Cities and Active Transport

Smart Places Design

transport.nsw.gov.au
smartplaces@planning.nsw.gov.au

Technical Guidance

This technical guide introduces the role of technology and data in delivering better place outcomes for communities and the core components that provide the foundations for a smart place. It should be read in conjunction with the relevant standards and legislative requirements.

Smart Places are where the physical and digital environments converge. They integrate technologies into the built environment to capture and convey data and insights. Figure 1 shows how a range of technologies interact in a place to help peoples' experience of the place. The embedded technology helps to capture information on assets and elements in the local environment. The data is analysed to help people and governments make better, evidence-based decisions about how to improve the productivity, liveability and resilience of cities, towns and communities.[1]

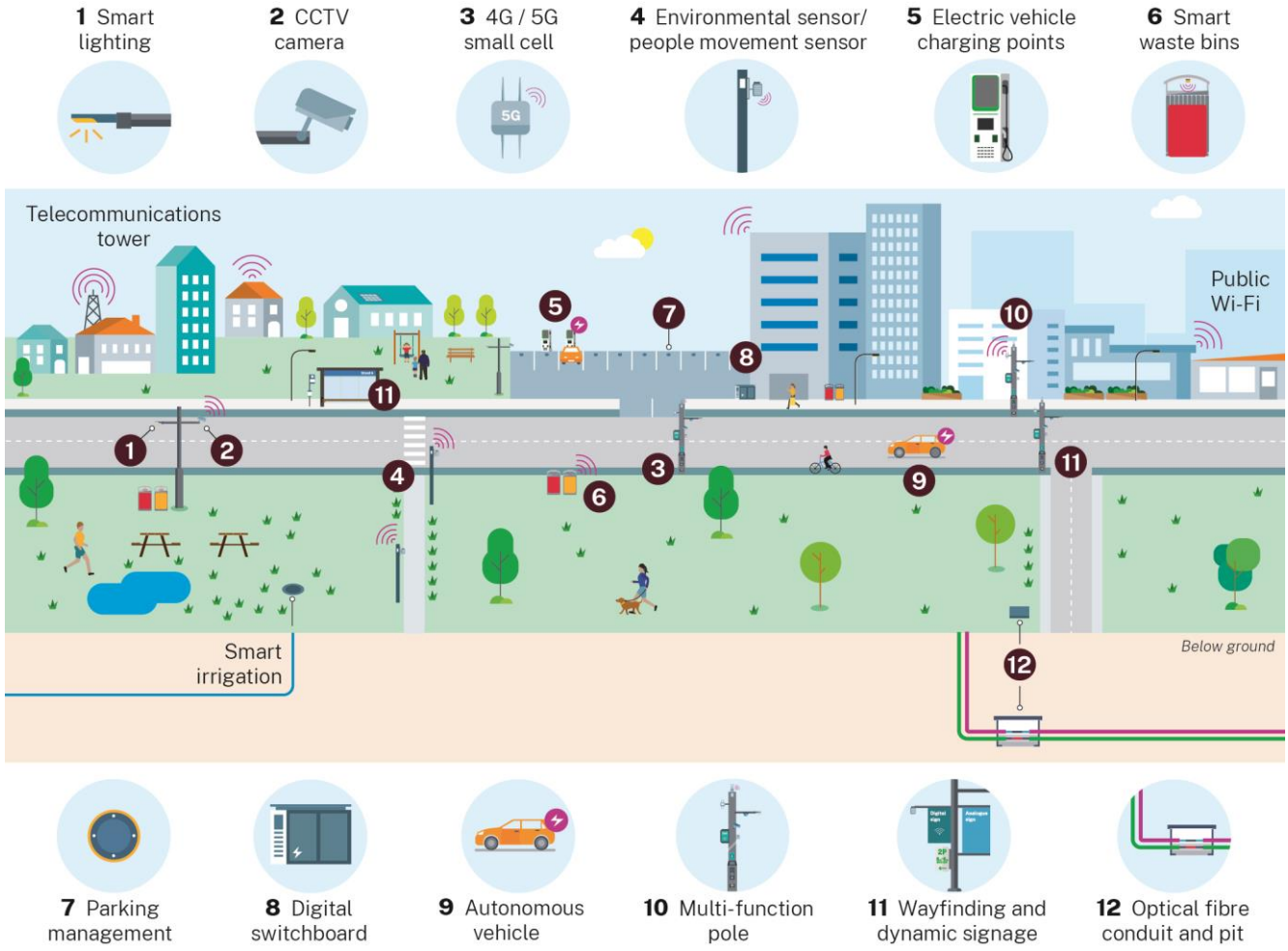

Figure 1 Examples of smart technologies

[1] NSW Government (2023), Smart Places Strategy.

A Smart Places design approach recommends that the enabling digital infrastructure for **connectivity** and digital networks be considered as essential components of city and regional planning. Connectivity demands are changing rapidly and there is a need for public spaces to consider and respond to this change. These changing demands include the capacity to transmit large amounts of data requiring fast, reliable broadband internet; cellular networks (5G and beyond) and small cell hosting; and Internet of Things (IoT) sensors and edge computing facilities. By following the proposed treatments set out in the Smart Places Technical Guidance, place owners can plan for the enabling digital infrastructure to support the connectivity demands, now and into the future.

Place owners are encouraged to start the design of a smart place with the place outcomes that are desired and may include supporting:

- innovation hubs with faster broadband internet
- resilient and sustainable places that use technology to manage natural resources
- safer community events and activities
- equal access to digital services.

By understanding the desired place outcomes, and the role of technology and data in achieving these, it will help place owners plan for the digital connectivity and enabling digital infrastructure that is needed.

Digital infrastructure is fundamental to providing the capacity for flexible, future-focused digital connectivity to support smart, place-based solutions for the urban environment. Digital infrastructure can be described as '**digital plumbing**' because it is best planned for with other utilities, such as water and electricity, and deployed across cities and regions as part of construction wherever possible. Digital plumbing includes the provision of high-capacity **conduit** and common access pits and may also include a network of multi-function poles (MFPs) and smart **street furniture**. Collectively, the infrastructure provides the capacity for high-speed digital connectivity to support the increased demand for data and the number of connected devices in public spaces.

This technical guidance proposes that the planning, design and delivery of digital infrastructure should consider connection to:

- non-premises such as public spaces
- all internal and external facilities, which includes multi-function poles (MFPs) and smart street furniture.

Planning for digital infrastructure should also consider the capacity to support:

- small cells for cellular networks 5G and beyond
- edge computing, where data is processed 'on the edge' or at the device level.

Connectivity

Connectivity or rather digital connectivity refers to the ability for technology, systems or devices to connect and communicate, generally through internet or another network. Fibre, mobile (4G/5G), Wi-Fi and IoT networks are examples of connectivity used in Smart Places.

Street furniture

Objects and pieces of equipment installed along streets and roads for various purposes, which can also host telecommunications infrastructure including antennas and radio units for mobile networks such as 5G, Wi-Fi access points, and IoT sensors.

Digital plumbing

Digital plumbing includes the provision of high-capacity conduit and common access pits and may also include a network of multi-function poles (MFPs) and smart street furniture.

Conduit

Parts of a closed wiring system enclosing cables within an electrical or telecommunications installation; it allows cables to be drawn in or

By forward planning for digital infrastructure and incorporating Smart Places design into greenfield, brownfield and infill developments, additional pit and conduit capacity can be provided to enable the connectivity speeds needed for future uses whilst streamlining deployment and reducing technology clutter in public spaces.

Digital connectivity environment

The technology used in the delivery of digital connectivity services will continue to evolve and change. Based on past and current trends, the digital environment will likely continue to be impacted by the:

- number of connected devices, which will grow significantly, driven in part by the **Internet of Things** (IoT)
- volume of data to be transmitted, which will continue to grow through both the deployment of additional devices and new applications
- reliability of data processing at the local level to support automation, such as vehicle movements
- dependence on 'real-time' processing of data.

Internet of Things

A network of devices, such as bin sensors, and other technologies that connect and exchange data over the internet.

By ensuring that the enabling digital infrastructure is embedded in places, it will make it easier for service providers to provide the future connectivity needed, and at the same time reduce the disruption to the community.

Figure 2 shows a high-level model of the elements in a smart place digital connectivity environment that is underpinned by optical fibre infrastructure. Early telecommunication networks were established to physically connect to individual telephones to enable a conversation. While voice calls are still provided over the digital connectivity networks, the needs have evolved. Commercial and residential areas are connected to the core network through **optical fibre** and cellular networks, and data can move from a device, such as a sensor, to a store of information, such as a data centre, which is not associated with a specific person.

Optical fibre

Hair-like and transparent fibre that is used for the transmission of data signals over large distances with higher speed.

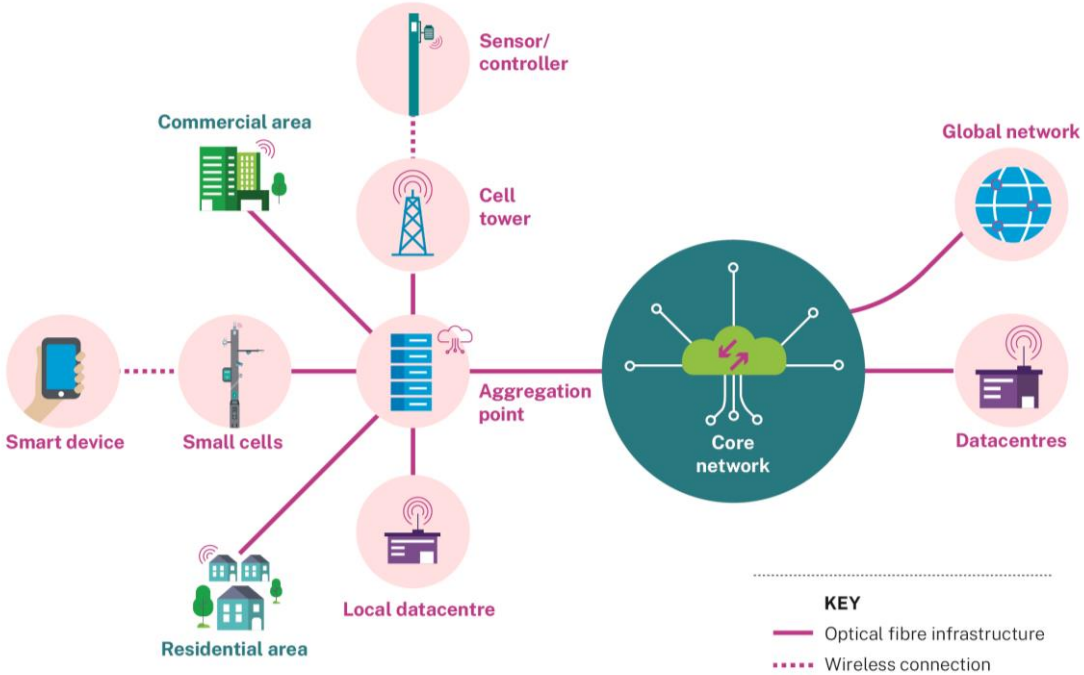

Figure 2 Smart place digital connectivity elements

Planning for additional pit and conduit capacity for optical fibre will support the transmission of large amounts of data that is envisaged in places in the future.

The components of the digital environment are connected across local places to regions and internationally. Figure 3 outlines the key components of the digital environment, provides a brief description and examples of the infrastructure.

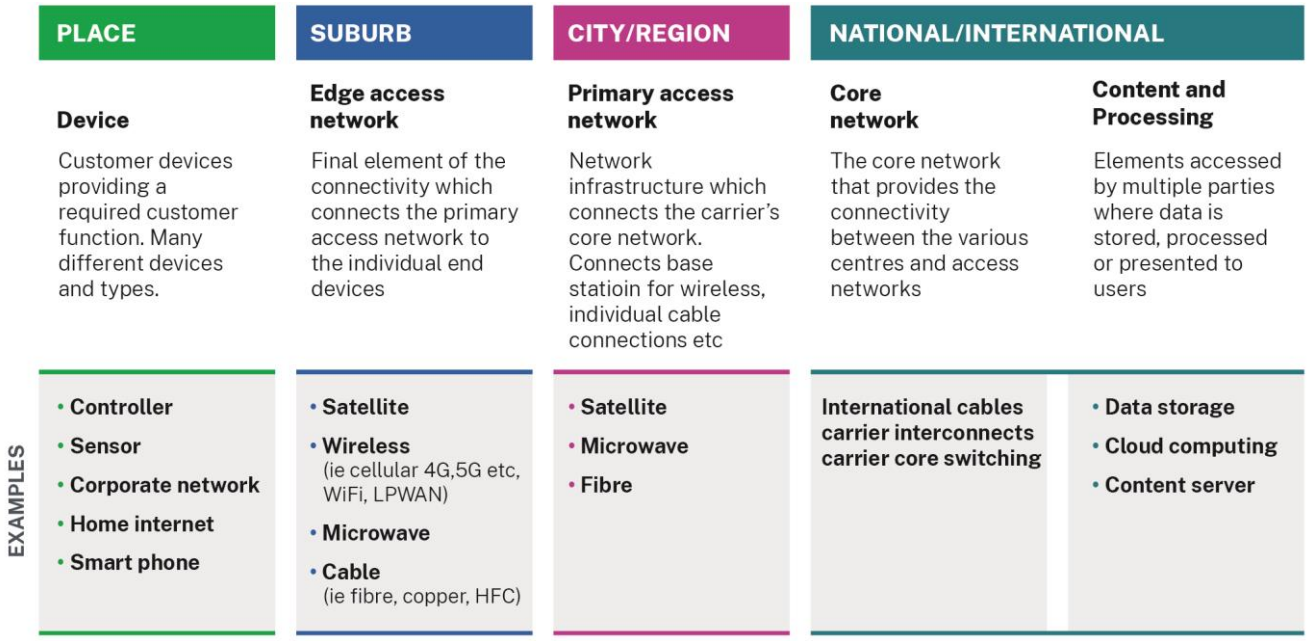

Figure 3 Overview of digital connectivity environment

Table 1 describes the function and physical characteristics of each component from Figure 3 and the relevance to Smart Places.

Table 1 Functional and physical characteristics of digital connectivity environment

Category	Description	Examples	Locale	Smart Places relevance
Device	Equipment which interfaces to a connectivity network and provides the link between function and carriage.	• Smart phone • IoT sensor • Broadband modem • Satellite receiver • WAN router	Site specific – although a device may move at any point in time, it is at a single location.	Individuals bring their own devices to the community while government and business have defined requirements in terms of capacity and performance.
Edge access network	The portion of the network that directly connects with the devices and provides the connection to other elements of the network. Specific to the service density, device type and functional requirements.	• Cellular (4G, 5G etc) • Cable (fibre, HFC, copper) • Satellite • LPWAN • Microwave Point to Point (P2P)	Network is specific to a defined geographical area, such as several suburbs. Either wireless or fixed network design, based on the location's needs. Satellite locale extends to the beam footprint.	The provision of the fixed edge access network is typically left to NBN (or a substitute) with carriers deploying cellular bases to satisfy coverage or capacity requirements. Extra capacity for connectivity to smart infrastructure may require enablement intervention.
Primary access network	A key element of the network that connects various edge access networks (such as a cellular base or fibre to the node installation) to the core network.	• Optical fibre from cellular base stations • Optical fibre from local concentration nodes • Microwave links • Satellite link from base station to the core network	Typically traverses a city area or between rural locations to a point of interconnection with the core network. Multiple edge access networks can be connected to the primary access network infrastructure.	Connectivity required from the development areas back to a carrier's core network. For example, NBN will connect back to one of its nationwide Points of Interconnect (POIs).

Category	Description	Examples	Locale	Smart Places relevance
Core network	Carrier core infrastructure that provides control and connectivity between various elements. Commonly an IP (internet protocol) network that creates the paths between devices and content.	• Cellular controllers • IP routers • Intracity and intercity fibre • International submarine optical fibre	Typically, equipment located in multiple key locations with high-capacity fibre cable connections between sites across cities, regions, nations and internationally. Includes interconnection to other carriers (internet).	Not directly related to any specific place-based geographical area. Designed to serve high customer volumes.
Content and processing	Equipment that either stores or provides information to be accessed. Typically used by multiple parties from various locations.	• Web server • Content server • Cloud storage • On-premise storage • Local processing	Location defined by suitability of environment and connectivity; could be anywhere in the world.	Not directly impacting Smart Places in most cases. However, with the deployment of edge computing effectively moving content and processing closer to customers, the impact should be considered. Often supplied by a different organisation to connectivity services.

WAN

WAN is a wide-area network which is a collection of local-area or other networks that communicate with each other. LP WAN is low-power wide-area network and is designed to allow for long-range communication at a low bit rate between devices, such as battery-operated IoT sensors.

Understanding the role of digital infrastructure in providing the connectivity to a place will help place owners plan for its delivery. Figure 4 shows how the infrastructure underpins the services that business and people reply upon in the place. The service layer of the digital environment that is enabled by connectivity is separated from the infrastructure layer. Underpinning the service layer, is infrastructure which can be divided into passive infrastructure such conduits and pits, the linking infrastructure such as the optical fibre and the active infrastructure, which is the device, for example the consumer device such as the smart phone. Different actors including local government and communities can play a role in providing infrastructure. Collectively, this infrastructure provides the basis for the connectivity to deliver the service layer. The service layer, is where the data is entered, visualised and finally acted upon.

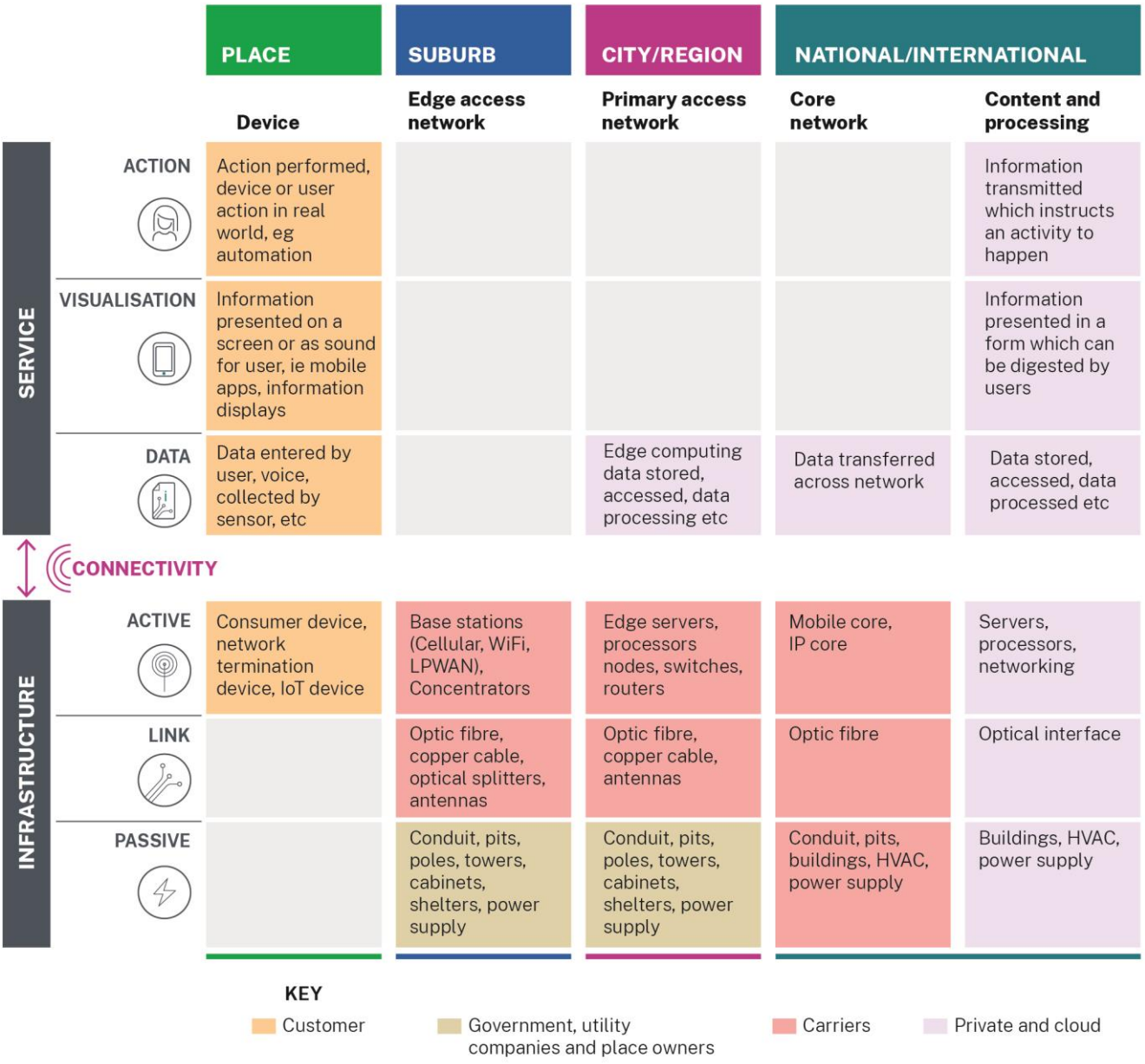

Figure 4 Digital connectivity environment – service and infrastructure layers

Further description of the key elements in the service and infrastructure layers from Figure 4 above are provided in Table 2.

Table 2 Connectivity elements

Element	Description
Passive infrastructure	The infrastructure to support link and other infrastructure elements. Not part of the regulated environment in terms of the delivery of carriage service and does not require a carrier licence to operate. Includes items such as conduit, pits, poles, towers, equipment cabinets, power and buildings. Has a much longer operational life of 40 years (compared to 20 years for fibre cable and 10 years for active equipment).
Link infrastructure	Infrastructure used to provide a telecommunication link. Examples include cables (copper and fibre) and antennas that are required to provide a connection between two points. Considered part of carriage services and needs to be operated by a licenced carrier.
Active infrastructure	Powered elements providing the functional components of connectivity controlling the network. Examples includes transmitters, receivers, routers, switches and mobile base stations.
Data	The data (including voice) that is transferred across the network connectivity, including its generation, storage and processing.
Visualisation	The development and presentation of information in a suitable form for consumption. This varies by application, with examples including banking, social media, internet pages and video streaming.
Action	Control of remote devices where an action occurs as a result of information sent. Examples include simple tasks (such as turning lights on and off) through to the control of remote devices.

A 'dig once' approach

A 'dig once' approach aims to reduce the impact on communities and the cost of providing digital infrastructure by embedding 'digital plumbing' at the same time as other utilities are provisioned or places are constructed. The 'dig once' approach has three broad areas of relevance:

- **New builds and developments:** ensuring alignment between public and private sector constructors, utility companies and connectivity providers to install conduits (and connectivity) during the construction phase. This will help to ensure that all future developments are connected and leads to future-proofed 'in-ground' connectivity being installed once only.
- **Existing builds and other assets:** enabling coordination between utility companies and connectivity providers during highway and street works, and other major infrastructure projects. This will reduce the need for multiple excavations; and allow for efficient installation of conduits and connectivity, including enabling the provision of all necessary conduits and simple retrofitting.
- **Delivering multi-purpose connectivity:** historically, conduits have played a key role in delivering wired connectivity. However, with next-generation wireless connectivity (including 5G, IoT and new Wi-Fi technologies), conduits will play a key role in providing the power and connectivity infrastructure needed, in addition to continuing to enable wired connectivity. A 'dig once' approach will drive and support the rollout of these crucial conduits.

A ‘dig once’ approach can reduce inconvenience and disruption to people, accelerate the rollout for connectivity providers, and significantly reduce the cost of connectivity rollouts as civil works for roads and streets often represent a significant portion of the overall deployment costs.

More technical guidance

Unlock the full potential of connected Smart Places with our SmartNSW Playbook and other Technical Guidance documents. Consult your organisation for the relevant industry standards that apply to your development.