City of Dallas

CITY OF DALLAS
INTERNET OF THINGS (IOT)
BEST PRACTICES GUIDELINES
VERSION 1.0

2018 - 2020

TABLE OF CONTENTS

For questions, please contact us at SmartDallas@dallascityhall.com

Published August 2018
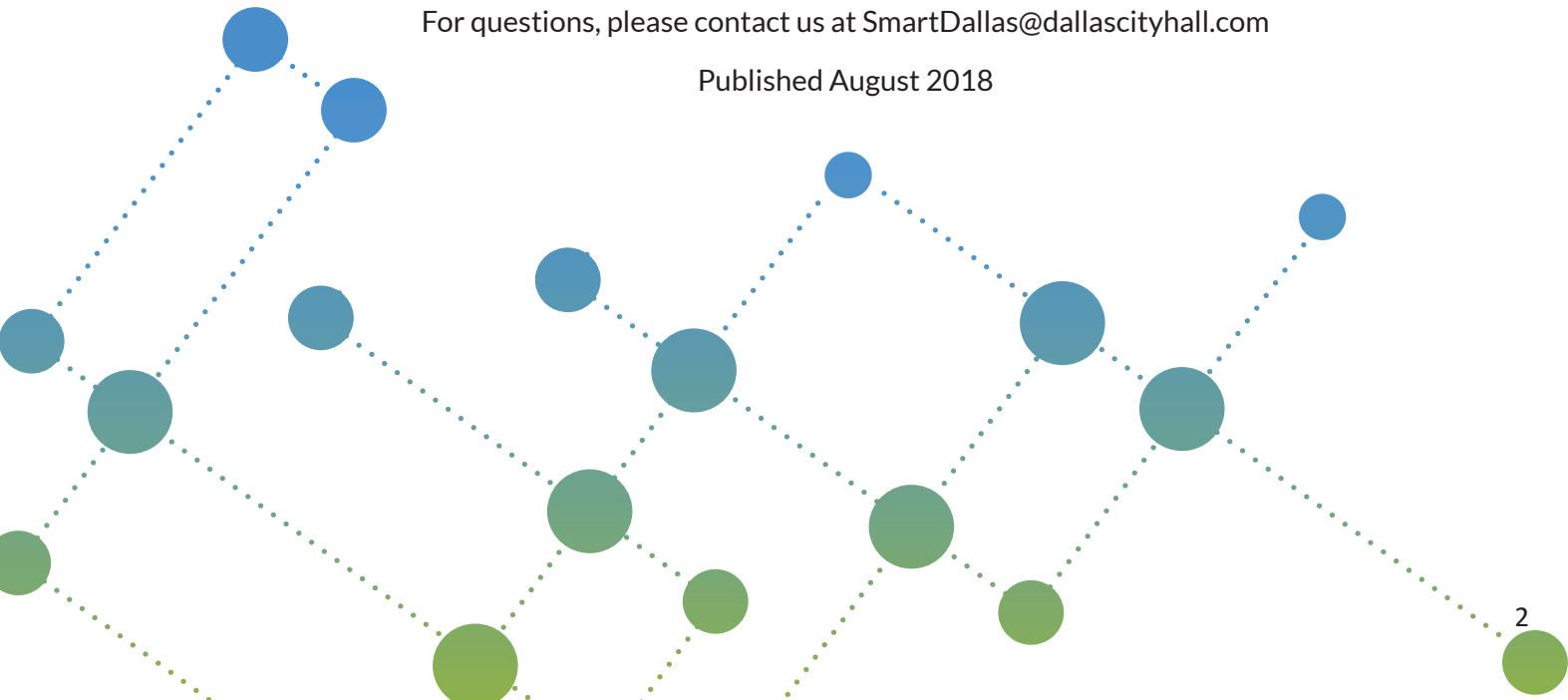
INTRODUCTION

The purpose of this publication is to articulate the guidelines and best practices that the City of Dallas and its partners and vendors will adhere to when operating, implementing or contemplating Smart City and IoT solutions. This document is written from a technology perspective and does not negate the need to adhere to any and all relevant ordinances, policies, guidelines, standards or similar instructions published separately by the City of Dallas or the industry leading best practices.

CITY OF DALLAS IOT & SMART CITY ARCHITECTURE

The City of Dallas' Technology+ Strategy encompasses a data-centric architecture and focuses on leveraging technology and data across as many use cases as possible to maximize the value citizens receive. The City has implemented Horizontal Enablers to meet the goals of Citizen Focused, Smart Technology Platform, Data Driven, and Security and Privacy as described in the Technology+ Strategic Plan.

In the context of this document, a Horizontal Enabler is defined as technology, data, intelligence and applications that are utilized to deliver value across multiple domains, use cases and departments. The City of Dallas has guiding characteristics for each category of Horizonal Enabler (Technology, Data, Intelligence, and Applications) that should be present in all Smart City Solutions.

	Smart Mobility+	Smart Infrastructure+	Smart Environment+	Smart Public Safety+	Smart Government+	SMART DOMAINS	Security & Privacy	Data Driven	Smart Technology Platform	Citizen Focused	HORIZONTAL ENABLERS
GOALS											
High Quality of Life											
Inclusive, Efficient & Effective Governance											
Scalable, Secure & Sustainable											
CHALLENGES											
Addressing Digital Divide											
Budgetary Challenge											
Data Transparency & Data-Driven Decisions											
Equitable Access to Economic Growth											
Focus on Citizen Safety											
Infrastructure Demands											
Mobility Challenge											
Optimization of City Services											
Strain on City and Natural Resources											
Structuring Innovative Partnership											

Find out more at DallasSmartCity.com

1. Technology

The City of Dallas implements Smart City solutions based on open and interoperable standards wherever possible—enabling evolution to changing market requirements and the ability to meet the diverse needs in different communities across Dallas. This also supports leveraging the existing assets to the fullest extent possible. The Smart Dallas program has a program-wide roadmap and synergies are leveraged across initiatives to reduce the cost to provide the value to the citizens. Leveraging existing assets to maximize the value of previous investments is key to this guideline.

2. Data

All Smart Dallas initiatives prioritize availability and access of data to enable cross-initiative insights and easy to implement visibility for citizens. Data should be accessible and follow the Smart Dallas data management guidelines. Solutions should avoid data lock-in and ensure interoperability with other government organizations locally and globally, where possible. All Smart Dallas initiatives should include open standards based APIs for both real-time and bulk data sharing.
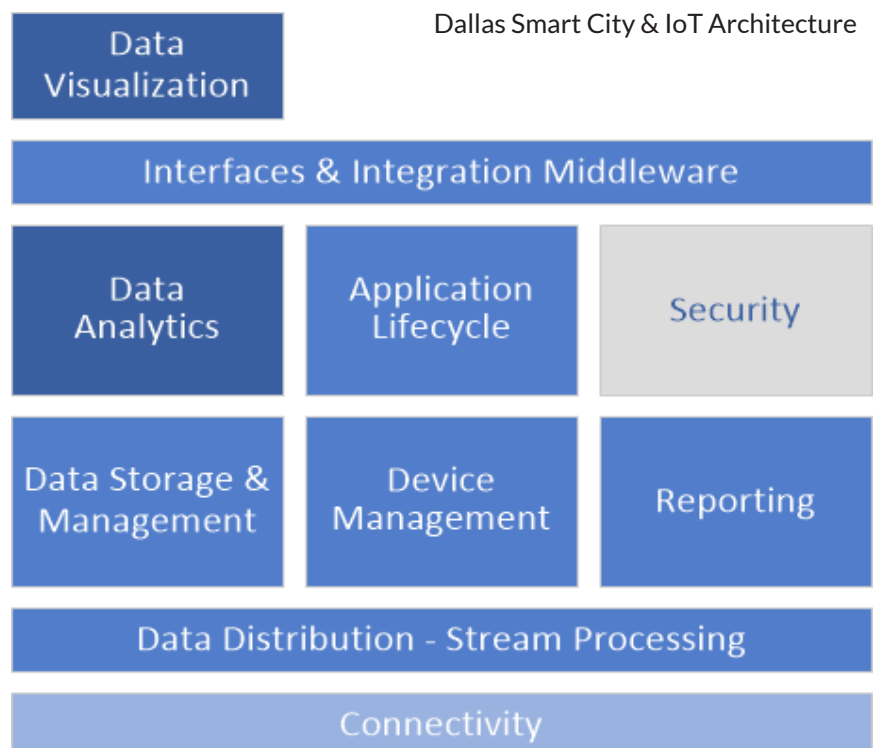
3. Intelligence

All Smart Dallas initiatives should consider availability and access of data to enable actionable insights by leveraging data across all domains. Data-driven decision making and optimization of government operations often require the big data platform to utilize data from numerous departments—all solutions should support the flexibility to share data with the big data platform in the future.

4. Application

All Dallas Smart City initiatives are implemented with a focus on how the specific application being realized is beneficial for Dallas residents and visitors. In the Smart Dallas vision, the City dynamically adapts to the needs of the citizens and communication with the citizens is a continuous feedback loop. All Smart Dallas initiatives should utilize Security and Privacy Frameworks, and citizens should have visibility into how their private information is being treated.

IoT Architecture

The Dallas Smart City & IoT Architecture is comprised of these horizontal enablers, packaged into an IoT stack as can be seen in the Dallas Smart City & IoT Architecture. All partners are ecouraged to leverage exisitng techology investments where it is in the best interest of the City to do so, and tailor their proposals to align with the City's technology architecture and vision.

Dallas Smart City & IoT Architecture

Data Visualization

Interfaces & Integration Middleware

Data Analytics

Application Lifecycle

Security

Data Storage & Management

Device Management

Reporting

Data Distribution - Stream Processing

Connectivity

Find out more at DallasSmartCity.com

Smart Dallas – Architecture Components

Data Visualization

The City of Dallas has a number of off-the-shelf data visualization tools that are utilized by the Data Analytics team to derive actionable insights and enable data-driven governance. In addition, the City has a team dedicated to ensuring high-quality Geographic Information System (GIS) services. Finally, to enable data transparency, data sharing and citizen engagement, the City of Dallas has created an Open Data Portal with over 100 published data sets.

Interfaces and Integration Middleware

For ingestion of data into the City of Dallas (CoD) data ecosystem, a number of off-the-shelf and open-source systems are currently leveraged. For northbound, external exposure of APIs, the necessary functions are provided by the Open Data portal and a variety of vendor solutions for other use cases.

Data Analytics

In order to realize the full value of collecting data, it is necessary to have the capability of combining data sets and mining relevant insights to enable efficient, effective, data-driven decision making. There are a wide variety of solutions available to enable analytics and big data. The cost for the City of Dallas to separately procure the necessary services for each individual use case can be cost prohibitive. Thus, the City of Dallas has invested in a complete Analytics and Big Data suite and has a team of data scientists utilizing this suite to deliver use cases across many departments.

Data Storage & Management

The City of Dallas has a data ecosystem that leverages our Hadoop database as well as RDBMS DBs and SQL Servers.

Application Lifecycle

The City of Dallas has historically trended towards utilizing off-the-shelf applications purchased from external vendors rather than building applications in house. That being said, the vision for the City of Dallas, for Citizen interaction, is to have a unified communication channel with residents or visitors across all forms and domains of interaction.

Device Management

A key aspect of the Internet of Things (IoT) is the realization of large, heterogeneous networks of devices/sensors providing data that can be used in real time or post processed to deliver situational awareness and insights. The benefits are numerous, but this phenomenon also presents challenges in how to manage a large, diverse group of devices to perform necessities such as monitoring device status, pushing necessary SW updates, troubleshooting issues and taking action remotely, etc. The City of Dallas has IoT device management technology available that utilizes the OMA DM LWM2M specification as well as IP Smart Objects guidelines. While it is not always the case that the City of Dallas would perform the device management, it is desired that vendor solutions be compliant with these specifications to enable future flexibility, if desired.

Security

The City of Dallas has a set of security guidelines, standards and best practices that all solutions must comply with, as indicated in the Request for Competitive Sealed Proposals template supporting documentation—these apply to Smart City and IoT solutions, as well. In addition, for IoT solutions Device and Data Integrity functions are needed to provide a level of assurance that neither the device nor the data has been tampered with prior to the data reaching the City's servers.

Reporting

All solutions should provide logging and reporting functionality to ensure adequate visibility into system and application performance and health as well as user experience. Standard industry practices for sharing of the reports and data should be followed.

Connectivity

One of the biggest challenges for IoT deployments is connecting the IoT devices to enable data transfer—fiber is expensive to run if it does not currently exist in the desired deployment local. The City is currently evaluating the plethora of connectivity options applicable to Smart Cities and IoT use cases. Not every use case will require the same type of connectivity, so a suite of options is anticipated. The City strongly prefers non-proprietary, open-standards-based communication protocols.

BEST PRACTICES FOR REFERENCE

The City of Dallas understands that multiple and sometimes conflicting open, non-proprietary standards exist for IoT and Smart Cities data and technology interfaces. Dallas' intent is for the most appropriate open, non-proprietary standard to be used for the Smart City project at hand. This approach may encourage the highest possible level of interoperability and future flexibility without stifling innovation given the nascent nature of the Smart City standards landscape.

- **IPSO Application Framework:** The City of Dallas appreciates the value of having a uniform guideline for representing IoT resources.

- **OMA LightweightM2M v1.0:** The City of Dallas appreciates the use of the LWM2M framework for interfacing with IoT devices and data in a standard way.

- **IEEE P2413:** This working group has not yet published the IEEE Smart City Framework Standard; however, the City of Dallas is anticipating this release.

- **The Open Group Architecture Framework (TOGAF), Version 9.2:** The City of Dallas currently uses TOGAF.

- **IEEE P1451-99:** Harmonization of IoT Devices and Systems

- **ISO/IEC 20802:** Information Technology – Open data protocol (OData) v4.0 – Part 1: Core

- **X.509:** Public Key Infrastructure (PKI)

- NIST Framework for Improving Critical Infrastructure Cybersecurity 1.1

- **ISO/TS 37151:** 2015 Smart Community Infrastructures – Principles and requirements for performance **metrics**

- **ISO 37120:** Sustainable development of communities — Indicators for city services and quality of life.