

ARE WE APPROACHING **SMART CITIES** THE WRONG WAY?

How to build a digital foundation that won't crumble





Executive Summary

Flashy, new technologies evolve rapidly and dominate headlines. Traffic and lighting sensors that ease congestion and aid parking were once novel; new stories include driverless cars and tree-like devices that convert vibrations into energy. According to Gartner research, smart cities will house 9.7 billion IoT devices by 2020, and the list of new technologies is growing daily. As private innovation speeds ahead, it can be tempting to look smart with a few new projects. But below the surface, how smart are you really?

An exact definition of “smart city” can be elusive, but every civic leader has an idea of how his or her city will embody that vision. Iterations likely include these points:

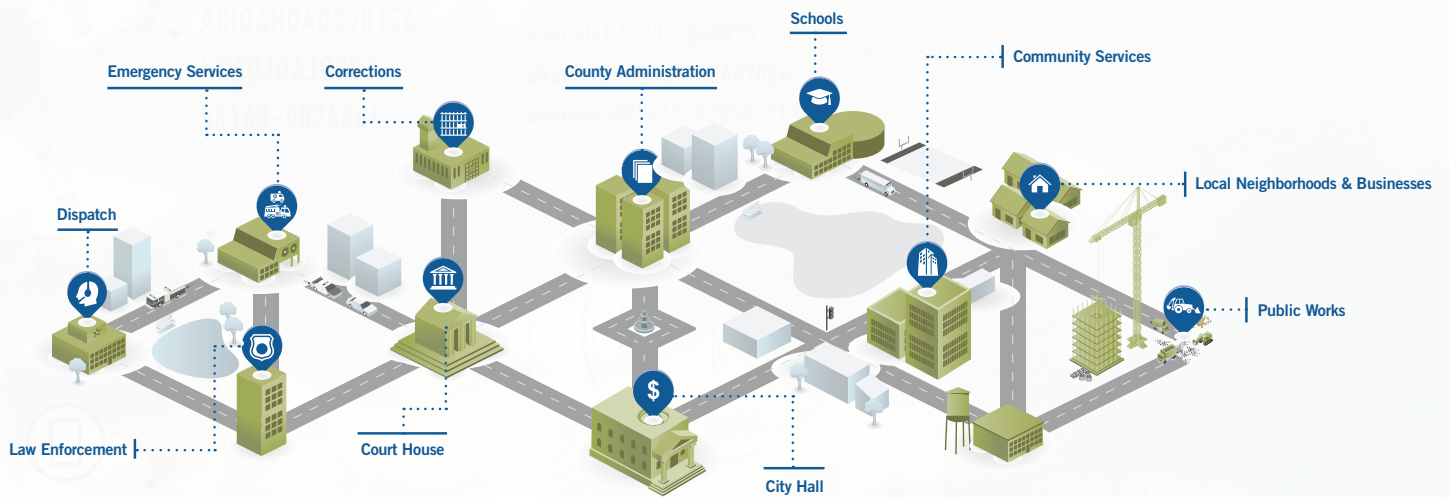
- Information flows uninhibited by technology barriers;
- Work processes flow seamlessly from department to department;
- Smart sensors collect big data that is immediately put to work in useful analysis;
- Information is consumable and actionable, presented in accessible dashboards.

Citizens living in the digital word expect as much and likely believe these processes are already occurring naturally in their government agencies. In reality, governments struggle to access, integrate, and get the most from this pervasive data.

Where there is challenge, however, there is opportunity. Chances are one, if not multiple, departments in your government right now is considering replacing its old, legacy software system. And that is the perfect starting point for laying the foundation to enable a sustainably smart city and connected community. Visionary leaders can drive decisions – in procurement and culture – that establish solid technology layers and facilitate meaningful data sharing through back-end attention and investment. These “hidden-to-the-user” operating systems may not get the headlines, but they are critical to building a smart city and supporting citizen service delivery in the digital era.

Back-Office Systems: Where We Are Now

Government agencies are well aware of the challenges in considering new technologies, and especially large, comprehensive back-office systems. These are the business systems in the individual departments across your city, county, and districts that collect, produce, and use data to run the essential workflows of government. To achieve the full smart city vision, these systems must be connected so they can work together.



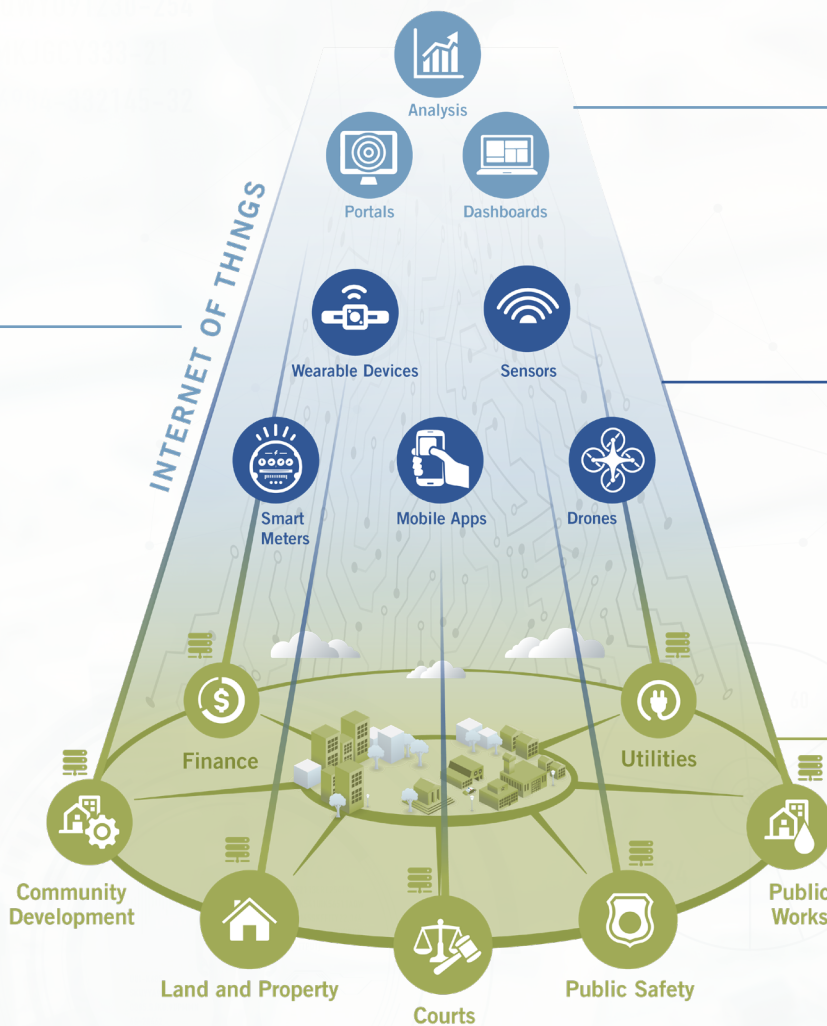
Back-office systems can be in place for decades, and replacing them is a significant investment that can take several years of approval, procurement, and implementation. When they come due for replacement, each department starts the procurement process independently, evaluating systems solely on the merits of functionality for their respective departments, and without considering interoperability with other systems across the jurisdiction.

If you're a typical local government, you have a dozen or more of these systems installed – for example, your public safety dispatching system and the records management system may be different. Your court case management and financial enterprise resource planning systems are likely built on different platforms. The same is true for programs used by the planning department, your county's deed office, building department, public works, tax assessor's office, parks & rec, etc.

Most of these systems are provided by different vendors, are at various stages of technical maturity, and don't interact with each other well, if at all. Processes and information are often trapped in individual departments. To leverage the information as part of a larger process, it must be manually transferred to the next department. How can this challenge be addressed to ensure a strong foundation; the necessary digital infrastructure for today's smart gadgets and those not yet imagined?

Understanding the Technology Layers Involved

To move the needle and overcome the barriers created by the common back-office disconnect, we have to first understand the technology layers involved. It may help to think of these layers as a **maturity model for smart cities**. Your city may have some of the features in each layer but should be working toward putting all features in place to create a fully functioning smart city.



1. Engagement Layer: Analytic and engagement portals and dashboards provide the ability to interact with collected data – both by local government leaders and staff, as well as sharing information with and accepting information from the public. This layer requires access to data sources.

2. Smart Data Collection Layer: This is the sensing and data collection function from smart utility meters, wearable technology, drone imagery, air quality sensors, etc. This layer requires a communications network, the technology infrastructure to support the devices and sensors connected through the Internet.

3. Back-End Operational Systems Layer: This is the collection of the many individual back-office systems managing the essential services of local government. The modernity and functionality of this layer to aggregate and push information up and across the other layers is critical.

4. Digital Infrastructure Layer: If you have a fully functioning connected community, your software systems are based on a common technology foundation that allows seamless connection of processes from department to department, within the city and across geographic boundaries. This layer is also comprises your cloud connections, IoT software, and networks that allow everything to interact.

Each of these levels interacts with data in different ways to come together and realize the full potential of connected communities and governments well-positioned to succeed and improve outcomes into the future. If this maturity model is the goal, then what gets in the way of achieving this vision?

Navigating the Challenges

Conversations about data fill conference agendas and industry publications; however, we tend to talk about “data” in a general way. Even the simplest type of data sharing is not so simple, and can experience multiple roadblocks. By understanding the challenges, the informed civic leader can better understand how they impact smart city initiatives and how they can approach future technology investments to successfully address them.

As data input methods and types have evolved over the years, the back-office systems that run the essential services of local government have been forced to evolve their technology. Many leaders are faced with the reality that an older system isn’t capable of processing, analyzing or integrating these new data sources. On the other hand, and even more important, leaders should not be lulled to complacency by thinking the technology these brand new systems bring to individual departments will solve organization-wide data issues.

The Importance of Both Sharing and Integrating

Conversations about data tend to generalize “data sharing” and “integrating data” without taking the time to address the distinction between the two – and why each matters.

Consider the three levels of data integration:



Point-to-Point Sharing

Simple data sharing or transactions between two systems.



Data Aggregation

The most basic level of sharing data from one system to another.



Process Integration

Sharing data to view or analyze workflows, create records, and trigger events across two or more systems.

Only a few local governments have achieved an integrated platform approach. Most of them are still connecting various initiatives together to achieve cross-synergies.

73

73% of counties identify application building, integration, and modernization as their greatest staffing needs in coming years.

(Source: Center for Digital Government Annual Survey 2018)

Multiple Data Systems Increase Complexity

Point-to-Point Data Sharing



Point-to-point cross-system data sharing may come to mind most readily where information created by one department's system is shared with another department. Common examples include:

- Usage data collected from smart water meters is provided to the utility billing customer information system.
- Information associated with a criminal record created in a police records management system can be viewed by a judge in a criminal court.
- An assigned property value in a computer-assisted mass appraisal system can be seen on a map in a city planner's land use management system.
- A maintenance cost from an enterprise asset management system can be shared with the finance department's enterprise resource planning system.

Point-to-point data sharing isn't usually technically difficult to accomplish.

Generally, you are going to use one of a few strategies: a data-warehouse-style information hosting and querying, a manual batch export and import of data, or a more automated API approach. Even with the ubiquity of these technical methods, challenges remain in achieving meaningful data sharing.



Consider the Barriers to Point-to-Point Data Sharing

1 *Legacy Technology*

Imagine how frustrating it is to purchase an amazing new smart meter reading technology, only to find during implementation that your CIS utility billing software provider doesn't provide the connecting points to import the data easily. It may be that the program language isn't compatible out of the box, or, even worse, you have a legacy system that doesn't support data imports.

2 *Vendor Barriers*

If you do face a technology barrier, often the next challenges are the vendors of the systems. They may be averse to opening their systems in fear of competition. Or you may find it's a service for which they charge and you didn't budget for custom programming.

3 *Stakeholder Barriers*

And often some of the most challenging barriers to overcome are the ones that exist internally between department heads and key stakeholders that are responsible for the integrity of the data in their own systems. Lack of trust, ineffective communication, and diverging priorities are common challenges that exist at some level in most any organization.

Multiple Data Systems Increase Complexity

Without an appropriate foundational system in place, it becomes exponentially more complicated to share data between multiple systems. For example, if you consider building development projects, a city planner often needs access to information from GIS systems, land records, property assessment, asset management, and others during the process. The planner may be lucky enough to open one system, but not the others, hampering complete data sharing.

Even if you find a less convenient, less automated work-around, the excitement you anticipated for your new smart technology never materializes because of your back-office system data integration challenges.

KEY POINT:

Several issues can hinder point-to-point data sharing.

1. Older technology does not connect to new, smart technology.
2. Vendors are hesitant to cooperate with competitors.
3. Siloed departments resist losing control of their data.

If you're not considering the back-office systems of record – that are feeding, accessing, and aggregating data – you will almost certainly find that the promise of becoming 'smart' will fall short of your expectations.

Data Aggregation



The next type of data integration is aggregation, which facilitates analysis, display, and engagement. Aggregation is related to point-to-point data sharing from a technology deployment perspective but is different in purpose.

A smart city brings together data to make meaningful discoveries and shares comprehensive data internally and externally to the public. This may be a budget dashboard intended to show transparency, plotting crime statistics and public safety activity by neighborhood, or linking property value data with homeless reports to support affordable living initiatives. This is the kind of transparency citizens are beginning to expect, but gaps in collecting data will result in limited ability to report and display information.

Small projects within cities will aggregate two data sources for one display, which may be presented outside the systems, but not used for the day-to-day operations of the source departments. In addition to citizen dashboards and public access, this could include management portals. It is important to identify what kind of data you want to integrate – special data, financial data, smart metrics.

Data Aggregation Barriers

Again, consider the problem of missing a key piece of data needed to conduct the analysis you are planning. What happens when one system can't connect?

The same challenges faced in point-to-point data sharing exist here, as well.

The added challenge is enterprise adoption. The promise and potential of data aggregation is that many sources of data are pulled together for enhanced performance, but when just one link is broken the whole system is rendered useless.

Process Integration



The last type of data sharing is process integration, and it is the function most overlooked in the smart cities discussion. Unlike point-to-point and aggregation data sharing, which focus on having access to data across systems, process integration focuses on the workflows that are required between different departments to keep an operational process moving forward. When process integration is achieved, true efficiencies can be realized and the power of data can be put to use.

It's typical for a task originating in one department to require the work of another department to complete. Common examples can be found in community development and planning processes where developers, planners, inspectors, and regulatory officials each have separate processes that are dependent on another being complete. This challenge is also found in the public safety and justice areas of a community where a single call to a regional 911 dispatch center results in the involvement of patrol officers, commanders, court administrators, judges, prosecutors, and jailers. Many times these processes are manual and paper-laden and can take days in the most efficient offices, or week or longer in some offices.

With each transfer to a new department's workflow process, there is the potential for a bottleneck, miscommunication, or operational delay that impacts the progress of providing essential services, ensuring safety and fostering economic development in your community.

Process Integration Barrier

Process integration is the pinnacle goal of data sharing and integration and allows for maximum levels of efficiencies and insights. It requires a technology confluence that builds all systems on the same fundamental elements for immediate results and future growth. Common workflow engines, authentication processors, and shared business rules are just a few elements necessary to achieve full process integration.

KEY POINT:

Data Sharing Barriers:

1. Technology
2. Vendor
3. Stakeholder
4. Data Aggregation
5. Process Integration

Smart Cities are Really Connected Communities

Real connection, the “Connected Communities” vision, connects data between departments and across jurisdictions that are providing essential services to the public. This is a vital part of the Smart Cities conversation – and one that can’t be addressed without attending to the foundational back office systems.

1 Create Connections Spanning Beyond Geographical Boundaries

Consider the need for information and data to be shared quickly and easily across local government agencies, departments, school districts, cities, and counties. When the flow of information becomes automated, paper usage is reduced and operations are streamlined as data is shared in real-time between offices. This means information can be shared in seconds, not minutes, which allows agencies like law enforcement can solve crimes faster and keep our communities safe.

2 Connect Through Shared Processes that Cross Department and Agency Boundaries

Imagine, the filing of a building permit automatically triggering a building inspection; Or the issuing of a warrant by the court alerts an automatic arrest warrant at the police department, automatically prompting the correctional facility to start the intake process. Many critical processes within one local government agency are part of a larger series of processes in another agency. When integrated, these agencies work seamlessly together to keep the necessary progression of events moving forward, all the way to completion.

3 Connect and Engage Citizens with Local Government

Engaged citizens make strong communities. In connected communities, citizens can access services and conduct civic business through a single, constituent portal, allowing them to pay bills, view business licenses, permits, and court information all in one place, at one time. In a connected community, citizens can self-report downed trees, vandalism, pot holes, and other common issues from a mobile application and see them through to resolution -- without waiting on hold and without long lines.

4 Connected Communities Start with the Back-Office System

While smart devices and network infrastructure projects tend to take the main stage, if you're not considering the back-office systems of record -- that are feeding, accessing, and aggregating data -- you will almost certainly find that the promise of becoming "smart" will fall short of your expectations.

The real call to action is to consider a platform approach to procurement, whereby leaders and decision-makers commit to a long-term, full integration vision, and seek out partners who can easily support continued growth. Software and technology purchases are typically made in siloes. As this continues to occur, we lose the opportunity to build smart, connected communities.

Consider four key questions as part of any strategic planning for Connected Communities effectiveness.

1. Do you have **best-of-breed solutions** in each department?
2. Does each solution have the **ability to integrate**?
3. Is each solution part of a **larger platform and scalable for the future**?
4. Does your vendor have a **long-term, proven track record**?

How to Build a Truly Smart City

Best-of-Breed Solutions

According to Gartner, the average life expectancy of an enterprise back-end system is 7-10 years, though extremely large, complex system have a longer longevity of 12-14 years. Between all the departments you may oversee, you're going to be in some phase of evaluating a major platform technology procurement in at least one department at any given time – and probably more. Given that most of these projects cost hundreds of thousands – if not millions – of dollars, you must consider the long-term investment for each project and ensure the product meets the back-office needs of the department, in addition to fitting into the larger picture of cross-department integration.

Is the system under consideration a best-of-breed system all by itself without any smart technology integration? If the system can't stand alone and meet all the needs of that department, it's not going to be improved by bolting multiple integrations on to it. It will always be the weak link. Start with the best solutions for the business need.

Supported Integration Technology and Tools

You can't assume a technology you're investing in is going to work out of the box with any existing system. Evaluate if your current system or the solution under consideration supports integration technologies and tools like APIs or batch data export/import tools. While APIs alone won't get the process integrations you're looking for, they are the easiest way to get real-time point-to-point integration.

Also learn what kind of integration support you can expect to receive from your vendor up front. Ask questions like: Who's responsible for the development? Are there additional fees to set up or support an API? Will technical issues be supported by the software vendor?

It's important to get real examples of living and working integrations being described by your vendor. Government agencies are often excited by a new "smart" product they've purchased, only to find the product doesn't integrate as expected with their back-office system. The more existing integrations you can confirm early in the process, the better off your project will be.

Platform Approach

Are you considering systems that are part of a larger platform your investment can grow with? This is critical for gaining the most efficiency from process integration and data sharing. The biggest challenge in achieving true connection is the compatibility of the foundational technology the systems are built on. While point-to-point data sharing can be accomplished between different technologies with skilled programmers mapping data points, this is often not possible when you're talking about the service-level architecture level within systems. Two systems need to be using at least some combination of the same enterprise service bus, the same communication and task management systems, and the same type of workflow engines to share data at this level and realize the full Connected Communities vision.

This doesn't mean you need to procure all the systems at once, or even all the modules of a single system. Adding to your investment over time when it's right for your organization is the smart way to procure back-office systems.

Dependable Vendors

Does the vendor have a proven track record of keeping up with innovation? Often startups initially have some of the coolest tech on the market and are powered by outside capital, allowing them to spend more on marketing and sales than ongoing development. When you look back on the hot vendors of five years ago, many aren't around today.

Other times, an established vendor has a lot of longevity, but its software hasn't kept up with current innovations. These vendors are stretched in their ability to both manage current products and invest in future smart technologies. When you're looking at long-term technology vendors, look to vendors who have navigated the rough waters of the last two, three, or four waves of technology and have kept up with innovation.

Finally, don't be enticed by quick-fix apps or risk your future on temporary technologies. App-driven technology may work for some data collection with Internet devices but should be a minor part of your overall strategy.

KEY POINT:

While point-to-point data sharing between departments is powerful, the greatest efficiencies occur when you integrate processes across agencies and jurisdictions, such as:

1. Common service bus
2. Single sign-on identification authentication engine
2. Shared business rules
4. Workflow engine
5. Task management
6. System notifications
7. Proprietary content management
8. GIS mapping
9. Cloud data
10. Payment processing



Tyler Technologies' sole business focus has been bringing software solutions to the public sector. Tyler has the most diverse client base in the country, providing back-end systems to more than 15,000 cities, counties, and school districts – more than any other vendor in the market. Back-end systems are the unsung heroes of transforming our towns and cities to modern, vibrant, thriving communities. These operating systems collect, analyze, aggregate, and share data and processes. They change communication timelines from minutes to seconds, making information and data sharing seamless, automating work flow, and drastically reducing redundancies in processes across agencies and beyond traditional geographic boundaries. Tyler's goal is to connect communities through technology, aiding the creation of smart cities across the nation to make our communities safer and better places to live.