City of Toronto Digital Infrastructure Plan

Technology Services Division

DRAFT

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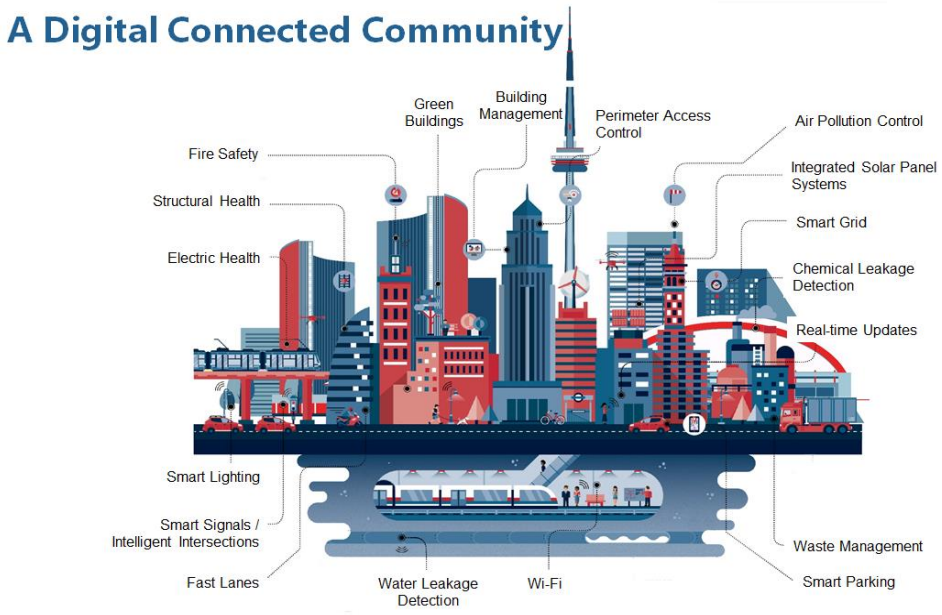
1. Introduction: A Digital Infrastructure Plan for Toronto

1.1. Toronto: A Digital Connected Community

Digital infrastructure[1] provides incredible opportunities – to work in new ways, personalise City services, inform policy and program decisions, and collaborate across silos, thereby addressing societal issues such as housing inequity and climate change. Digital infrastructure can also shape the way many City Council priorities — such as equity, affordable housing, financial sustainability and accessible transportation - can be achieved. However, digital infrastructure is also transforming expectations of public services, and comes with challenges — around privacy, accountability, security, protecting digital rights, and social exclusion.

A Digital Connected Community is one where digital infrastructure is increasingly used to deliver services, perform data-driven asset management, help manage public resources efficiently, and inform decision-making. In Toronto's journey to becoming a Digital Connected Community, it is important that people can trust digital public services, and feel comfortable and safe when using public digital infrastructure. It is also important that decision making around the use of digital infrastructure, both by the City of Toronto and private actors, include consideration of non-technical alternatives and public buy-in.



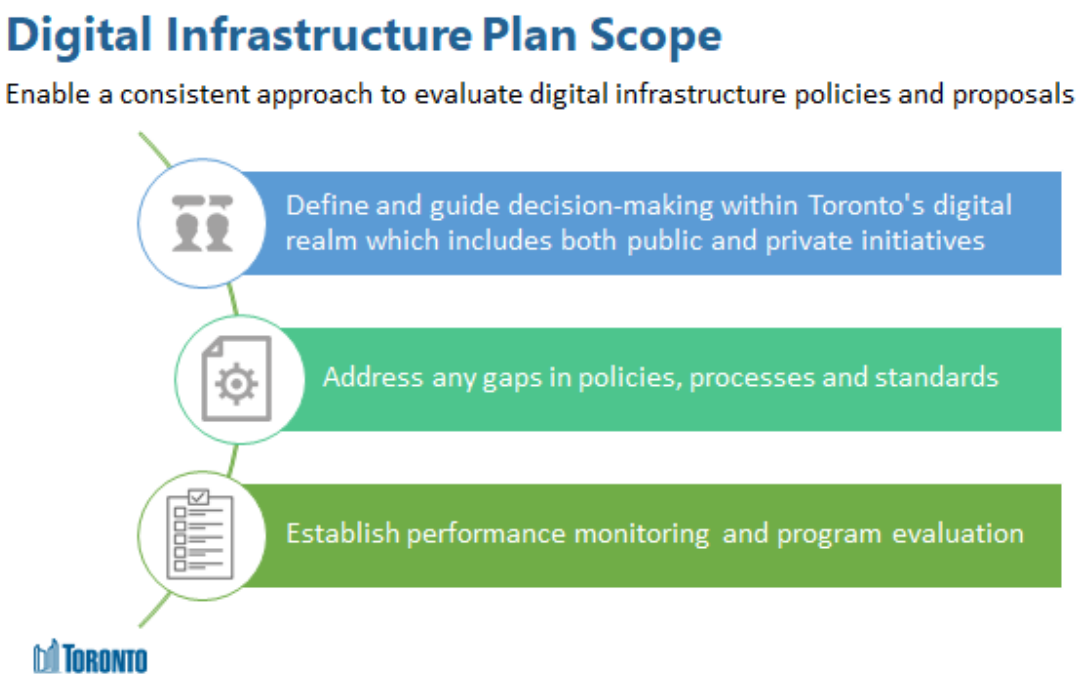
[1] *Digital Infrastructure is defined as*: infrastructure that creates, exchanges or uses data or information as a part of its operation. Digital infrastructure includes physical structures, cabling and network systems, software systems, data standards and protocols as well as the data itself. Some examples include sensors (cameras, GPS sensors, microphones, etc.), broadband and telephone networks, Wi-Fi, desktop software, web pages, mobile apps and open data standards.

However, the benefits of digital infrastructure will only be realized when they are applied to the right problems and deployed and operated in responsible ways. Objectives, aspirations and values associated with the use of digital infrastructure must therefore be clearly defined and well understood.

1.2. The Digital Infrastructure Plan

The Digital Infrastructure Plan (DIP) is a response to these opportunities and challenges, and sets out the overarching vision for Toronto as a Digital Connected Community. It aims to clearly define objectives, aspirations and values associated with the use of digital infrastructure, and guide Toronto in a direction where:

- Digital infrastructure is used to create and sustain equity, inclusion, accessibility, and human rights in its operations and outcomes
- Digital Infrastructure enables high quality, resilient and innovative public services, and supports the use of data and evidence in decision-making
- Digital Infrastructure is leveraged to create a society that supports equitable and inclusive benefits whether for social, community, health, economic or environmental prosperity
- Privacy and security are at the core of our digital infrastructure, and where residents feel safe and secure online when accessing the City services, systems, and products and services they interact with or choose to use
- Decisions about digital infrastructure are made democratically, in a way that is ethical, accountable, transparent and subject to oversight, and
- The City has full control over its ability to develop, select, maintain and use its digital infrastructure to deliver public services and advance the public interest



The DIP has been developed as a tool to enhance transparency, accountability and consistency of decision-making, while strengthening the flexibility, safety and efficiency of the City's digital infrastructure. In this way, the Plan plays the following key inter-related functions:

1.2.1. Statement of Vision and Aspirations

The *Digital Infrastructure Plan* is the primary forum for the expression of Toronto's vision and aspirations for digital infrastructure. This vision is expressed through related principles, policy areas and policy statements. This framework will guide decision-making, and uphold the City's values in the digital realm.

1.2.2. Centralized Digital Infrastructure Policy

While a number of policies, strategies and processes within this decision-making framework already exist (e.g. Business Case/Value Outcomes, Privacy Impact Assessments, and Threat Risk Assessments), further guidance will be needed as the City's digital infrastructure expands. As technology changes and new policies, standards and processes related to this infrastructure are developed, they will be housed in a centralized space: the *Digital Infrastructure Plan*.

1.2.3. Formalized Governance

Formalized governance will be developed as part of the implementation phase of the Digital Infrastructure Plan. This will ensure that decisions, processes, and procedures related to digital infrastructure are made in a consistent manner that reflect corporate objectives, including the corporate Strategic Plan.

1.2.4. Framework for consistent decision-making

The DIP is a tool to help guide day-to-day as well as long-term decisions related to the City's digital infrastructure. The design or procurement of all digital infrastructure at the City must be in compliance with the principles and related policy statements within the DIP, as well as other relevant policies, as appropriate.

1.3. Audience

The DIP has been written for several audiences:

City staff: The design or procurement of all City digital infrastructure must be guided by the principles and related policy statements within the DIP. The Connected Community team will work with colleagues across the City to facilitate compliance, and to identify and undertake new initiatives that meet City strategic priorities in alignment with the DIP. The Technology Services Division is responsible for oversight and accountability.

Residents: the DIP provides a clear framework for residents to ask questions about digital infrastructure proposed or deployed in Toronto; establishes enhanced transparency and insight into how their data is used; and sets out a common vision on

issues such as equity, inclusion, social and environmental benefit, as it relates to digital infrastructure.

Businesses and Innovators: the DIP sets common standards and expectations for new digital infrastructure initiatives within the City of Toronto.

1.4. Authority

Authority to develop the Digital Infrastructure Plan is provided by the following directives from City Council:

a. On June 6, 2019, City Council directed the Chief Information Officer to develop a City-wide policy framework associated with digital infrastructure and data.

b. On October 29, 2019, City Council directed the Chief Technology Officer to take on an expanded City-wide scope and mandate providing support, oversight and direction on standards, practices and policies to all City divisions and a number of agencies and corporations identified in Appendix 1, with immediate effect with respect to all technology assets, goods, and services and direct, or request, those City divisions, agencies and corporations accordingly.

c. On January 29, 2020, City Council adopted 5 Working Principles and related vision statements as the guiding framework for the Digital Infrastructure Plan. Council also directed that any digital infrastructure proposal must be in compliance with all five of the Digital Infrastructure Plan Working Principles, in addition to all existing policies, standards, and processes, as a condition of approval of the proposal.

1.5. Defining "digital infrastructure"

Digital Infrastructure is defined as: infrastructure that creates, exchanges or uses data or information as a part of its operation. Digital infrastructure includes physical structures, cabling and network systems, software systems, data standards and protocols as well as the data itself. Some examples include sensors (cameras, GPS sensors, microphones, etc.), broadband and telephone networks, Wi-Fi, desktop software, web pages, mobile apps and open data standards.

Additional definitions are included in Chapter 10.

1.6. Organization of the Plan

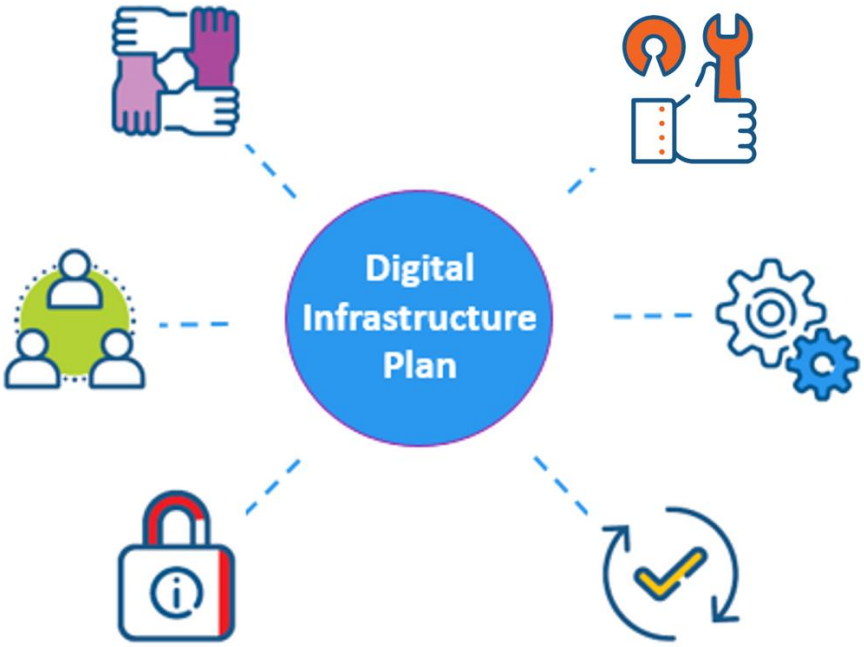
The foundation for the DIP is a set of principles that were developed through community consultation and stakeholder engagement. A Vision Statement, expanding on the related vision and aspirations, accompanies each principle. All principles and Vision Statements - with the exception of Digital Autonomy - have been approved by City Council. Each principle has an associated Chapter within the Plan. Each Chapter includes:

- Descriptive text, providing greater context to the principles, and the different Policy Areas identified within each Vision Statement
- Informational sidebars, which highlight related initiatives or examples of the DIP in action, and
- Policy Statements, outlining the specific measures that will be taken to achieve the Vision Statements

Additional chapters address implementation and monitoring of the DIP.

As of September 2021, the *Digital Infrastructure Plan* is founded on the following 6 Principles:

1. Equity and Inclusion
2. A Well-Run City
3. Social, Economic and Environmental Benefits
4. Privacy and Security
5. Democracy and Transparency
6. Digital Autonomy



1.7. Implementation and Evolution of the Plan

The Digital Infrastructure Plan will be implemented on an ongoing basis, as part of the process of digital transformation. Updates may be needed from time to time as the use and nature of technology evolves, as changes take place within the City (for example, via regulatory amendments), as community values shift, or as the DIP matures. Any changes to the Plan, other than those that are administrative in nature, must be approved by City Council following a robust process of community and stakeholder engagement. At a minimum, the DIP shall be reviewed every three to five years. Further Implementation details are included in Chapter 9.

2. Principle: Equity and Inclusion

Vision Statement: Digital infrastructure will be used to create and sustain equity, inclusion, accessibility, and human rights in its operations and outcomes. Digital infrastructure will be flexible, adaptable and responsive to the needs of all Torontonians, including Indigenous, Black, equity-deserving groups, and those with accessibility needs.

Description

This principle describes how the City of Toronto will ensure that people can enjoy their rights and freedoms, and feel safe and secure online when accessing City services (apps, web pages, bill payments, reservations, online permits etc.). All residents and visitors are entitled to respect and fairness online, benefitting from digital services and opportunities without discrimination. This principle reflects the City's motto "Diversity, Our Strength" in the development and use of digital infrastructure.

Equity in the context of digital infrastructure is vital: access to digital tools and services is directly linked to life opportunities, well-being and freedom. The benefits and burdens of the digitized world have not been equally distributed and particular communities continue to experience disproportionate barriers to access and participation which has led to a digital divide. In addition, digital technologies and data are not neutral and have historically had harmful impacts on many communities. Achieving equity in the digital realm requires intentional strategies and investments to reduce and eliminate barriers to access of services and technology, as well as its fair application. Digital equity also requires an understanding of barriers (i.e. algorithm biases) facing Indigenous, Black and equity deserving communities including those with accessibility needs and strategies to ensure that they are able to participate and fully leverage the benefits of online spaces and technology (i.e. learning, content creating, business opportunities).

2.1. Policy Area: Equity, Inclusion and Human Rights

Identifying and removing systemic barriers to the full participation of diverse communities in the digital realm is key to creating equitable access to services and programs for residents and visitors. This need has been emphasized even more so by the COVID-19 pandemic. Under the Ontario Human Rights Code, every person has a right to equal treatment in the provision of services and facilities, occupation of accommodation, contracts and in employment. In keeping with these core foundations, the City will strive to design digital infrastructure using an equity lens with the goal of fostering inclusion and addressing and removing systemic barriers, bias, discrimination and existing inequities.

Collecting sociodemographic data can be incredibly useful to understand and address systemic discrimination and inequities. However, it is important to recognize that some residents, including undocumented individuals, may be hesitant or unwilling to provide

this information (or to use digital infrastructure and digital services) for a variety of reasons, including if they are required to provide personal information.

Policy Statements

The City will:

1. Build digital infrastructure using equity as a lens, emphasizing human dignity, human rights, and ethical digital service standards
2. Identify and address systemic barriers that restrict the full participation of Toronto's diverse communities in the digital realm
3. Proactively consider and respond to the potential or realized negative implications of digital infrastructures, including potential harms such as bias, discrimination, or privacy breaches
4. Ensure that safeguards (such as tools, infrastructure, and governance mechanisms) are in place to detect, prevent, and remedy discrimination and inequity that could arise through the use of digital infrastructure
5. Ensure that communities facing affordability barriers and discrimination have access to affordable high speed internet connectivity and internet-enabled devices that meet user needs
6. Provide support to improve residents' digital literacy, awareness, skills, connectivity, access to devices, and reinforce their ability to act and make informed decisions in the digital realm
7. Collect socio-demographic and disaggregated data to identify, monitor, and address inequities in public services, including digital services
8. Engage, educate and train staff - and the broader public - on the value of collecting socio-demographic/ personal information in a standardized way, where appropriate

Sidebar: Data for Equity

*Indigenous, Black, and equity-deserving communities face systemic discrimination and barriers when it comes to accessing income, housing, employment, education and services. This can translate to negative health, economic and life outcomes and significantly affect overall wellbeing. For example, in Toronto, racialized groups have an average income that is about half (52.1%) the average income of white people, 87% of Indigenous adults live in poverty, 83% of lone parent families are led by women and 40% of those families live in poverty. People with disabilities are twice as likely to live in poverty and half as likely to be employed as able-bodied people, despite being qualified. The **Data for Equity Strategy** provides City divisions with guidance to support the collection and use of data to identify, monitor and address inequities in City services. It is anticipated that the implementation of the strategy will reduce inequities by helping City divisions to identify gaps, reduce or remove systemic barriers, and improve City service access and impacts for Indigenous, Black, and equity-deserving communities.*

2.2. Policy Area: Accessible Digital Infrastructure

Toronto is committed to ensuring all people can access all City services, products, and information. This includes providing an accessible digital environment where people can

access the City's web-based services, information and communications in a way that meets their individual needs. The City is committed to the identification, removal and prevention of accessibility barriers, including attitudinal, systemic, information, communications and technology, as well as built environment and physical barriers. Enabling accessibility and usability are achieved through the combination of a number of factors, and not simply about complying with a policy.

Policy Statements

The City will:

1. Ensure that all City digital services and infrastructure, including websites and web applications, digital kiosks and apps are fully accessible to and usable by all residents, businesses, visitors and City staff
2. Through training, guidelines and other similar means, ensure that staff are familiar with and know how to use all available accessibility features that are integrated into enterprise software (closed captioning, hand gestures etc.)
3. Ensure that alternative means for accessibility are provided for any digital services
4. Integrate usability and accessibility testing from a diverse range of skills and abilities in any new digital infrastructure initiative
5. Work with community and external partners to develop and integrate accessibility functions into materials and products where this has historically been challenging (maps, geospatial data, dashboards etc.)

Sidebar: Procurement of Accessible Goods, Services and Facilities

As required by the Accessibility for Ontarians with Disability Act, 2005 (AODA), the City must incorporate accessibility criteria and features when acquiring or procuring goods, services, and facilities. This is done as early as possible in the procurement process to ensure that digital infrastructure is compliant with the AODA. Incorporating accessibility requirements into digital infrastructure procurements will ensure that all people can use and access City services, products, and information.

2.3. Policy Area: Responsive Digital Infrastructure

Responsive digital infrastructure is infrastructure that is inclusive, helps solve societal challenges, and does not reproduce discrimination or systemic barriers. To ensure that all residents, businesses, visitors and City staff can navigate Toronto's digital infrastructure with confidence and in a self-determined manner, it is necessary to understand the needs of people and our communities – many of whom speak languages in addition to, or instead of, English – and involve them in the design of products and services. The Toronto Public Service and businesses are users too, and to succeed, digital infrastructure must also respond to their needs. As broad acceptance of digital public services depends on trust, residents and businesses must be able to rely on responsive, trustworthy and verifiable digital government applications and services that have high security standards and are responsive to user needs.

Policy Statements

The City will:

1. Pursue a human-centred and responsible approach to designing, developing, procuring and implementing digital infrastructure and services, based on user needs and preferences
2. Ensure that continued access to non-digital public services remains available to people who cannot or choose not to access digital services
3. Ensure people can access digital services in a language they understand that meets their needs
4. Enable access to digital public services through different channels, devices and platforms
5. Design and deliver digital infrastructure and services that are inclusive, ethical and resilient, based on user needs
6. Develop a consistent, predictable user-experience for City web-based services that is intuitive, simple, and that responds to and evolves with citizens' digital preferences

Sidebar: 311 Toronto

311 Toronto is the City of Toronto's one-window brand and customer service system that supports residents, businesses and visitors. 311 Toronto provides access to non-emergency City services, programs and information 24 hours a day, seven days a week. Information inquiries or requests are received via multiple channels such as phone, online, email, mail, mobile phone applications and Twitter. 311 Toronto is an example of city services that integrate responsive digital infrastructure solutions, by ensuring that residents with analogue preferences are accommodated. 311 also offers assistance in more than 180 languages.

3. Principle: Well-run City

Vision Statement: Digital infrastructure will enable high quality, resilient and innovative public services, and support the use of data and evidence to inform decision-making.

Description

A well-run City depends on evidence-based decisions and new insights to inform recommendations, guide decisions and ultimately enable better outcomes. Introducing more online interaction, paperless services, better access to data, and shared services can help create efficiencies and ensure public resources are better allocated. Resilience will enable the public service - and its digital infrastructure - to survive, adapt, thrive and ensure business continuity in the face of the chronic stresses and acute shocks that may arise. Tangible outcomes for residents, business and visitors can include fewer traffic collisions, enhanced quality-of-life, and a more efficient transportation system, and a government that works in deep collaboration with the people it represents to advance an agenda of fairness and prosperity for everyone.

3.1. Policy Area: Digital Transformation

Now, more than ever, the need to scale delivery of digital government services and engagement is a focus. Public health standards, fiscal realities, customer expectations and increased comfort level for fully digital experiences are driving digital transformation at an unprecedented rate. Digital transformation is an ongoing process in which manual and legacy systems are enhanced or replaced with more advanced digital ones that typically enable greater efficiency, faster service delivery, new capabilities, and better customer experience. Digital adoption is a change and involves a learning process where individuals accept and use new digital resources in the way that they are intended. Digital transformation cannot succeed without digital adoption. Success also comes through people understanding the reasons behind the change.

Policy Statements

The City will:

1. In the process of digital transformation:
    a. Provide a consistent customer service experience
    b. Maximize self-service opportunities
    c. Optimize customer service delivery and building trust
    d. Build confidence in City services
    e. Explore opportunities for easy integration with other City digital infrastructure systems and data assets
    f. demonstrate a clearly defined necessity for the proposed use of digital infrastructure, in relation to a municipal service or public interest objective

g. demonstrate that the proposed use of digital infrastructure is empirically effective at addressing the issue (need), and clearly connected to solving a problem

2. Drive digital transformation by streamlining and automating manual, disjoint security processes, when applicable
3. Work to increase the proportion of services that are available digitally

3.2. Policy Area: Data Governance

Data can provide deep insight into how the city functions, and cities have an ever-increasing need for accessing data: for developing new policies, managing traffic, zoning and planning, enforcement of regulations and monitoring environmental conditions. Better quality and real-time data can improve urban planning, support local decisions and result in more user-friendly services. Data can also play a transformational role in increasing transparency, empowering communities, transforming products and services, and driving innovation. The more data that is collected, the more important it becomes to direct its use in an ongoing and systematic way. To deliver high-quality, integrated services to residents, businesses, and visitors, data must often be collected, shared, and integrated across multiple agencies for operational use, analysis, and evaluation. This is driven by the availability of smart, secure, reliable, up-to-date, and resilient digital infrastructure.

Policy Statements

The City will:

1. Collect, manage, use and share data legally and securely. This will also be done in an ethical manner, by ensuring data collection clearly aligns with equity goals and priorities
2. Make better use of data across the public service to enable transformation, improve decision-making and improve liveability
3. Provide service users with assurance that their data is being used effectively for public benefit, efficiently and securely to deliver high quality public services
4. Invest in data infrastructure, and improve data sharing and integration capabilities across City divisions and regional jurisdictions (regional transit, watershed matters, business, tourism etc.)
5. Identify possibilities for greater data integration, analysis, and performance management as legacy technology systems are upgraded
6. Develop robust data governance mechanisms for all data stored on local systems as well as in the cloud, including appropriate levels of human oversight when necessary, to ensure data is used in an ethical manner, is managed responsibly through its lifecycle, and prevents the risks of abuse or malicious practices
7. Maintain high quality data standards with complementary metadata so it is clear where the data comes from and how it was collected

8. Periodically review and assess the data it collects to ensure it is relevant, required, and in alignment with the City's policy and equity goals and priorities
9. Develop training or resource materials to ensure staff understand data integration capabilities, limitations, and responsibilities

Sidebar: What is Data Governance?

Data governance programs commonly address goals in the following domains:

- *Data quality: E.g., ensuring data is able to be used as intended in a given context*
- *Data security: E.g., controlling internal and external access and protecting privacy*
- *Data architecture: E.g., developing and maintaining an enterprise data model*
- *Data lifecycle: E.g., setting up processes and procedures that specify what happens to data from the point of collection, organization, usage, storage, sharing, archiving, up to deletion.*
- *Metadata: E.g., classifying data according to sensitivity level, provenance, and retention period.*
- *Data storage and infrastructure: E.g., managing hardware and software capacity in order to support data quality, security, and lifecycle needs.*
- *Data integration and sharing: E.g., sharing data safely, in compliance with privacy and data protection requirements*
- *Data confidentiality: E.g. those who require access on a need to know basis*
- *Data integrity: E.g. ensure data isn't changed or manipulated*

3.3. Policy Area: Asset Management

The City uses sensors, data analytics, and internet-connected smart infrastructure for a variety of uses including to monitor the water supply, improve the efficiency of transit service, measuring air pollution, and improving health and safety outcomes. Deploying smart technology effectively has the potential to further improve the City's understanding of its assets, making it possible to plan maintenance more effectively, track local variations in environmental conditions, and even save money. For example, the City's automated water meter reading system helps predict leaks and connects residents to water usage data, saving millions of dollars since its launch. However, the use of sensor technology requires coordination of deployments, greater attention to interoperability (that is, the ability for systems or devices to communicate or exchange information with each other), and a mature process of data governance.

Policy Statements

The City will:

1. Use sensor technology to improve asset management, quality of life, and meet environmental targets
2. Centralize its approach to sensing devices, including requirements for interoperability and the coordination of deployments
3. Institute comprehensive review procedures that emphasize greater inter-divisional collaboration and sharing of historical and real-time data while ensuring compliance with cybersecurity and privacy policies

4. Establish and maintain the secure configuration of sensor assets through such means as device hardening
5. Install and configure preventative measures to deny unauthorized access, unwanted modification, and unplanned disruption of sensor assets that utilize network infrastructure

3.4. Policy Area: Toronto Public Service as a Connected Community

Access to the internet is essential. As daily life increasingly requires connectivity, Toronto's residents, visitors and businesses must be able to access and use the internet to its full potential. Internet service options for residents and businesses vary throughout the city, both in terms of quality and pricing. Free public Wi-Fi is available at most Civic Centres, all Toronto Public Libraries, TTC subway stations, and on some TTC bus routes. However, infrastructure gaps and other factors related to the digital divide prevent many from fully benefiting from connectivity.

In the search for new ways to address complex challenges, there is a growing recognition that the City can help drive solutions by collaborating across sectors and regions. It is important for the City to build on existing relationships, and to develop new partnerships to tackle policy approaches and coordinate cross-boundary matters.

Policy Statements

The City will:

1. Pursue a coordinated and sustainable method of expanding the ConnectTO Municipal Broadband Network through a "dig once" approach
2. Enhance resident experiences with digital services by using connected and digital infrastructure
3. Support the expansion of full fibre and prepare for 5G, using public assets to stimulate infrastructure investment
4. Work closely with intergovernmental, regional, and cross-sectoral partners, and Higher Education Institutions to address digital infrastructure challenges and coordinate cross-boundary matters

Sidebar: Dig Once

The Municipal Broadband Network can be expanded by integrating the installation of conduit for fibre optic cable into major capital and construction projects such as upgrades or repairs of water mains or sewer pipes; repairing or building roads, streetcar tracks and sidewalks; or the construction of transit infrastructure. This sustainable approach to expansion of the Municipal Broadband Network requires minimal upfront financial investment, can result in significant long-term savings through reduced re-construction costs, and will foster resilience through gradual expansion of the network over time. A "dig once" approach can support a number of related initiatives within the Digital Infrastructure Plan, including supporting economic benefits, by creating the conditions for businesses to grow; and supporting environmental benefits, by reducing the environmental footprint of digital infrastructure initiatives.

Sidebar: Cities Coalition for Digital Rights

The Cities Coalition for Digital Rights represents cities from around the world. The Coalition was conceived as an ongoing world-wide initiative to promote and defend digital rights of citizens, residents and visitors in cities and urban environments to ensure fair, inclusive, accessible and affordable non-discriminatory digital environments.

The Coalition Principles are inspired by the Internet Rights and Principles Coalition based at the UN Internet Governance Forum and in this endeavour the Coalition Cities have been joined by United Nations Human Settlements Programme (UN-Habitat), United Cities and Local Governments (UCLG) and Eurocities, the latter being aligned in the aim of furthering digital rights of citizens among its 190 members in 39 countries. Toronto became a member of the Cities Coalition for Digital Rights in 2019, and a core member in 2021.

4. Principle: Social, Economic and Environmental Benefits

Vision Statement: Digital infrastructure will contribute to positive social, economic and environmental benefits by supporting the success of Toronto's residents, businesses, academic institutions and community organizations

Description

This principle is focused on leveraging digital infrastructure to create a society that supports equitable and inclusive benefits whether for social, community, health, economic or environmental prosperity.

4.1. Policy Area: Social Benefits

As Toronto grows and changes, its digital infrastructure will need to expand. This presents an opportunity to direct infrastructure investments towards enrichment of the quality of life of Toronto's residents, businesses, visitors, and City staff. Digital infrastructure and rapid connectivity bring people new opportunities. To be fully empowered, people should first have access to affordable, secure and high quality connectivity; be able to learn basic digital skills – which should become a right for all that desire it; and be equipped with other means which together allow them to fully participate in economic and societal activities of today and the future. People also need easy access to digital public services. As digital transformation proceeds, it is essential to ensure that the increased use of digital infrastructure does not harm but rather contributes to people's physical and psychological well-being, and that digital transformation serves residents and businesses on an individual level as well as society as a whole: people should benefit from non-discriminatory access to online services in secure and trusted digital spaces, work-life balance in a remote working environment, protection of minors, and ethical algorithmic decision-making.

Policy Statements

The City will:

1. Use digital infrastructure to create a vibrant city by providing online health and safety resources, and improved access to City services such as recreation and culture events, and social assistance
2. Support community partners to help protect and empower everyone, especially children and young people, from malicious cyber activity such as cyber bullying, mobbing or grooming
3. Ensure that digital infrastructure does not knowingly collect youth data without verifiable parental consent
4. Collaborate with partners across public, private and voluntary sectors to drive innovation and help more people go online
5. Support a workplace culture in the Toronto Public Service that promotes a healthy and appropriate use of digital technologies and work-life balance

6. Pursue inclusive and equitable opportunities for digital infrastructure initiatives through community benefits initiatives such as the City's Social Procurement Program, which aims to create jobs, increase supply chain diversity and drive economic growth.

Sidebar: Collection of Data from Minors

Data privacy and security are complex and highly regulated areas of law, particularly as related to minors. Ways in which minors interact with technology is rapidly changing. Some examples include online learning platforms, advertisements, gaming platforms, and social media platforms. Information collected on children is always considered highly sensitive. Information about adults and children collected by private organizations under contract with the City are required to meet all obligations outlined in applicable laws (not limited to MFIPPA and PHIPA).

While the various pieces of legislation do not differentiate between the personal information of adults and children, it is an established fact that children's personal information is highly sensitive and must be safeguarded from inadvertent disclosure, which may result in potential harms.

Sidebar: Social Procurement

Social procurement at the City of Toronto is the achievement of strategic social, economic and workforce development goals using an organization's process of purchasing goods and services. The City's Social Procurement Program is comprised of two components: Supply Chain Diversity and Workforce Development. The Social Procurement Program was implemented across all City divisions beginning in January 2017. The Program aims to drive economic growth by improving access to the City's supply chain for diverse suppliers and leveraging meaningful training and employment opportunities for Indigenous Persons and persons belonging to an equity-seeking community. Social procurement uses the City's procurement power to achieve social, economic, and workforce development goals. This practice means every dollar spent achieves a double bottom line, one for operations and one for social impact.

4.2. Policy Area: Economic Benefits

Digital infrastructure has the potential to bring additional prosperity to Toronto's economy, allowing entrepreneurs to innovate, set up and grow their businesses, and create employment opportunities. The continued success of Toronto's tech, creative and innovative sectors is vital to sustaining our economy, while safeguarding social and environmental wellbeing. In an environment where digital infrastructure has the capacity to disrupt markets and revolutionise industries, these sectors should seize opportunities to innovate ethically and responsibly.

<u>Policy Statements</u>

The City will:

- Support local business to adapt and be successful in the digital economy
- Ensure digital infrastructure fosters and creates opportunities for Toronto's cultural, tourism, film, music and entertainment sector
- Create the conditions for technology ,creative and innovative sectors to grow, thrive, create jobs and attract investment
- Broaden the range of vendors tendering to supply digital services, including more small and medium sized enterprises and diverse suppliers from Indigenous, Black and other equity-deserving communities.
- Stimulate innovation through the provision of secure and affordable spaces for testing and experimenting with digital infrastructure (i.e. innovation zones)
- Build strong partnerships with regional partners, cross-industry partners, and Higher Education Institutions, and cooperatively pursue opportunities to build capacity and skills, secure investment and research partnerships
- Support innovative suppliers seeking to sell into the public sector by providing clearer routes to local procurement
- Set open calls to the tech sector to help solve City challenges

Sidebar: Transportation Innovation Zones

The City has a role to play in supporting local economic development in Toronto's vibrant start-up sector. Toronto has a globally strong talent pool, particularly in technology and manufacturing, and a robust start-up economy, including in the transportation innovation sector. The City has established a Transportation Innovation Zone (TIZ) at Exhibition Place to learn about emerging transportation technologies and approaches and how they could meet some of Toronto's transportation needs. The program will facilitate trials by industry and academic actors in the real-world environment of Toronto's streets. This initiative enables the City to learn about emerging technologies while supporting local innovation that can help meet the City's needs and goals.

4.3. Policy Area: Environmental Benefits

Climate change is a defining challenge of our time, and digital infrastructure has the potential to significantly contribute to the achievement of emissions reduction goals and targets. The uptake of digital solutions and the use of data will help in the transition to a climate-neutral, circular and more resilient economy. Similarly, data can be harnessed to help tackle the climate crisis. However, digital infrastructure also has the potential to result in harmful environmental impacts, from greenhouse gas emissions and high intensity use of fossil fuel sourced energy, and the accumulation of obsolete hardware. There is a need to critically examine options for sustainable digital infrastructure, including:

- renewable energy and waste heat recovery to advance TransformTO climate action goals
- repair, reuse and recycling of hardware to advance circular economy practices and software, and
- implementing procurement practices that avoid or reduce the consumption of resources in the first place.

Decisions related to new digital infrastructure initiatives – including sustainable procurements - need to consider the environmental impact of products and services through their lifecycle: will products be repurposed, reused, or recycled, or will they end up in landfill? What additional waste do digital services generate? Perhaps more importantly, decisions related to new digital infrastructure initiatives need to consider ways to avoid or reduce the generation of waste, enhance social outcomes, and drive cost savings and the efficient use of City resources while limiting negative environmental impacts across a product or service's life cycle in the first place

Policy Statements

The City will:

1. Ensure that digital transformation is sustainable in keeping with United Nations Sustainable Development Goals (SDGs)), and Council adopted TransformTO climate action goals
2. Pursue digital infrastructure that is sustainable, including renewable energy and waste heat recovery, has a lower overall environmental footprint, and higher energy and material efficiency including by such means as:
    a. extending the service life of devices and equipment through sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible
    b. minimizing the environmental impact of sensors and other digital infrastructure devices, and
    c. implementing configurations and policies that minimize printing
3. Identify opportunities to implement circular procurements in digital infrastructure initiatives using the City's Circular Economy Procurement Implementation Plan and Framework
4. Use digital infrastructure to raise community awareness of key environmental issues in order to generate greater commitment to climate change targets

Sidebar: Circular Economy

Electronics waste is now globally among the fastest growing waste streams. The ability to repair digital infrastructure will extend the longevity of digital infrastructure, and reduce the need to discard and replace them. The repair and reuse of items is an important aspect of the circular economy, and in meeting the City of Toronto's TransformTO climate action goals.

A circular economy also becomes increasingly important as resources become scarce and land degradation persists: extraction of raw materials, use of rare-earth metals, lead soldering, shipping and packaging are just a few examples of the ecological toll imposed by the short lifespan of digital infrastructure.

To drive innovation and the growth of a circular economy in Toronto, the City has established a ***Circular Economy & Innovation Unit*** *within the Solid Waste Management Services Division. The Unit is involved in research and planning as well as incorporating circular economy principles into new programs, policies, procurement and*

processes. The overarching goal of the unit is to make Toronto the first municipality in Ontario with a circular economy.

With respect to Circular Economy in Procurements, the Purchasing and Materials Management Division and Solid Waste Management Services Division worked collaboratively to develop the City of Toronto's Circular Economy Procurement Implementation Plan and Framework which guides how circular principles could be applied to the City's purchasing decisions to reduce waste, enhance social outcomes, and drive cost savings and the efficient use of City resources.

Sidebar: Sustainable Procurement

The City's Purchasing and Materials Management Division is working to develop a Sustainable Procurement Policy. To inform the development of this policy, the City of Toronto is a member of the Federal Government's Buyers Climate Action group which is collaboratively working with other public procurement organizations to develop a buying strategy on high environmental impact categories such as technology.

The City's Sustainable Procurement Policy will ensure the City's procurement processes include criteria that address reductions in GHG emissions and support the procurement of green, social and ethically produced goods and services. In addition, the City's Sustainable Procurement Policy will be aligned with the City of Toronto's Climate Lens Strategy and will continue to support TransformTO climate action goals and the City's transition to a more a circular economy.

Sidebar: The Sustainable Development Goals and TransformTO

The Sustainable Development Goals (SDGs) are the global blueprint adopted by all countries at the United Nations to achieve a better and more sustainable future for all, encompassing strategies to end poverty, improve health and education, reduce inequality, spur economic growth, and tackle climate change. For example, SDG #12 – responsible production and consumption – is about doing more and better with less to reduce the *environmental degradation that is endangering the very systems on which our future development depends. Aligning the Digital Infrastructure Plan with the SDGs will help position Toronto as a more digitally equitable, holistic, sustainable, and inclusive City.*

Learn more about the SDGs online at: https://sustainabledevelopment.un.org/sdgs

TransformTO is Toronto's ambitious ***climate action strategy****. Unanimously approved by City Council in July 2017, it includes a set of long-term, low-carbon goals and strategies to reduce local greenhouse gas emissions and improve our health, grow our economy, and improve social equity.*

Learn more about the TransformTO online at: www.toronto.ca/transformTO

5. Principle: Privacy and Security

Vision Statement: Toronto's Digital Infrastructure will operate in a way that protects the privacy of individuals in accordance with legislative requirements, and be safe from misuse, hacks, theft or breaches.

Description

Many public services are now deeply reliant on digital infrastructure, and the ensuing interconnectedness between City systems and data places greater focus on privacy, integrity, safety, and resilience. Yet this increasing reliance on digital infrastructure brings with it an increased potential for vulnerabilities that could lead to cybersecurity attack, breach, failure, or disruption. Toronto's digital infrastructure requires a Privacy- and Security-by-Design approach to ensure that the benefits created are not overshadowed by the privacy and security risks that may be created.

5.1. Policy Area: Security

Cybersecurity is the ongoing practice of ensuring the City's digital infrastructure is adequately protected from threats, vulnerabilities, and risks. This is essential to deliver quality and secure interactions between components within the City's digital realm (people, process and technology).

Digital infrastructure must always be designed, developed, maintained, and managed in alignment with the City's cyber risk position. The possibility of cyberattack must be anticipated, assessed, and mitigated by the City on a continuous basis. The successful implementation of Security-by-Design and timely, targeted response to attacks constitutes Cyber Resilience. Cyber resilience is key to operational resilience and business continuity, as well as the City's capacity to grow and flourish as we adapt to the increasing move to digital transformation. It ensures that the City can continue delivering services in the event of a cyber incident. Efforts to build cyber resilience are critical to both surviving and even thriving in the face of cyberattacks or physical disasters.

Policy Statements

The City will:

1. Design and/or procure all digital infrastructure with security-by-design principles up-front
2. Continuously detect, assess, manage, mitigate, and develop response protocols in response to evolving digital infrastructure and the cybersecurity risks it uncovers
3. Integrate security and safety into all digital infrastructure in order to foster trust in digital services

4. Ensure that cyber resilience and cybersecurity principles are built into all aspects of data solutions
5. Protect the data integrity and security of all data collected by the City of Toronto
6. Integrate information security procedures and guidelines into everyday business activities
7. Ensure appropriate access control (i.e. right level of access, to right assets, at right time and for right reasons) is built into all aspects of digital infrastructure

5.2. Policy Area: Privacy

Privacy plays a key role in a free, democratic society and is an essential element in maintaining public trust in government. Privacy-by-Design is a set of seven foundational principles which describe how privacy and data protection may be built directly into the design of systems, processes, and services. Privacy-by-Design applies not only to digital infrastructure, but also to the business processes and practices which support that infrastructure.

The seven principles of Privacy-by-Design are:

1) Proactive not Reactive; Preventative not Remedial - Anticipate and prevent privacy invasive events before they occur
2) Privacy as the Default - Automatically apply privacy as a default feature
3) Privacy Embedded into Design - Incorporate privacy as a key feature of the design of digital infrastructure
4) Full-Functionality - Make an effort to accommodate all reasonable and legitimate privacy and security features and functions
5) Full Data Lifecycle Protection - Map the entire lifecycle of data, and protect it from breach at all stages
6) Visibility and Transparency - Allow full access to and independent verification of all technology and business practices which use personal information
7) Respect for User Privacy - Offer users measures such as privacy defaults, consent, and appropriate notice of collection

<u>Policy Statements</u>

The City will:

1. Ensure Personal Information is only collected, used and disclosed by authorized users, for authorized purpose and on authorized terms
2. Design and procure all digital infrastructure with Privacy-by-Design principles up-front
3. Install adequate safeguards and compliance mechanisms for digital infrastructure that collects, uses, discloses or retains personal information
4. Continuously detect, assess, manage, mitigate, and respond to issues which threaten the privacy and integrity of data collected through or used by the City through digital infrastructure
5. Ensure that Privacy Impact Assessments are undertaken prior to implementation of any digital infrastructure initiative involving the collection or use of personal information

6. Ensure that Privacy and Security risk mitigation plans are aligned to, and address any risks that have been identified through a Privacy Impact Assessment (PIA) or Threat Risk Assessment (TRA)
7. Ensure that personal data (or personally identifiable information) collected by the City of Toronto or any of its subcontractors cannot be sold for the purpose of revenue generation or reward system
8. Institute mechanisms that help residents understand and better control the use of their information.

Sidebar: Privacy Impact Assessment

A Privacy Impact Assessment (PIA) is an in-depth review and analysis of a project, program, technology system, and/or process and is intended to identify and resolve privacy risks throughout the design or redesign of a technology, system, program or service. The City of Toronto is responsible for ensuring the protection of individuals' privacy at all times. The protection of privacy also forms part of the City's Accountability and Openness principles as stated in the Information Management Framework.

Some scenarios that could trigger the requirement for a PIA are as follows:

- *New or increased collection of personal information, with or without the consent of individuals.*
- *A shift from direct to indirect collection of personal information.*
- *New data matching or increased sharing of personal information between programs within the same division or across the City of Toronto, other government organizations or third parties. Electronic service delivery initiatives may involve shared service delivery models where data is shared with more than one program area.*
- *New proposal may affect client privacy in the collection, use, disclosure and/or retention of personal information.*

5.3. Policy Area: Consent

The City cannot collect, use or disclose personal information unless it is legally authorized to do so to fulfill an explicitly specified and legitimate purpose. The City must give advance notice of collection in writing (either on a form or online) before collection takes place. Consent is significantly more challenging to obtain when it relates to the *passive* collection of data – this could take place when an individual passes by a sensing device that collects data (e.g. it detects movement), but does not collect personal information. In general, this type of collection requires reliance on "implied consent", however efforts must be made - such as through signage - to inform people that they may be subject to data collection.

<u>Policy Statements</u>

The City will:

- Establish expectations and standards to obtain meaningful consent when collecting data, including in scenarios which rely on “implied consent”
- Ensure that residents are informed when data is collected and what safeguards are in place to protect their confidentiality and data

5.4. Policy Area: Digital Identity

Digital identity is a fundamental and critical component of the overall IT security system that manages user identities and their accesses within an organization. Digital identity identifies risks within programs, processes and projects and validates the secure usage of City services, assets, and business applications, and limits unauthorized access and data breaches within the City.

The following principles are used to support the City's digital identity mission and vision:

- Encourage the development of robust, secure, and scalable solutions capable of achieving security in a dynamic landscape.
- Promote digital infrastructure that is inclusive and delivers benefits to a wide range of users and/or devices.
- Foster confidentiality, integrity, and availability at the core of all solution designs to enhance the security posture of the City.
- Recommend viable and sustainable solutions that support user centric designs and deliver intuitive and seamless user experiences across all technology channels.
- Support digital infrastructure that can be independently assessed, audited and subjected to enforcement to achieve a transparent digital footprint.
- Build a centralized identity store with the capability of integrating with applications having identity stores in silo.

<u>Policy Statements</u>

The City will:

1. Promote an understanding and accelerate the adoption of digital identity within the City
2. Develop digital identity requirements needed to address specific business needs to achieve an intuitive and seamless user experience
3. Enhance and support compliance, auditing, and digital identity controls across all information technology environments on an ongoing basis

6. Principle: Democracy and Transparency

Vision Statement: Decisions about Digital Infrastructure will be made democratically, in a way that is ethical, accountable, transparent and subject to oversight. Torontonians will be provided with understandable, timely, and accurate information about the technologies in their city, and opportunities to shape the digital domain.

Description

Cities are the closest democratic institutions to the people. As such, they have an important role to play in building trust in digital services and infrastructure that supports our community. This can be done in a variety of ways, including by ensuring that human rights principles of privacy, freedom of expression, and democracy, are incorporated by design into the City's digital infrastructure.

6.1. Policy Area: Public Consultation and Participation

Ensuring Toronto's continued growth as an ethical connected community is a collective responsibility. For people to feel confident that digital public services are reliable and can be trusted, the City must engage fully with all sectors and the general public to ensure their concerns are reflected. Digital infrastructure opens up the potential for the City to consult more widely, share openly and involve more people in shaping how the city grows and thrives in a digital world. And just like how public consultation is a necessary component of building out the City's physical infrastructure, so is it necessary for development of the City's core digital infrastructure: residents should have the opportunity to help shape the digital realm and share their ideas and content with others unimpeded. Indeed, the success of Toronto's digital transformation can be measured by the level of consultation in this process, including with stakeholders, sectors, businesses, communities, neighbourhoods and organizations. This also includes the involvement of persons who feel anxious about digitalization, security and privacy, or find it difficult to keep pace with rapid technological development.

<u>Policy Statements</u>

The City will:

1. Assess the impact of digital infrastructure planning and decision making processes from an equity and reconciliation lens
2. Ensure that residents can easily access and understand information about the City's digital infrastructure: how it operates, and why the decision was made to support its deployment
3. Establish mechanisms, such as program advisory bodies, to ensure residents and stakeholders have a voice in the decision-making process in development of the City's digital infrastructure

4. Communicate openly with local communities and other groups who might be affected by proposed digital infrastructure initiatives. This will include establishing minimum requirements for:
    a. Thresholds to identify the types of initiatives that would benefit from consultation (for example, ones that have a direct impact on the lives of residents and clients)
    b. The kind of information that should be made available during these engagements (i.e. transparent, understandable, accurate)
    c. Stage-gating requirements which ensure feedback can inform decision-making (i.e. accountable, timely); and
    d. "Plain Language" communication materials that clearly explain what the digital infrastructure is, what it can do, and why it is being considered. These materials should be accessible, easy for everyone to understand, and where appropriate, available in multiple languages
5. Engage openly with people on issues such as privacy, ethics, and inclusion
6. Use digital infrastructure to facilitate better community engagement and participation, further developing approaches such as online consultation and participatory budgeting

Sidebar: Digital Citizen Advisor

The City of Toronto operates a Digital Citizen Advisor program, where volunteers can provide input into the development of new or changing digital municipal services. Advisors can participate in a variety of ways including through surveys, focus groups, interactive online consultations, accessibility testing, and one-on-one interviews. Advisors are currently helping the City gather input into how it can transform its recreation and facility booking system to serve residents better. The Digital Citizen Advisor program is an example of how residents can participate in the development of the City's digital infrastructure and digital services.

6.2. Policy Area: Access to Information: Transparency

The City wants to ensure that the public has the means and tools to access and understand its digital infrastructure. Building on the International Open Data Charter principles set out in Toronto's Open Data Master Plan, we will improve transparency, accountability, and open government. The City will also ensure that digital infrastructure improves access to data about local needs and assets to allow people to make informed decisions in their communities. This work will be strengthened by data classification, for example by distinguishing between non-personal data (such as the number of streetcars that run on time) and personal data (such as the number of times a certain person traveled on the streetcar).

Policy Statements

The City will:

1. Publish data about local needs and assets to allow people to make informed decisions in their communities, while respecting the fundamental right to privacy

2. Develop tools to make data processing (management methods, risks, guarantees and rights) accessible and understandable to everyone
3. Commit to the open publication of the criteria for, and rationale behind, any decisions that are made to implement a digital infrastructure initiative that has a direct impact on the lives of residents and clients
4. Publish all internal policies and standards related to digital infrastructure, except in instances where security, privacy or legal matters would be compromised
5. Develop a public registry of digital infrastructure, such as sensors, that is deployed in the public realm
6. Maintain a registry of all open source software and hardware projects that are undertaken by the City
7. Record and report all security breaches including corrective action that is taken

Sidebar: Open Data

The City routinely releases non-personally identifiable data that can be used by anyone for any purpose through an Open Data license. Organizations collaborating with the City are also encouraged to provide data that can be shared through the Open Data Portal. The Open Data Portal is an example of an initiative to support innovation, and improve transparency, accountability, and open government.

6.3. Policy Area: Open Contracting

Open contracting is about the increased disclosure of government contracting and procurement processes and decisions related to information technology. This includes opening up information on contracts for both hardware and software. Opening up the contracting process to greater public oversight is in alignment with the Democracy and Transparency principle. This approach will lead to fundamentally better outcomes for the City (increased competition, more insight, analysis and efficiency), for local businesses (fairer competition, ability to research the market, fostering entrepreneurship) and civil society (improved integrity, better monitoring and tracking of service delivery).

Policy Statements
The City will:

1. Ensure the City's procurement processes continue to be fair, open and transparent for all procurements including digital infrastructure, including the use of open contracting methods where appropriate
2. Ensure information related to each procurement is disclosed, including the planning, decision making, scoring, and awarding of all digital infrastructure contracts

6.4. Policy Area: Trust in Digital Government

Everyone should be able to navigate the digital realm safely and conveniently. As broad acceptance of digital government depends on trust and confidence, it is essential that residents and businesses can rely on trustworthy and verifiable digital services that are in full conformity with high privacy and security standards.

Policy Statements

The City will:

1. Foster trust in digital services and ensure a safe digital realm by integrating fundamental rights and security into all projects that have a digital component

6.5. Policy Area: Algorithmic Transparency and Responsibility

The use of algorithms, Artificial Intelligence (AI) and similar technologies to support actions and decisions taken within systems and technologies are becoming increasingly common. However, issues can arise when such technologies are inaccurate, reinforce existing inequalities, or are accepted as an unquestioned source of truth. It is therefore critical that public services which rely on AI respect the same principles of responsibility, transparency and security as all other City services.

Policy Statements

The City will:

1. Foster responsible, accountable and human-centred development and use of transparent and explainable AI.
2. Develop a public AI registry, providing understandable and up-to-date information about how algorithms are used by the City, and how residents may interact with them
3. For all algorithms, the City will seek to:
    a. Make source code open source
    b. If the algorithm has been trained, provide sufficient information about the training data used to permit analysis for potential bias; and
    c. Provide information about how the algorithm operates in a fair and non-discriminatory manner
4. Ensure that necessary safeguards are in place to prevent, detect and remedy unlawful discrimination through the use of AI systems
5. Establish data governance mechanisms and ensure appropriate oversight - including human oversight, if necessary - over AI systems used by the City

Sidebar: COVID-19 Chatbot

In 2020, the City implemented a 'chat bot' to help process the volume of inquiries related to the COVID-19 pandemic. This chatbot used artificial intelligence (AI) technology, enabling a computer system to perform tasks that would typically be performed by a human (i.e. provide answers to common questions). The chatbot drew from content found on toronto.ca/covid-19 to find answers, and its performance improved with every interaction. The chatbot complemented traditional channels for members of the public to engage with the City, and integrated human oversight to ensure correct functionality and decision-making.

7. Principle: Digital Autonomy

Vision Statement: **The City will maintain control in the selection, use and design of its digital infrastructure, so that it - and its residents - can act with autonomy and in a self-determined manner within the digital realm.**

Description

Digital Autonomy refers to the City's ability to develop, maintain and control the selection, use and design of its digital infrastructure to deliver public services and advance the public interest, as informed by legislation, community consultation, and the needs of its residents to adapt to living in the digital realm. It is an approach to building out digital infrastructure in a way that ensures the City has the ability to autonomously control and maintain its digital infrastructure assets through constructive and self-directed relationships with technology companies and vendors. Historical ways that the City's control of digital infrastructure assets have been limited or restricted include:

- Products having embedded or contractual limitations, that could - for example - restrict the addition of extra functionality into the product
- Manufacturers and vendors placing restrictions (or prohibitions) on who can repair, modify or maintain digital infrastructure, and
- Both of these above situations contribute to "vendor lock-in" scenarios, where it becomes impractical to switch to another product or vendor, even if the original product or vendor has a known deficiency.

These scenarios can also limit the interoperability of digital infrastructure.

7.1. Policy Area: Open Source

Open-source software refers to all software that can be used, modified and shared (with or without modifications) by any person, and published or distributed under an open licence. Open Source itself is a type of licensing agreement that allows users to freely modify a work, use said work in new ways, integrate the work into a larger project or derive a new work based on the original. Open Source Software is integral to digital autonomy as it contributes to interoperability and reusability of solutions; contributes to the avoidance of vendor lock-in (i.e. promotes independence from specific vendors); and promotes collaboration and sharing of solutions across public institutions. Public access to source code is a key component of Open Source Software, which aligns with the Transparency and Democracy principle.

Policy Statements

The City will:

1. Integrate Open Source Software requirements into procurement processes, where appropriate, while promoting free competition in terms of software and hardware purchases
2. Promote the reuse of technological solutions developed by or for the City, and streamline sharing with other public administrations

3. Ensure that all code or technological material developed by or for the City are under open licenses and published, where appropriate
4. Ensure all code is validated for vulnerabilities, and subject to a secure development lifecycle (SDL)
5. Engage the local civic tech community to develop, pilot or test open source solutions

7.2. Policy Area: Intellectual Property

Intellectual property and Open Source are closely related concepts in which open source licenses accompany a specifically purchased software program. The use of Open Source Software therefore compels the City to develop a legal framework for determining and managing intellectual property rights. A number of Open Source licenses include intellectual property rights clauses.

Policy Statements

The City will:

1. Integrate intellectual property rights clauses into the procurement process when undertaking an Open Source initiative
2. Seek to ensure that local benefit accrues from Intellectual Property when value is generated by the City or enhanced through partnerships with the City or its residents, when using City data assets.

7.3. Policy Area: Open Standards & Interoperability

Open Standards are a set of rules designed to do a specific job in technology. Open standards refer to file formats, protocols and application interfaces that can be implemented by everyone (in open source and proprietary software alike) since the specifications are available at no cost, and since their development and standardization is open and transparent. This standardization work is done by specialized agencies that are usually either government agencies or organizations created by professionals from a given industry sector. Examples of such organizations include the Internet Engineering Task Force (IETF), the International Organization for Standardization (ISO) and the Organization for the Advancement of Structured Information Standards (OASIS). The use of open standards promotes interoperability and compatible integration between multiple information systems, and are therefore an integral element of digital autonomy.

As the City and its services become increasingly contingent on networked digital infrastructure, interoperability is critical for the City's internal operations, services and processes, as well as its ability to work with other municipalities and external stakeholders. Interoperability is the capacity of different information systems - which could come from different providers - to work together and share information without technical or legal boundaries. Interoperability is an important element of digital autonomy as it allows for data to be accessible by different systems (also referred to as portability), as opposed to being limited or restricted by proprietary technology. In the longer term, this will ensure that data retained by the City can be used (shared, modified

and expanded upon) regardless of the applications and providers that are used in the future.

Policy Statements

The City will:

1. Ensure that its digital infrastructure works and communicates with other technology and systems, and can be easily upgraded and expanded
2. Enable digital infrastructure to interoperate - through open standards and protocols where appropriate - including between the City and its Agencies, Boards, Commissions and Corporations
3. Enable data exchange to occur between software and data stores / data centres
4. Ensure the availability of diverse and high-performing digital infrastructure to guarantee freedom of choice and the ability to change modules when necessary
5. Ensure that software, data and tools generated by the City are reusable and openly accessible as long as this is compliant with fundamental rights
6. Foster our own key digital capacities to develop and deploy digital solutions in a secure cloud infrastructure for City services
7. Develop interoperability by design of policies, data, solutions and services

7.4. Policy Area: Data Residency in Canada

Prior to the use of digital infrastructure, data and records were largely in print and paper format, and stored in file cabinets, file rooms, and records centres. Most of that information is now stored electronically. As more City services are made available online, cloud-based solutions will play an increasing role. A key feature of cloud-based solutions is the ability for data to travel rapidly from one location to another. However, the ability for data to cross borders can raise privacy and security concerns: if data is stored outside of Canada, Canadian laws that protect it from being improperly disclosed may not apply. The requirement for City data to be stored and transmitted in Canada removes this risk, and ensures that public data will remain subject to Canadian privacy and data protection regulations. As data is a key element of digital infrastructure, requiring it to be stored in Canada is a key concept of digital autonomy.

Policy Statements

The City will:

1. Ensure that City data, including personal information, is stored within Canada,
2. Ensure encryption of any data that contains personal information whether in transit or at rest (i.e. in storage)

7.5. Policy Area: Maintenance & Repair

Digital infrastructure solutions are becoming harder to fix and maintain, with repairs often requiring specialized tools, difficult-to-obtain parts, or access to proprietary diagnostic software. The repair and maintenance of digital infrastructure can also be impeded by legal protections, software locks, and end user licence agreements. These challenges can hasten the obsolescence of digital infrastructure, leading to increased operational

costs and environmental waste. Integrating the right to repair into digital infrastructure solutions – both hardware and software – will provide the City with greater control, choice and flexibility around repairs and maintenance, and help meet climate change objectives.

Policy Statements

The City will:

1. Integrate Right to Repair requirements into new digital infrastructure solutions
2. Establish maintenance standards for digital infrastructure

7.6. Policy Area: Control

To facilitate the move towards digital autonomy, and to help achieve the policy statements within this Plan, it will be necessary for the City to maintain ownership and control over its digital infrastructure assets. "Control" in this sense is wide-ranging, and will be realized through a variety of channels such as procurement and licensing agreements, as well as through the digital skill-set of the Toronto Public Service.

Policy Statements

The City will:

1. Establish thresholds to consider ownership or control of digital infrastructure and assets deployed for City purposes
2. Require a clear rationale be provided when ceding control of digital infrastructure to any third parties or vendors
3. Ensure that the Toronto Public Service has the expertise to design, use and implement digital infrastructure

Sidebar: First Nations Data Sovereignty

First Nations people have historically had a problematic relationship with researchers, academics, and other data collectors. First Nations have often expressed that they have been the focus of too much research, that research projects are too often conducted by non-First Nations people, that research results are not returned to communities, and that the research does not benefit First Nations people or communities.

The First Nations Information Governance Centre (FNIGC) developed principles establishing how First Nations' data and information will be collected, protected, used, or shared. These principles of ownership, control, access and possession - more commonly known as OCAP® - assert that First Nations alone have control over data collection processes in their communities, and that they own and control how this information can be stored, interpreted, used, or shared. OCAP® respects that rights of First Nations communities to own, control, access, and possess information about their peoples is fundamentally tied to self-determination and to the preservation and development of their culture. Initiatives related to the collection and use of First Nations data and information should respect these OCAP® principles.

8. Monitoring and Performance Measurement

The fast pace of innovation in the technology sector brings a requirement to ensure that the Principles and Policy Statements within the Digital Infrastructure Plan are reviewed regularly for currency and relevance. As Toronto gains experience in applying the Digital Infrastructure Plan, and as legal, technical and/or community standards are established, it will be revisited, re-evaluated, and renewed as necessary. At a minimum, the DIP shall be reviewed every three to five years.

In order to monitor how the DIP is being used across the City and agencies, boards, commissions, and corporations, an evaluation matrix will be developed. This matrix will be in accordance with the City's Results-Based Accountability framework that tracks the extent to which DIP guidelines are followed.

As part of this matrix, performance measures will be established for each policy area so that it is possible to measure and demonstrate the impact of the Digital Infrastructure Plan (i.e. How was it used? How well was it done? Who is better off?)

Individuals, organizations or other affected parties are welcome to submit comments on the Plan at any time. The evolution of the DIP is intended to be a transparent process. This includes a version history (including a description of consulted parties), with all prior versions of the Plan remaining available for review.

9. Implementing the Plan

The DIP sets out the overarching vision for Toronto as a Digital Connected Community. Distinct policies, strategies and/or action plans will be required for some specific policy areas. Updates to the Plan will align to and describe further sector-specific actions to bring the DIP to life.

The design or procurement of all digital infrastructure must be guided by the principles and related policy statements within the DIP. At a micro level (i.e. project by project), guidelines and an accompanying checklist will be used by City and Agency staff to ensure compliance with the DIP. To ensure consistency with City Council's direction, the DIP and these guidelines must be applied to Corporate technology as well as Operational / Divisional technology.

The Plan incorporates the principles and requirements set out in related Federal and Provincial regulations to bring the City into compliance with applicable legislation. Should a provincial or federal law or regulation contain a higher standard than the DIP, those higher standards must be met. In the event of a conflict between the DIP and a provincial, or federal law or regulation, obligations under the latter must be met. The DIP does not replace or supersede any legal obligation or requirement which applies to any

organization; rather, it is to be applied in addition to any such obligations or requirements.

10. Appendix 1: Key Terms and Definitions

Accessible: an adjective, which in the context of the Accessibility for Ontarians with Disabilities Act, means "without Barriers ". The Ontario government creates accessibility standards as laws to make Ontario more accessible

Algorithm: a set of well-defined instructions or rules which produces an output. When we say algorithm, we normally mean an algorithm done by a computer, but the word can also refer to things like bureaucratic rules.

Artificial Intelligence: the theory and development of computer systems able to perform tasks that normally require human intelligence. Some examples include visual perception, speech recognition, decision-making, and translation between languages

Barrier: In the Accessibility for Ontarians with Disabilities Act, the term means anything that prevents a person with a disability from fully participating in all aspects of society because of their disability including, but not limited to, physical, architectural, communications, technological barriers, or a policy or practice.

Breach, Security: any incident which results in unauthorized access to a digital infrastructure, regardless of intent

Consent: Free, explicit and informed expression of will by which an individual agrees voluntarily, without pressure, to the collection and processing of data concerning him/her.

Cloud; The Cloud: a set of servers which do what personal computers used to, like run applications and store files. There are many types of clouds, such as "private clouds", where the servers are under the control of one entity, and "public clouds", where access is normally sold on a per-usage basis

Cyber resilience: The ability to prepare for, respond to and recover from cyber attacks

Cybersecurity: the practice of security applied to digital infrastructure. Includes protection of physical digital infrastructure (like literal cables and servers) and non-physical digital infrastructure (like access and storage of data, limiting use of technologies, etc.).

Device Hardening: process to eliminate cyberattack by patching vulnerabilities, turning off non-essential services and enabling security controls such as password management, file permissions and disabling unused network ports

Digital Adoption: The size and scale of usage or uptake of a digital service, compared to a non-digital counterpart. For example, paying bills online versus paying bills in-person. Can be extended into analogies about people's "digital adoption" and institution's "digital adoption", which typically require further definition

Digital Autonomy: Refers to the City's ability to develop, maintain and control the selection, use and design of its digital infrastructure to deliver public services and advance the public interest, as informed by legislation, community consultation, and the needs of its citizens to adapt to living in the digital realm.

Digital Divide: The disparity within the population regarding access to digital technologies, due either to a lack of equipment and services, or a lack of knowledge and understanding of these technologies.

Digital Equity: equal access and opportunity to digital tools, resources, and services to increase digital knowledge, awareness and skills. This includes the equitable application of digital data, tools, programs and services.

Digital Infrastructure: Infrastructure that creates, exchanges or uses data or information as a part of its operation. Digital infrastructure includes physical structures, cabling and network systems, software systems, data standards and protocols as well as the data itself. Some examples include sensors (cameras, GPS sensors, microphones, etc.), broadband and telephone networks, Wi-Fi, desktop software, web pages, and mobile apps and open data standards

Digital Literacy: Ability to understand and use digital communication technologies, including digital data, in everyday life to achieve personal goals and to expand one's knowledge and abilities.

Digital Rights: the legal and human rights which apply to us all when using digital technologies. These include rights such as freedom of expression, privacy and non-discrimination under protected human rights grounds

Digital Transformation: the intentional reform of organizations and business practices to achieve more value from digital technology.

Discrimination: Any practice or behaviour, whether intentional or not, which has a negative impact on an individual or group protected in Ontario's Human Rights Code (e.g., disability, gender identity, sex, race, sexual orientation, etc.) by excluding, denying benefits or imposing burdens on them.

Equity and Inequity: Equity understands, acknowledges and removes barriers that prevent the participation of any individual or group, making fair treatment, access, opportunity, advancement and outcomes possible for all individuals. In the context of City of Toronto services, inequities refer to unfair and avoidable differences in service access, experiences, impacts and outcomes. Socio-demographic data is a critical tool to understand who our service users are and if any sociodemographic groups are disadvantaged or require additional supports.

Equity-deserving Groups: Equity-deserving groups refers to communities that face significant collective challenges in participating in society because of barriers to equal access, opportunities and resources due to disadvantage and discrimination, and actively seek social justice and reparation.

While Indigenous people and communities in Toronto face inequities, they are not considered to be an equity-deserving group. Indigenous people are the original inhabitants of what is today Toronto, and have unique status and rights recognized under Section 35 of the Constitution. More than equity, Indigenous communities seek prosperity that is characterized by economic and social well-being, inclusion and self determination, which were eroded through historical and ongoing colonization.

While Black people in Toronto also face inequities and seek equity, they are recognised as unique and separate from other equity-deserving groups. People of African descent who commonly self-identify as Black people have a unique experience of centuries of enslavement in what is now Canada. The time period of legalized enslavement was longer than the period during which Black people have been legally free. The legacy of socio-economic enslavement continues to significantly impact Black communities in Toronto and across Canada through inequities in social and economic outcomes and well-being. As such, Black communities are more appropriately to be considered as freedom-seeking.

Ethical digital service standards: concerns the questions of how developers, manufacturers, authorities and operators should behave in order to minimize the ethical risks that can arise from the use of digital infrastructure in society, either from design, inappropriate application, or misuse.

First Nations: Adopted in the early 1980s, this collective term refers to the original Nations who existed across the territory for thousands of years, and who were colonially referred to as “status and non-status Indians” under the Indian Act, 1876.

Hack, Security: refer to Breach, Security

Hardware: refers to the physical parts of a computer and related devices. Internal hardware devices include motherboards, hard drives, and RAM. External hardware devices include monitors, keyboards, mice, printers, and scanners.

Human-centered: an approach to system development that focuses on making systems usable. It is a multi-disciplinary activity which incorporates human factors and ergonomics knowledge and techniques

Indigenous: a term used internationally to collectively represent the original inhabitants or those naturally existing in a particular place. In this context, “Indigenous” is used to refer to the First Nations, Métis and Inuit.

Intellectual Property: a branch of law which extends the concept of property to intangible creations of the mind. Examples include copyrights, patents, trademarks and trade secrets.

Internet-connected smart infrastructure (also referred to as Internet of Things): Digital Infrastructure such as sensors, devices and wearables, that are connected to the internet and which generate data

Interoperability: the capacity of different information systems - which could come from different providers - to work together and share information without technical or legal restrictions

Legacy system(s): older technology systems, typically using programming languages and physical technologies which are no longer in common use, are less likely to be interoperable, and which can be hard to continue to support.

Open Data: Data, and related data-like information, made proactively available to the public under an open data license that allows the public to use the data as they wish

Personal Information: recorded information about an identifiable individual. This definition comes from provincial public-sector law, which puts restrictions on how governments can collect and use this type of information

Privacy by Design: To build privacy and data protection, into the design specifications and architecture of information and communication systems and technologies at the beginning, in order to facilitate compliance with privacy and data protection principles.

Privacy Breach: The improper or unauthorized creation, collection, use, disclosure, retention or disposition of personal information.

Privacy Impact Assessment (PIA): an in-depth review and analysis of a project, program, technology system, and/or process and is intended to identify and resolve privacy risks throughout the design or redesign of a technology, system, program or service.

Racialized: Racialized persons and/or groups can have racial meanings attributed to them in ways that negatively impact their social, political, and economic life.

Right to Repair: a proposed legal idea, which would provide the practical means for electronic equipment owners to repair their devices. There is no inherent right to repair in Ontario nor in most of the world, but when purchasing technology this can sometimes be negotiated.

Secure Development Lifecycle: process of including security artifacts in the Software Development Lifecycle

Sensors: an electronic device which collects data about the physical world, such as light (e.g. cameras), sound, heat, motion, etc., and transmits it to a computer

Software: programs and other operating information used by a computer.
Socio-demographic data: Socio-demographic data describes personal characteristics and social identity. Characteristics such as age, language, race, First Nations, Inuit, Métis identity, Canadian-born or immigrant, disability, gender, sexual orientation, income and place of residence are all examples of socio-demographic data.

Standards: a document which provides a set of agreed-upon rules, guidelines or characteristics for activities or their results. Technical standards are typically established by governments, by standards development organizations and industry associations

Systemic Barrier: A barrier embedded in the social or administrative structures of an organization, including the physical accessibility of an organization, organizational policies, practices and decision-making processes, or the culture of an organization.

Threat Risk Assessment (TRA): process for identifying the threats to confidentiality, integrity, or availability of Information Technology (IT) assets, assessing current vulnerabilities for each IT assets based on existing or proposed controls, analysing and quantifying the risk levels for the vulnerable IT assets, and providing recommendations to lower the risks to acceptable level.

11. Appendix 2: Agencies and Corporations overseen by Chief Technology Officer

Service Agencies:

CreateTO
TO Live
Exhibition Place
Toronto Transit Commission
Toronto Atmospheric Fund
Toronto Parking Authority
Toronto Zoo
Heritage Toronto
Yonge-Dundas Square

Arena Boards:

George Bell Arena
Larry Grossman Forest Hill Memorial Arena
Leaside Memorial Community Gardens Arena
Moss Park Arena
North Toronto Memorial Arena
Ted Reeve Community Arena
McCormick Playground Arena
William H. Bolton Arena

City Board-run Community Centres (Association of Community Centres or AOCC's):

519 Community Centre
Applegrove Community Complex
Cecil Community Centre
Community Centre 55
Eastview Neighbourhood Community Centre
Central Eglinton Community Centre
Ralph Thornton Community Centre
Scadding Court Community Centre
Swansea Town Hall Community Centre
Waterfront Neighbourhood Centre

City Corporations:

Toronto Community Housing Corporation
Lakeshore Arena Corporation