-face interactions, study visits, participation in thematic and networking events, and capacity-building initiatives. Its activities support the achievement of policy objectives as well as major international agreements on urban development and climate change, such as the EU Urban Agenda, the UN Sustainable Development Goals, and the Paris Agreement. The program is part of a long-term strategy by the European Union to foster sustainable urban development in cooperation with the public and private sectors, researchers, innovators, community groups, and citizens. IURC NA is financed under the EU Foreign Policy Instruments and benefits from the strategic support of the Directorate-General for Regional and Urban Policy of the European Commission.

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Links to related outputs:

Translation of the DIN SPEC 91607

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