7. Set up

Best practice considerations at this stage in a project

- ☐ Is a comprehensive change management plan in place for pre-and post-go live periods, and have the affected business unit(s) been involved in this plan?
- ☐ What communications are planned for release or for live transition?
- ☐ Is training and support adequate? Is ongoing support provided to those affected by the change?
- ☐ Are there any legacy systems, and are the plans to transfer data, integrate with them and exit them adequate?
- ☐ Have you documented the key decision points and information needed for the ongoing operation of the solution?
- ☐ If applicable, is the operations or delivery team ready to take over and manage the operations and have you transferred asset information to them?
- ☐ Has adequate time been allowed in schedules to fix faults and are there arrangements for proactive monitoring and management of any slippage?
- ☐ Are there business contingency and continuity arrangements and plans that aim to minimise the impact on the business in the event of major problems during implementation and rollout?

7.1 Change management

This chapter provides guidance on internal change management, to assist with managing change brought about by new IoT solutions in an organisation.

7.1.1 What is change management?

Introducing new and innovative tools and practices such as IoT can result in periods of unrest for affected people including staff, customers and other stakeholders. While change can be exciting for some, for others change means loss, disruption or threat. Effectively managing the people and process side of an IoT-enabled project is essential for a successful implementation.

Change management is the process of taking a planned and structured approach to help align an organisation with change. It is about supporting and understanding people who are undergoing change and handling that change with minimal disruption.

In an IoT context, change management means working with the stakeholders affected by the IoT-enabled project and the accompanying new processes, to help them:

- understand what the change means for them
- navigate the transition
- understand the value of the IoT-enabled project
- to overcome challenges together.

7.1.2 Why is change management necessary?

Effective change management allows organisations to deliver new initiatives, embrace evolving technology and adapt to new environments more easily.

Change management is necessary for IoT-enabled projects because people are integral to the successful adoption and integration of IoT. You may have all the right processes in place but if the people involved in the IoT-enabled project do not understand the change and why it is happening, your project may be at risk.

It is important to remember that systems and processes impacted by IoT have a human element, and the people impacted will have different levels of technology awareness and enthusiasm for change.

7.1.3 Managing change resulting from IoT-enabled projects

There is no one size fits all approach to change management. Change management requirements and best practices differ by organisation and subject area. There is currently no whole of NSW Government change management policy or guidance.

When managing change for your IoT-enabled project you may consider:

- *Vision and objective*: Do you have clear definitions of your goal and why the change is happening? Are the people affected aware of these and do they understand them?

- *Trust*: Do the people affected know they can trust you to do this respectfully and with minimal disruption?
- *Consultation*: Will people be consulted about the changes? How much influence will they have?
- *Journey*: Is every stakeholder on the change journey with you? Do they know what you are trying to achieve and why? Do they understand it?
- *Communications*: Are all stakeholders aware of the important pieces of information? Is there a way you can be more open and transparent?
- *Executive support*: Does the change and change management plan have the support of senior managers and executives in your team?
- *Training*: Has there been enough training provided? If not, how can you get everyone on the same page?

7.1.4 Managing ICT infrastructure change

a) ICT infrastructure change management

For the purpose of this policy, managing infrastructure change refers to changing ICT infrastructure systems (not managing the impact of change on people). An example is replacing legacy systems so that IoT solutions can integrate with your organisation's ICT systems.

There is no one size fits all approach to managing ICT infrastructure change. Speak to your agency's IT/Operational Technology team for further information and assistance about the matters in this section.

b) What are legacy systems?

Legacy systems refer to ICT infrastructure systems that are outdated but continue to be used over updated versions of the system (or a new system altogether). Legacy systems continue to be used for various reasons (e.g. they may have been custom-built or the cost of changing and re-training staff is too high).

Some legacy systems may not be capable of integrating with new IoT systems and will need to be replaced for an IoT solution to be adopted.

c) How to integrate new technology with old technology

There is no one size fits all method of integration/migration of systems or data to work with your IoT solution. As each organisation's ICT infrastructure is different, it is important to assess your infrastructure to determine the best solution for your scenario.

When assessing your current infrastructure, consider:

- What is the current state of your ICT?
- How old is the technology?
- Is the technology still compatible with your current business needs?

- If your current ICT system is one that is working and meeting business needs, where are the connections between the current infrastructure and the IoT solution you want to introduce?
- If you decide to replace your current ICT system, what kind of solution meets your business needs, including the needs of the IoT solution you want to introduce?

Depending on your ICT infrastructure and the responses to the questions above, you may require expertise in migration to new systems and integration of IoT systems with legacy systems. It is important to undertake this transition properly as rushing can result in a loss of data and/or lead to larger costs down the track.

There are many approaches to introducing IoT systems. Three options are:

- remove and replace the legacy system with an IoT-enabled system
- integrate the legacy system with a new IoT-enabled system
- develop a custom solution that mixes both.

Speak to your organisation's ICT team for further information on legacy systems.

7.1.5 Additional resources

See the Queensland Government's Change Management Best Practices Guide (2014) for further information on what change management is.

The Government of South Australia has developed a Change Management Toolkit that provides guidance and resources to assist organisations to manage people through a process of change.

Also, speak with your organisation's change management team and check your intranet/website for organisation-specific resources.

7.2 Spatial data requirements

7.2.1 What is spatial data?

Spatial data refers to the location, shape, and size of an object tied to the Earth's surface. Datums provide the conventions by which coordinates in latitude and longitude (or other coordinate types) and height describe the real-world location of features on the Earth.

A road map is a common example of spatial data. The location of cities, roads, and boundaries that exist on the surface of the Earth are projected onto the map, preserving the relative positions and distances. The data that indicates the Earth's location of these cities, roads, and boundaries (i.e. longitude and latitude) is the spatial data.

7.2.2 Introduction to the NSW Digital Twin

The NSW Government is developing a Spatial Digital Twin, or digital model, of NSW that is supported by an ecosystem of data, platforms, infrastructure and governance arrangements. It will be relevant for urban and regional planning and development, emergency management, natural resource management and environmental management. The NSW Spatial Digital Twin will provide the platform upon which government, developers and residents are able to visualise, plan, develop and assess infrastructure (such as transport links), new community facilities, public spaces, and homes.

Currently in NSW authoritative 2D foundation spatial data – that is, a map of the State – is used across government, industry and the community to inform decision making and planning. However, 2D foundation spatial data does not leverage the full capabilities of emerging systems, platforms, digital modelling, and monitoring of our natural and built environments. Increasingly infrastructure will be planned, delivered and operated using digital models.

The development of an effective digital model that contains four-dimensional (4D) data sources must include a foundational layer of authoritative 4D spatial data (4D means 3D visualisation with the ability to move forwards and backwards in time). Once a foundation layer is available, specific information can then be overlaid to inform planning for future infrastructure and maintenance of current infrastructure, creating a digital twin that mimics real-world behaviour.

The benefits derived from a digital twin include:

- reducing the cost of capital projects and operating costs of infrastructure
- supporting the construction sector to adopt digital technology
- exploring skills and services in digital technology
- creating real-time learning opportunities by providing access to digital models and improving whole of life integration of infrastructure and place.

7.2.3 Recording IoT device position to meet spatial data requirements

a) Importance of recording IoT device position correctly

Mobile and stationary IoT devices frequently communicate their position, time and status, and may pass this information onto third party systems. An example of this is Cooperative Intelligent Transport Systems (connected vehicles) which uses IoT to enable real-time wireless communication between vehicles, roadside infrastructure, mobile devices, and back-office systems to improve the transport network.

To communicate effectively, IoT devices must be clear on the:

- datum in which they express their position
- date and time that the dataset measured
- quality of the data measured.

An intelligent Geographic Information System (GIS) should consume data in any nominated datum and translate between datums using established standards.

b) **Requirements for IoT device spatial data**

Data collected by IoT devices can be absorbed into the NSW Digital Twin. To enable this, IoT devices **must**:

- Record device location, including datum:
  - Restricted to datums (or Coordinate Reference Systems (CRSs)) defined by existing European Petroleum Survey Group (EPSG) codes, which includes all internationally known and accepted datums/projections (as well as the official transformations between them). GDA 2020 is recommended.
  - Refer to Standard Data Format Standard:
    - Refer to ISO19111:2019 Geographic information - Spatial Referencing By Coordinates
    - E.g. XML and JSON formats:
      - Geojson, with inclusion of a defined CRS
      - Geography Markup Language (GML), see ISO 19136:2007
- Include a time/date stamp for all observations recorded at the device (time zone to be included e.g. AEST, UTC etc.)

IoT devices **should** also record:

- The time-stamp of the coordinates in the given datum or CRS. Please note ISO 19111:2019 now supports spatial coordinate reference systems in which coordinate values of points on or near the surface of the Earth change with time due to tectonic plate motion or other crustal deformation, and
- Uncertainty value (expression of how well coordinates are known) for each dataset if possible. While this feature-level metadata is desirable, it may not be well catered for by existing standards. At a minimum, location accuracy (known or estimated) should be included in the metadata for the dataset or device.

> For **automation** of sensor to Digital Twin data exchange, a standard data format for communicating location is required:
>
> *Co-ordinates + Datum (i.e. GDA) + Standard (geojson, GML, etc.) + time and date (include time zone)*

7.2.4 GDA2020 and the Australian Terrestrial Reference Frame

In October 2017 GDA2020 superseded GDA94 as the new National Datum of Australia. Since then NSW Government has been working to make data and services available in GDA2020 to support high-precision positioning applications like IoT.

It is expected that from 2023 the continued movement of the Australian tectonic plate (approximately 7cm per year) will necessitate a transition to time-dependent coordination.

In Australia, the Australian Terrestrial Reference Frame (ATRF), along with GDA2020, will cater to this need.

More information on the adoption of GDA2020 and ATRF is available from the Intergovernmental Committee on Surveying and Mapping and on the NSW Spatial Services website.

7.2.5 Positioning standards

Communication of position and datum information is accomplished by various standards including PROJ, EPSG, WKT. A discussion of some of the technical differences can be found at the website of the Earth Lab at the University of Colorado.

Other standards relating to spatial data are listed in the following table.

Other standards relevant to spatial data

Spatial-related standards	Description
NSW GDA2020 and AGRS Implementation Policy	A geocentric (Earth-centred) coordinate reference system that is Australia's official national datum within the Australian Geospatial Reference System.
AS/NZS ISO 19111:2019 Geographic Information; Referencing by Coordinates	This standard is applicable to producers and users of geographic information. Describes the conceptual schema for the description of referencing by coordinates, and the minimum data required to define coordinate reference systems
ISO 19127 Geographic information	Developed as a Geodetic Registry to supersede/coordinate ISO 19111 to support time-dependent coordinates. See also associated ISO standards from the ISO/TC211 Working Group.
AS/NZS ISO 19162:2018 Geographic information	Provides a well-known text representation of coordinate reference systems, defines the structure and content of a text string implementation of the abstract model for coordinate reference systems.
AS/NZS ISO 19115.1:2015 Geographic Information	Provides the technical definition of the standard and is intended to provide tech-savvy implementers with detailed information for software development and other purposes.
AS/NZS ISO/TS 19139 series Geographic Information XML schema implementation	Defines XML based encoding rules for conceptual schemas specifying types that describe geographic resources.
NSW Standard for Spatially Enabling Information (2018)	Established standards for spatially enabling NSW Government data and information.

7.3 IoT deployment and configuration

7.3.1 Device deployment and configuration

The way that IoT is deployed and configured can have a significant impact on data quality and security. IoT devices need to be configured with attributes such as name, location, and application-specific settings (i.e. the unique ID of the asset the device relates to).

It is also important to recognise that data from your project may be used in a future project. Consideration should be given to a wider set of information being captured such as:

- records for who installed the sensors
- how access for maintenance is managed
- who is responsible for changing batteries, calibration needs, and other responsibilities?
- any commercial constraints or agreements
- any other factors that might make the usefulness of sensor data more valuable on future projects.

IoT devices also need to be managed as configuration items in your organisation and documented for asset management and incident management purposes. This helps them to be trusted components in your organisational architecture and ensures that devices and the data they transmit can be part of organisational data flow.

Appropriate deployment and configuration will establish device monitoring benchmarks; this allows you to proactively identify and remediate real or potential security issues. Testing during the deployment phase ensures that data is being generated and transmitted as expected.

Configuration and adaption should be an ongoing process. You need to ensure business users of IoT data can communicate with device owners and software providers to tailor data collection rates or to drive quality and calibration checks throughout the lifespan of your project.

Tip: An IoT device may use many off-the-shelf software and hardware components. Only a small proportion of these components may be manufactured and maintained by the IoT service provider. Maintaining a Software Bill of Materials for each device may be a good practice to ensure documentation and traceability for all components.

7.3.2 Communicating about deployment

Consider what communication or education your stakeholders may require support about any IoT deployment. This can be supported by a stakeholder engagement strategy. See Chapter 3.2 Stakeholder engagement and Chapter 6.1 Change management for further advice.