P5 presentation

ISO 19650 standards in Web GIS for project's information management including GIS & BIM

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THE SCIENCE OF WHERE

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Content

- Introduction
- Related work
- Research objective
- Motivation
- Methodology
- Case study (field analysis)
- ISO 19650 standards
- Common Data Environment (CDE) workflow and components
- Reference implementation of the components in Web GIS
- Conclusions & answer to the research question

Introduction

GIS provides context & content on a big scale

Environmental/Urban information modeling

BIM provides (high detailed) content

Construction information modeling

In the context of this thesis

BIM = IFC, CAD, Revit, Civil 3D etc.

GIS = Maps, 3D Objects, file GDB, as web services on Web GIS

Project information management & ISO 19650 Series standards

Introduction - ISO 19650 standards - Part-1 & Part-2

Organization and digitization of information about buildings and civil engineering works, including building information modeling (BIM) — Information management using building information modeling (BIM)

- Collaborating in projects using BIM
- Adopted by (none)-governmental organizations e.g., Sweco and BAM Infra.
- Support in main BIM vendors' platforms (Common Data Environment)

ISO 19650: Part 1 - Concept and principles

ISO 19650
Part 2
Delivery phase

ISO 19650
Part 3

Operational phase

ISO 19650
Part 4

Not confirmed yet

ISO 19650: Part 5
Security minded approach to info management

Related work

- BIM and ISO 19650 from a project management perspective (K. Rudden, 2019)
- Expert View: How ISO 19650 Will Change the Construction Supply Industry (Oberste-Ufer, 2019)
- Guidance Part 1: Concepts - Information management according to BS EN ISO 19650 (Kemp, 2019)
- Guidance Part 2: Parties, teams and processes for the delivery phase of the assets - Information management according to BS EN ISO 19650 (Kemp, 2021)
- Nederlandse praktijkrechtlijn - Guidance on how to implement EN ISO 19650-1 and -2 in Europe, 2020.
- Guidance Part C Facilitating the common data environment (workflow and technical solutions) (Kemp, 2020)
- Implementing BIM360Docs to Support the New ISO 19650 Series of Standards Using BIM (P. Shillcock and M. Suchocki, 2019).

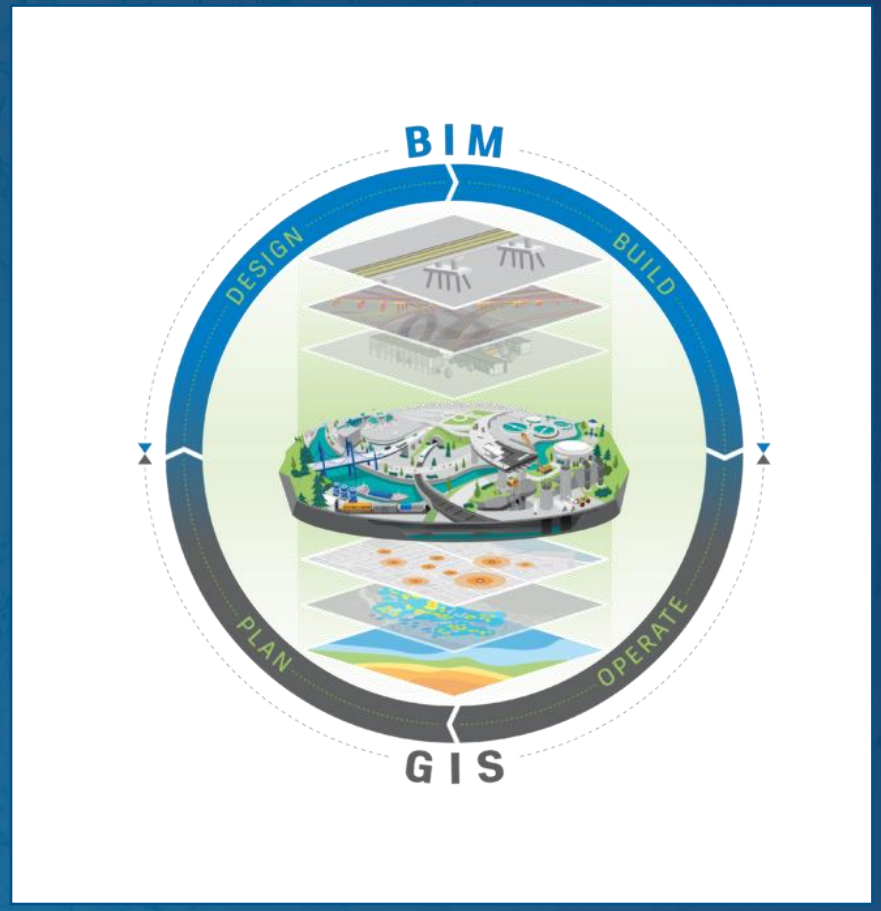
Research objective

Question:

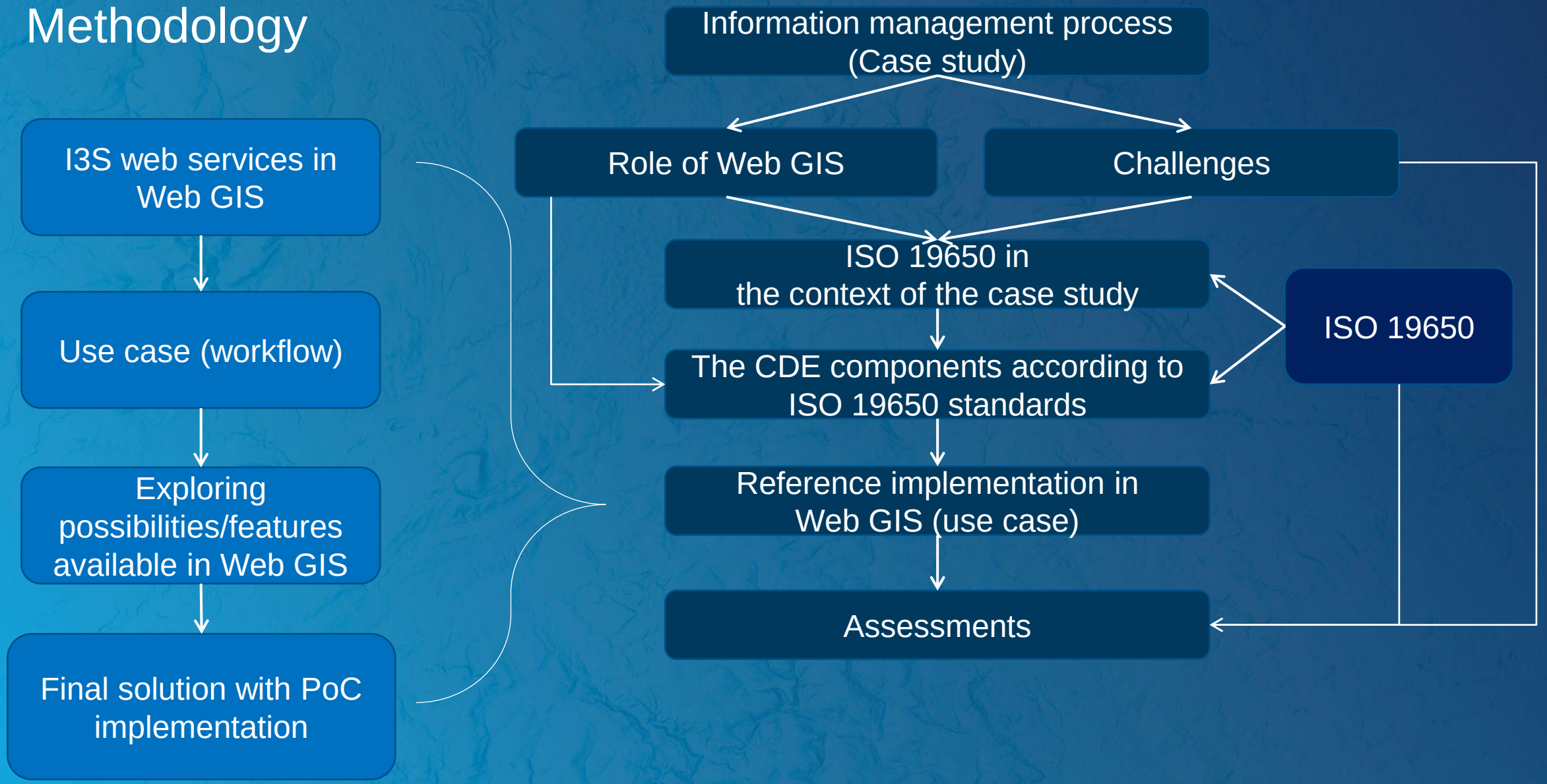
How to implement a Common Data Environment (CDE) in Web GIS to enable ISO 19650-1&2:2018 compliant workflows for web services?

Motivation

- Tightly integrated GIS & BIM workflows
- Importance of Web GIS and GIS data in asset data management related application, including BIM data converted to GIS data.
- Market demand for applying ISO 19650 standards in Web GIS.



Methodology

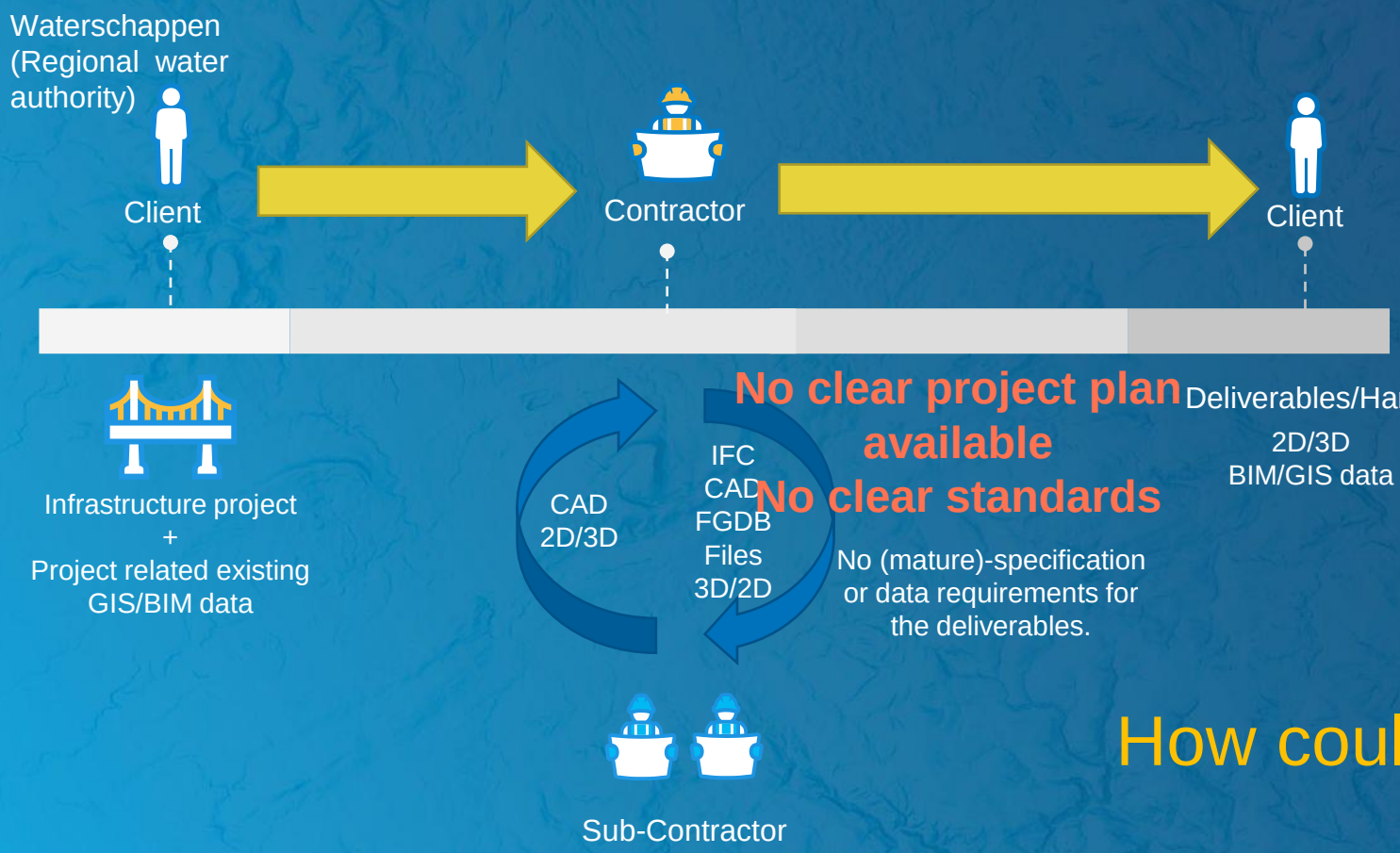


Case study (HWBP) - GIS & BIM for infrastructure project

Hoogwaterbeschermingprogramma (HWBP)

- The Afsluitdijk - widening the body & raising it by 2m.
  - Activities examples: water pumping stations, roads, and body layers
    - Client: Rijkswaterstaat - GIS user (kernGIS)
    - Contractor: construction companies e.g. BAM

Case study (HWBP) - Information management process



Resulting data:
Deliverables requires post-processing (time and data loss)

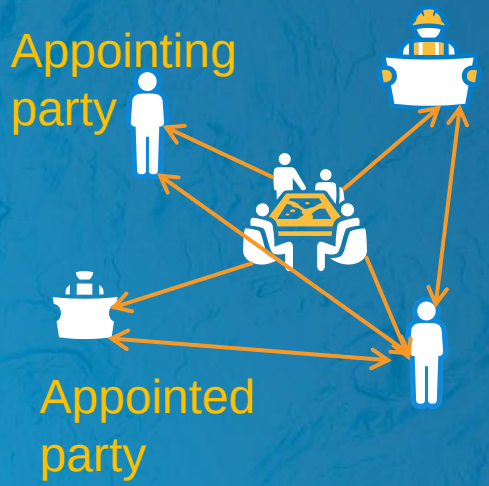
How could we improve?

ISO 19650 standards

Roles & activities (phases)

Benefits:

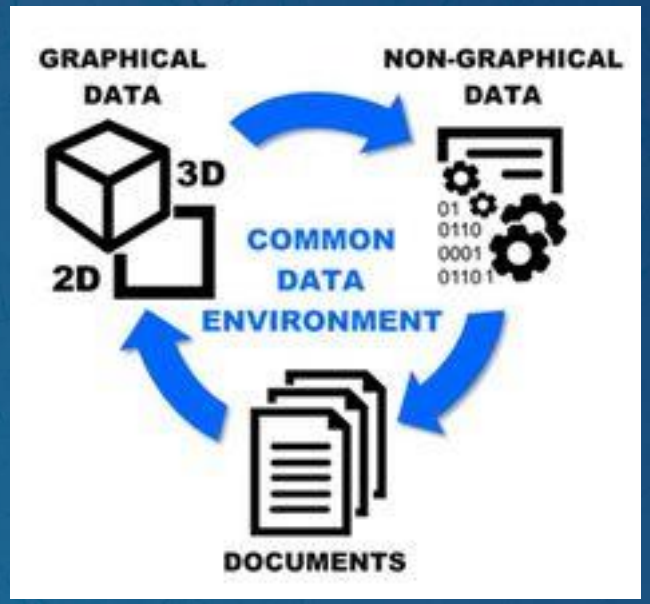
Clarity & efficiency.



Common data environment (CDE)

Benefits:

Control, productivity, trust and confidence.



Source: https://www.modelical.com/en/common-data-environment-modelical-advisory/

ISO 19650 standards - roles

Applied whether there is a formal agreement or not

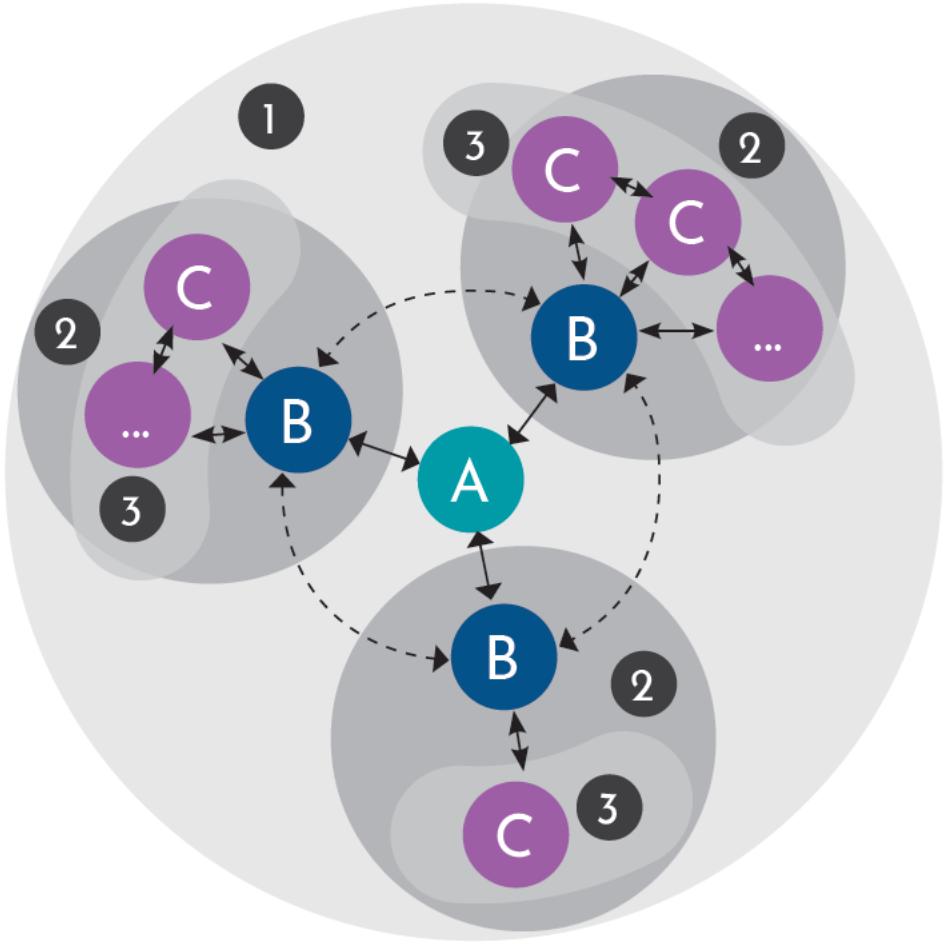
Client / owner
Rijkswaterstaat

(Sub)-Contractor

Appointment/ agreement

Key:

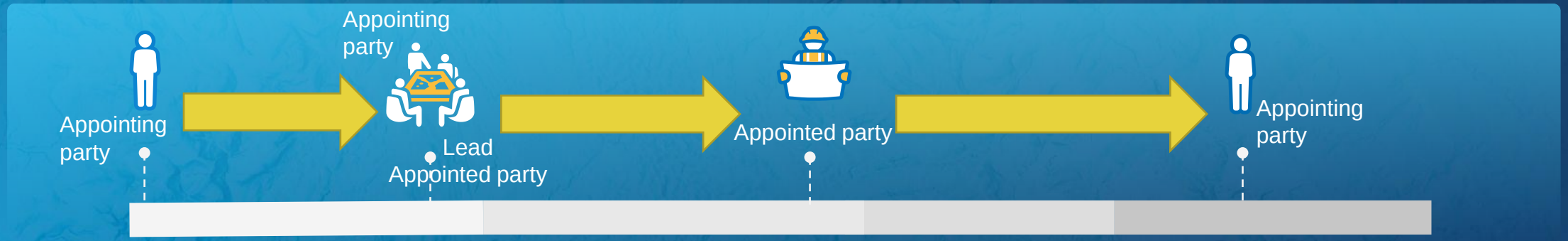
- A — Appointing Party
- B — Lead Appointed Party
- C — Appointed Party
- 1 — Project Team
- 2 — Delivery Team
- 3 — Task Team(s)
- ⟷ Information requirements and information exchange within a delivery team and with the appointing party
- ⟷ Information co-ordination between delivery teams



Interfaces between parties and teams, (Kemp, 2021) - simplified version of ISO 19650-2 Figure 2

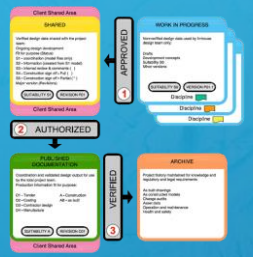
ISO 19650 standards – activities

ISO 19650 information management process in the context of HWBP



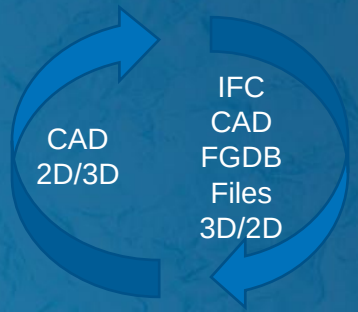
Infrastructure project
+
Project related existing GIS/BIM data

CDE with the technical solution.



Common data environment

Mature specification
and data requirements
for the deliverables.
+
Tools to convert BIM to feature/scene services
With the original BIM data



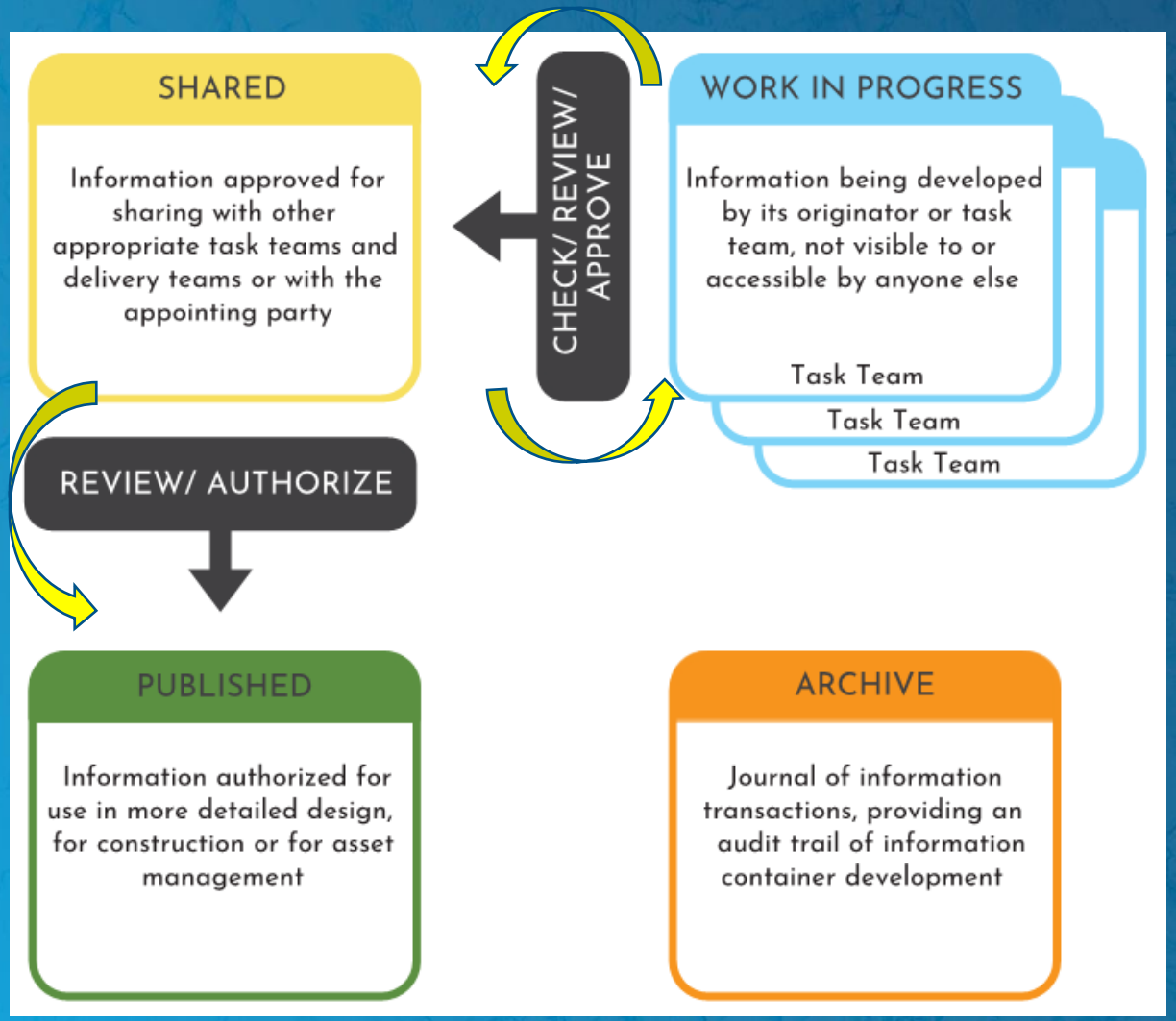
Sub-Contractor

Deliverables/Handover

Managed data
Maps & Apps == web services
These include:
REST Services containing:

- Feature Services === Geodatabase
- Scene Services ==== SLPK (I3S items)
- IFC / Revit / CAD as Scene Layers ===== SLPK (I3S items)
- Files (tabular, CAD, PDF) === ZIP files

ISO 19650 CDE workflow & components



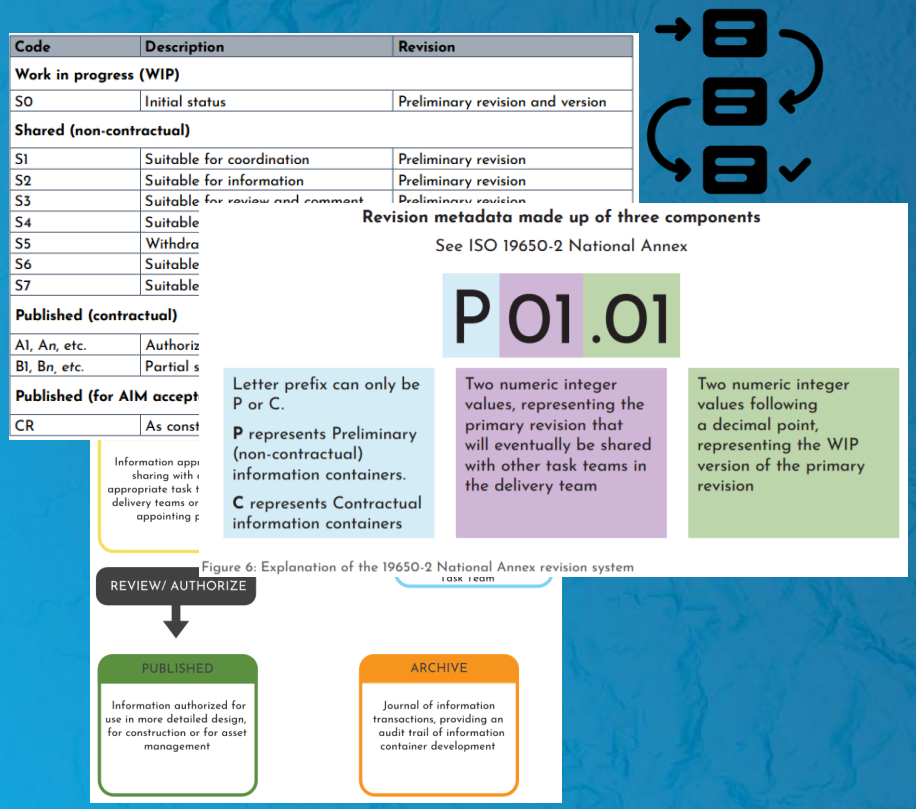
Source Common data environment (CDE) concept (ISO 19650-1:2018, Figure 10) – modified

Components for information containers

1. Being in different States (WIP, shared and published)
2. Metadata allocation:
   - Information container's ID
   - Attributes (revision, status, classification)
3. Access privileges levels
4. Audit trail (version history)

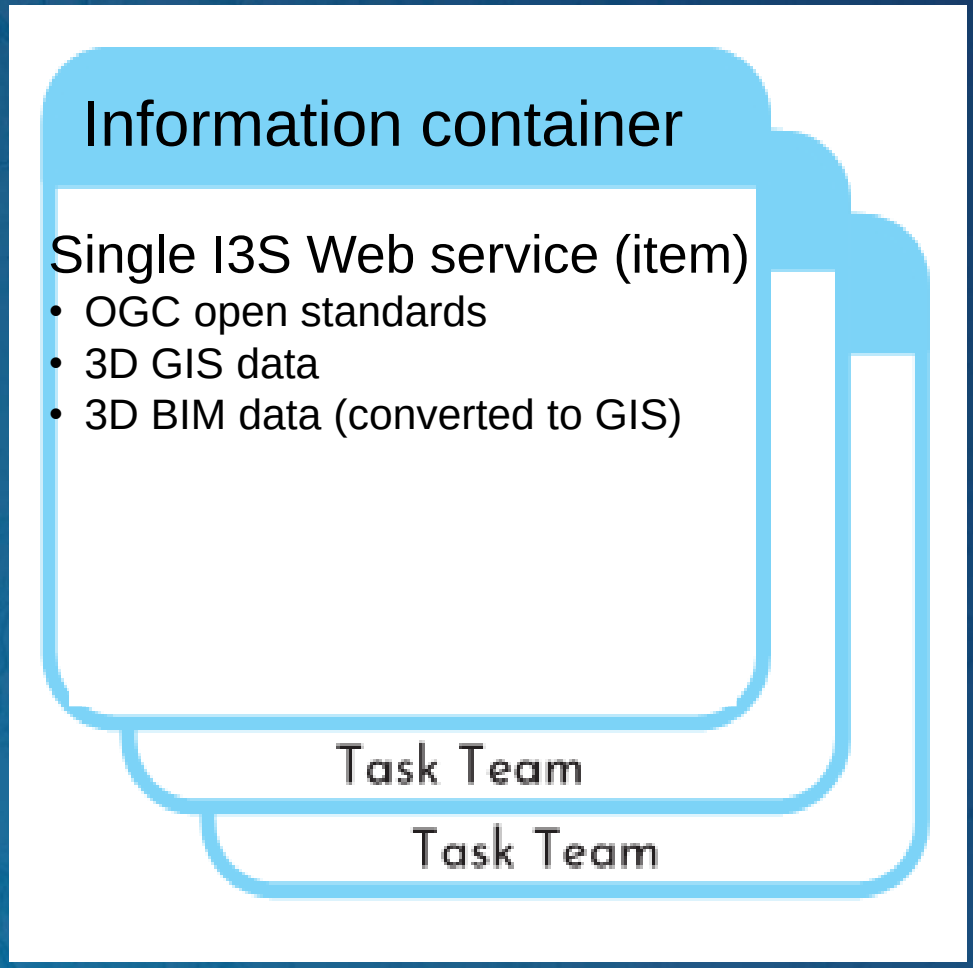
ISO 19650 CDE workflow & components

Metadata:
States (WIP, Shared, and Published)
Revision system (British national annex)
Status codes system (British national annex)

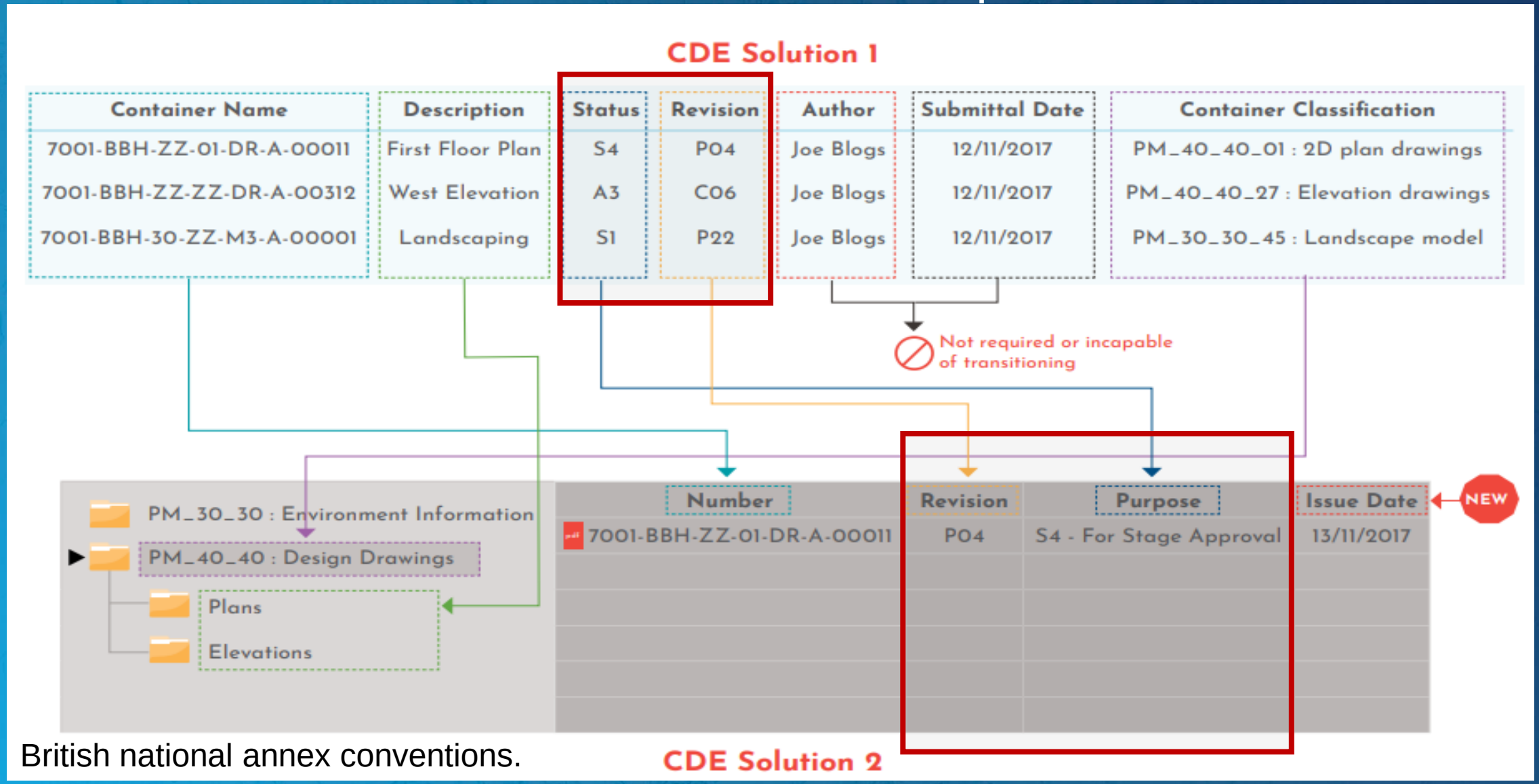


Code	Description	Revision
Work in progress (WIP)		
S0	Initial status	Preliminary revision and version
Shared (non-contractual)		
S1	Suitable for coordination	Preliminary revision
S2	Suitable for information	Preliminary revision
S3	Suitable for review and comment	Preliminary revision
S4	Suitable	
S5	Withdra	
S6	Suitable	
S7	Suitable	
Published (contractual)		
A1, A*n*, etc.	Authoriz	
B1, B*n*, etc.	Partial s	
Published (for AIM accept		
CR	As const	

Figure 6: Explanation of the 19650-2 National Annex revision system



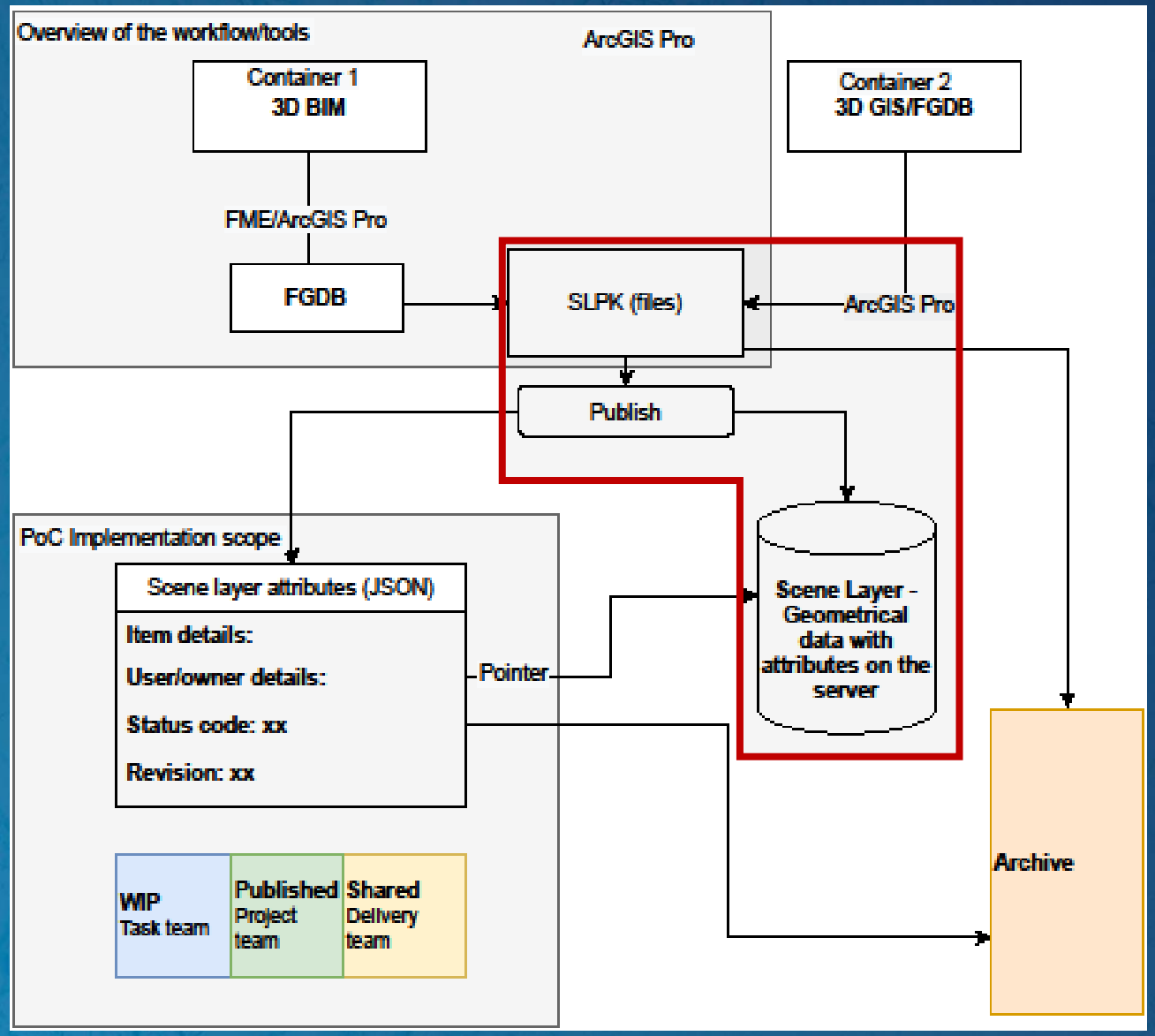
ISO 19650 CDE metadata allocation – comparison of two solutions



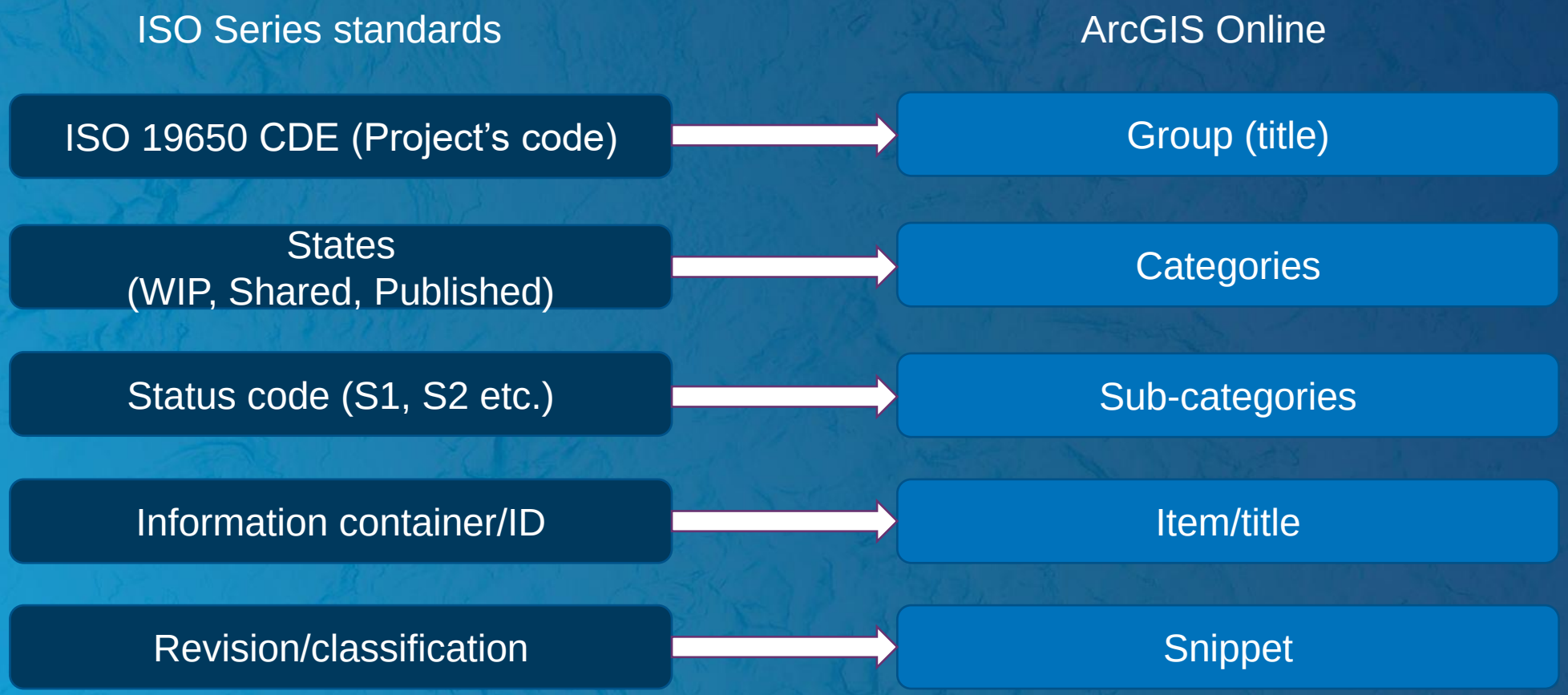
British national annex conventions.

Reference implementation in Web GIS - ArcGIS Online (use case)

- I3S (scene layer) & SLPK files
  - Same data in two formats
- Metadata allocation components
  - ***Group*** feature (JSON)
    - Categories
  - Scene layer attributes (JSON)



Reference implementation in Web GIS - ArcGIS Online



Proof of concept functionalities

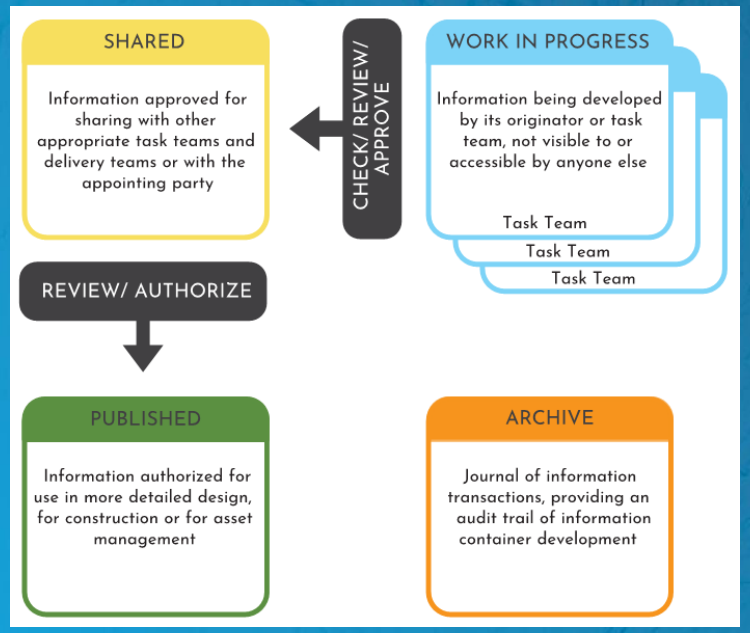
ISO 19650 Group function

- Configures a Group according to the ISO 9650UK national annex conventions.

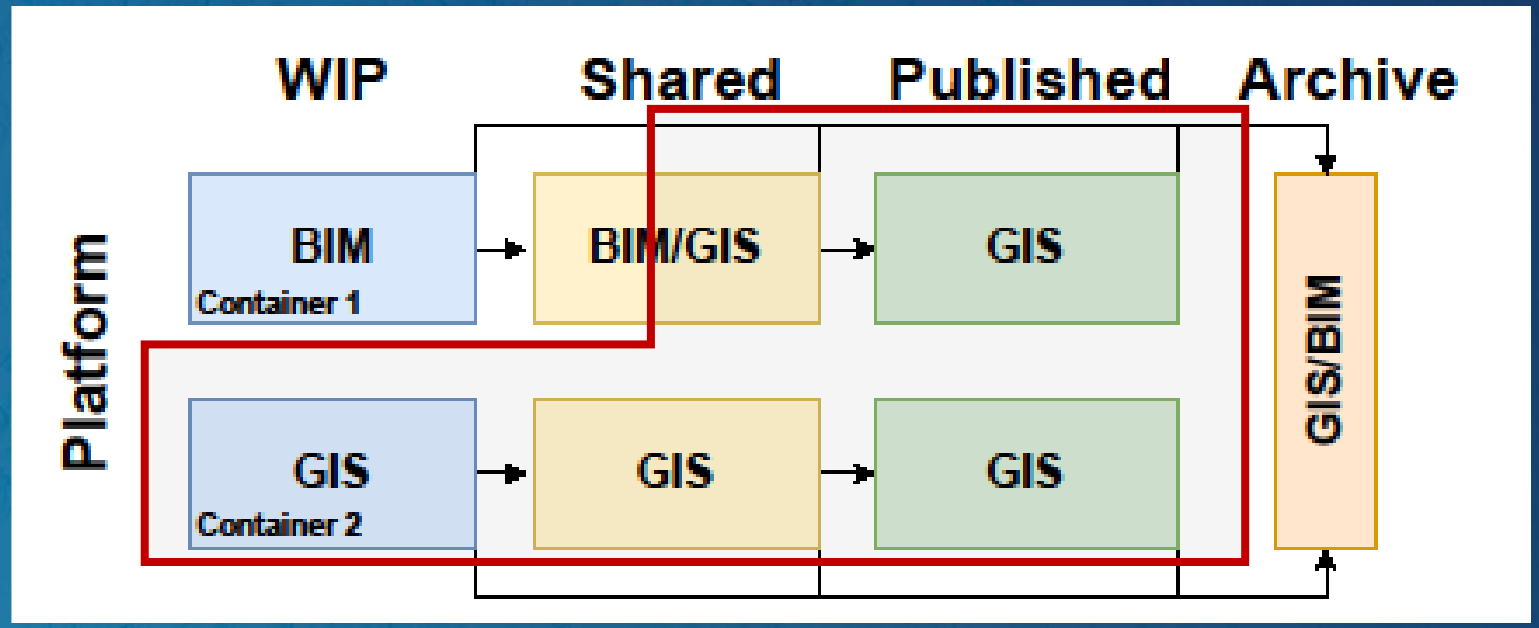
Push function:

- Does the transitioning of an item between states and updates its metadata (*revision and last updated by*) accordingly.
- Also, it adds a comment (as a register of the push action done) in the comments section which ensures tracking of the workflow of the information container.

Reference implementation in Web GIS – scope



GIS & BIM data general workflow in the CDE (case study)



The implementation scope

Source Common data environment (CDE) concept (ISO 19650-1:2018, Figure 10) – modified

Answer to the research question

Research question:

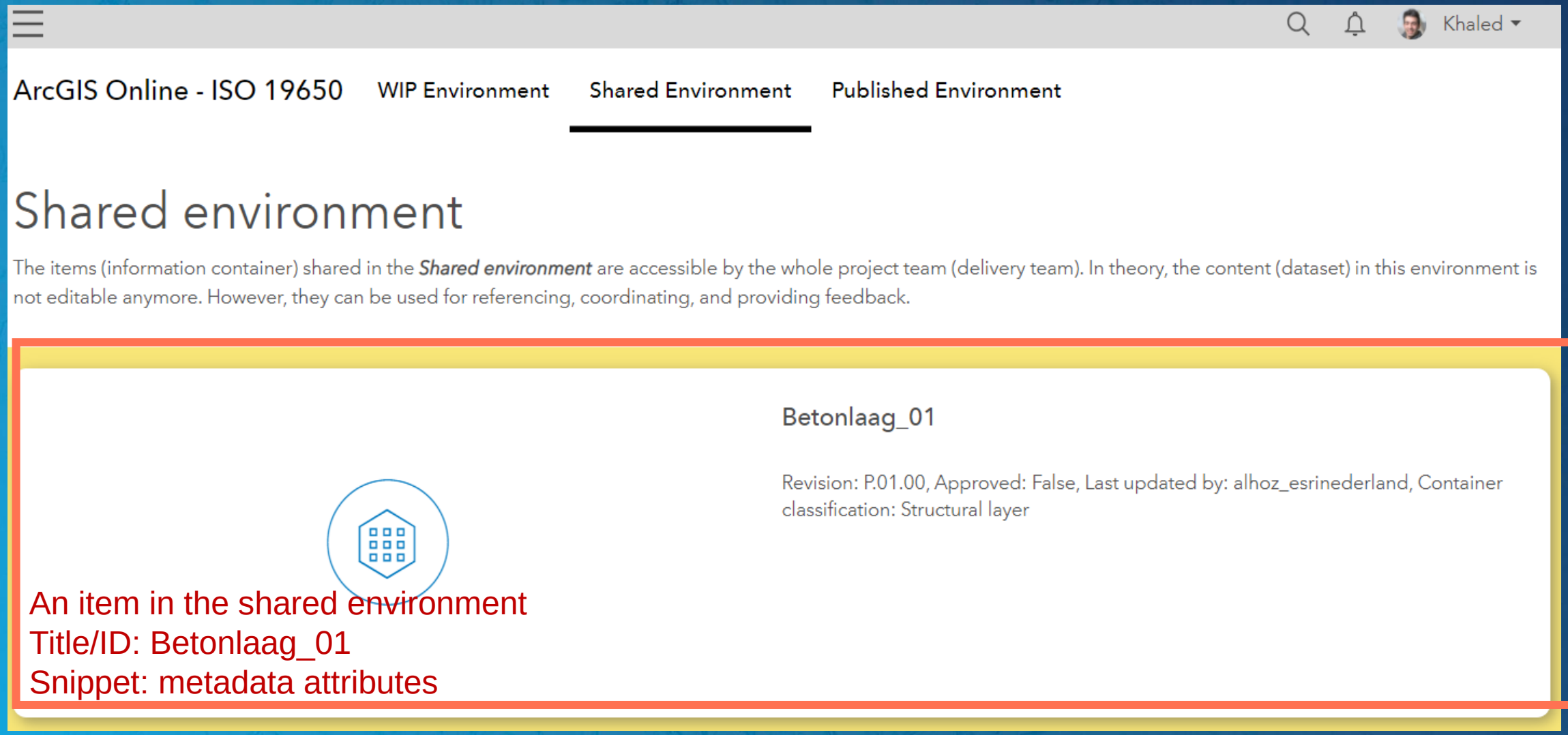
How to implement a CDE in Web GIS to enable ISO 19650-1&2:2018 compliant workflows for web services?

- ArcGIS Online has potentials to offer CDE solutions that enables ISO 19650 workflows for I3S web services
  - This research gives ideas on how to use utilize already available features to implement/configure a CDE solution.
  - This research can be a good step towards offering a tool that allows configuring CDE solutions in the ArcGIS Online platform.
- Other Web GIS Platforms can utilize the reference implementation to compare the used features and implement/configure CDE solutions.

Further research can address the (automatic) transfer of data between a CDE in the BIM platform and a CDE in GIS platform

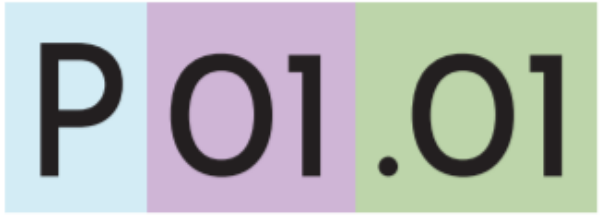
Thank you!

Example of an item in the ISO 19650 Hub



Revision metadata made up of three components

See ISO 19650-2 National Annex



Letter prefix can only be P or C.

P represents Preliminary (non-contractual) information containers.

C represents Contractual information containers

Two numeric integer values, representing the primary revision that will eventually be shared with other task teams in the delivery team

Two numeric integer values following a decimal point, representing the WIP version of the primary revision

Figure 6: Explanation of the 19650-2 National Annex revision system

Example of a Group categories – states & status

```
// 20210607143556
// https://www.arcgis.com/sharing/rest/content/groups/38d66a69c5e5457a90dcf0970e4d215f?f=pjson

{
  "total": 1,
  "start": 1,
  "num": 1,
  "nextStart": -1,
  "items": [
    {
      "id": "dd4df552575b4d71944a51731b0a4e59",
      "owner": "alhoz_esrinederland",
      "created": 1615971492000,
      "modified": 1622578659000,
      "guid": null,
      "name": "Polygon_Layer3DToFeatureCla
      "title": "Polygon_Layer3DToFeatureCl
      "type": "Scene Service",
      "typeKeywords": [
        "3DObject",
        "ArcGIS Server",
        "Data",
        "Metadata",
        "Scene Service",
        "Service",
      ],
      "listed": false,
      "numComments": 1,
      "numRatings": 0,
      "avgRating": 0,
      "numViews": 20,
      "groupCategories": [
        "/Categories/Shared (non-contractual)/S4 - Suitable for stage approval"
      ],
      "scoreCompleteness": 46,
      "groupDesignations": null
```

Example of an Item title (ID) & snippet (revision & classification)


```
  owner: "alhoz_esrinederland",
  orgId: "emS4w7iyWEQiulAb",
  created: 1615984755000,
  modified: 1628760580000,
  guid: null,
  name: "bk_filterlaag_lijnen3D",
  title: "Betonlaag_01",
  type: "Scene Service",
- typeKeywords: [
      "3DObject",
      "ArcGIS Server",
      "Data",
      "Metadata",
      "Scene Service",
      "Service",
      "Hosted Service"
  ],
  description: "This is a random and outdated data of a dyke in Ameland in the north of the
  Netherlands, it is only used here for illustration purposes regarding workflows and data management.
  <div>This data was received from <a href='https://www.wetterskipfryslan.nl/' rel='nofollow ugc'
  target='_blank'>Wetterskip</a> (<span style='font-family:Calibri, sans-serif; font-size:11pt;'>Jelle
  Posthumus), in Civil 3D format, </span>for testing purposes in the innovation sprint about data
  management of HWBP related projects. It is not permitted for any further use.</div>",
- tags: [
      "Shared (non-contractual)"
  ],
  snippet: "Revision: P.01.00, Approved: False, Last updated by: alhoz_esrinederland, Container
  classification: Structural layer",
  thumbnail: "thumbnail/thumbnail1628760577518.png",
```

UK national annex - CDE workflow recommendation for BIM

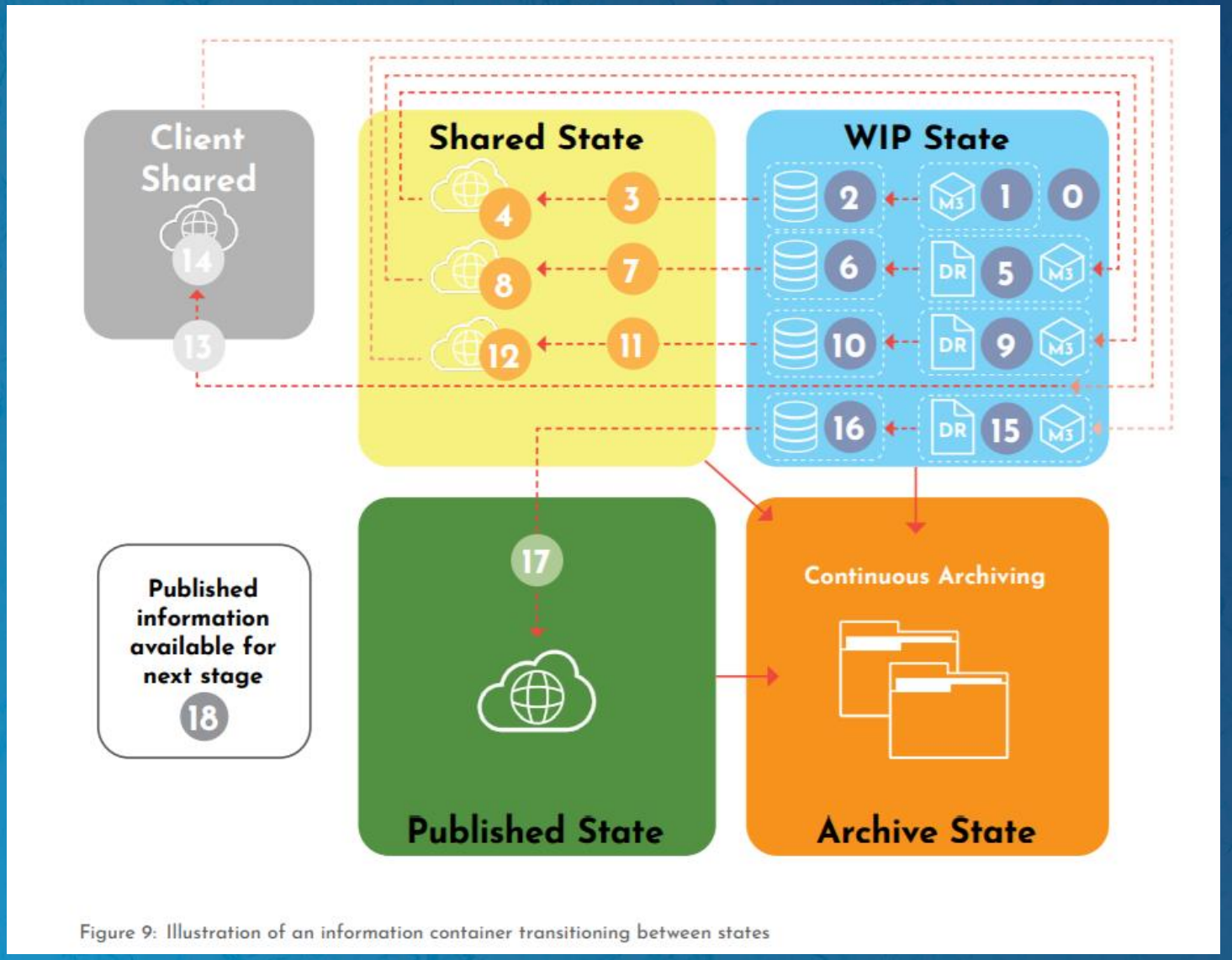
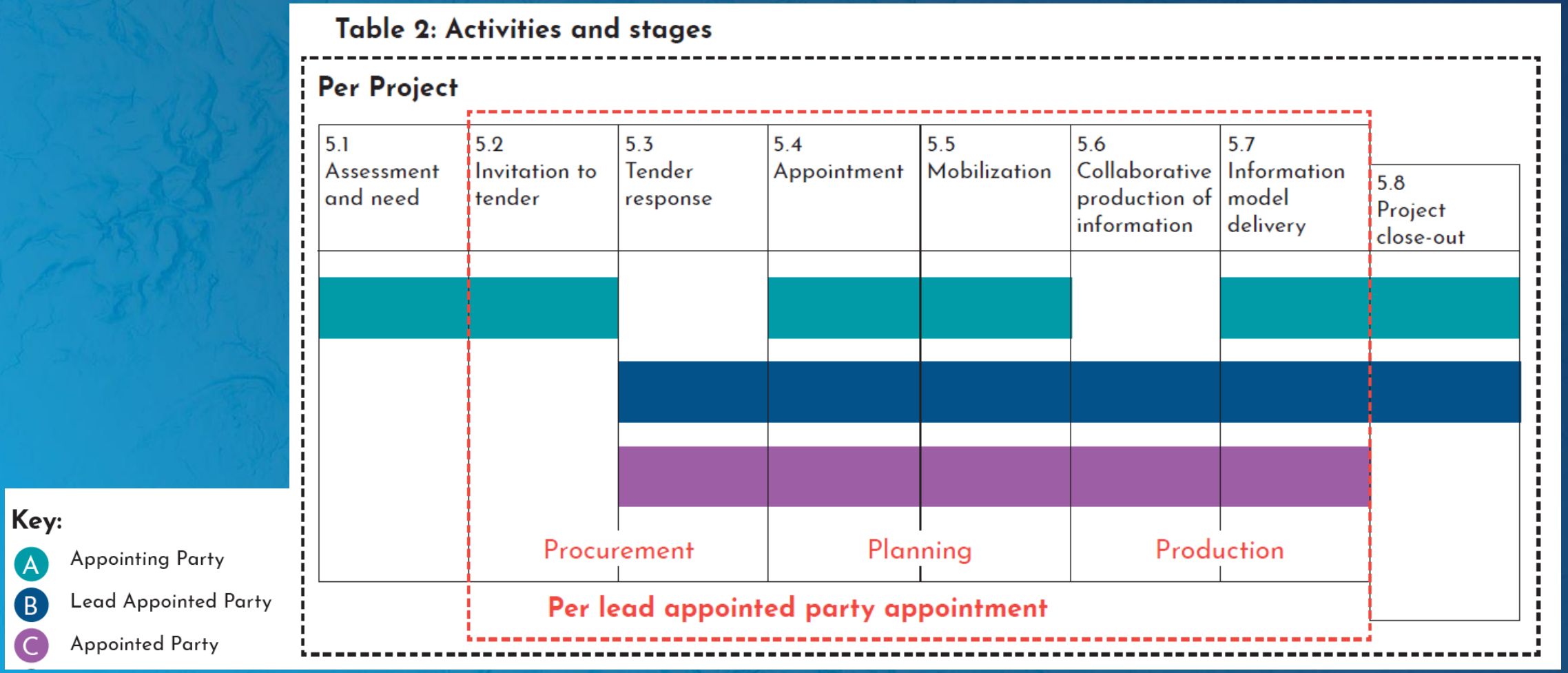


Figure 9: Illustration of an information container transitioning between states

Technical requirements (functionalities)

- The ability of each information container (Web service on the web) to transition between states (WIP, shared, published)
- The ability for each information container to have attributes assigned (status, revisions, and classification (see table below))
- Controlled access at an information container level.
- Recording of user details (name, date) when information container transitioning between states - record of version history of an information container.

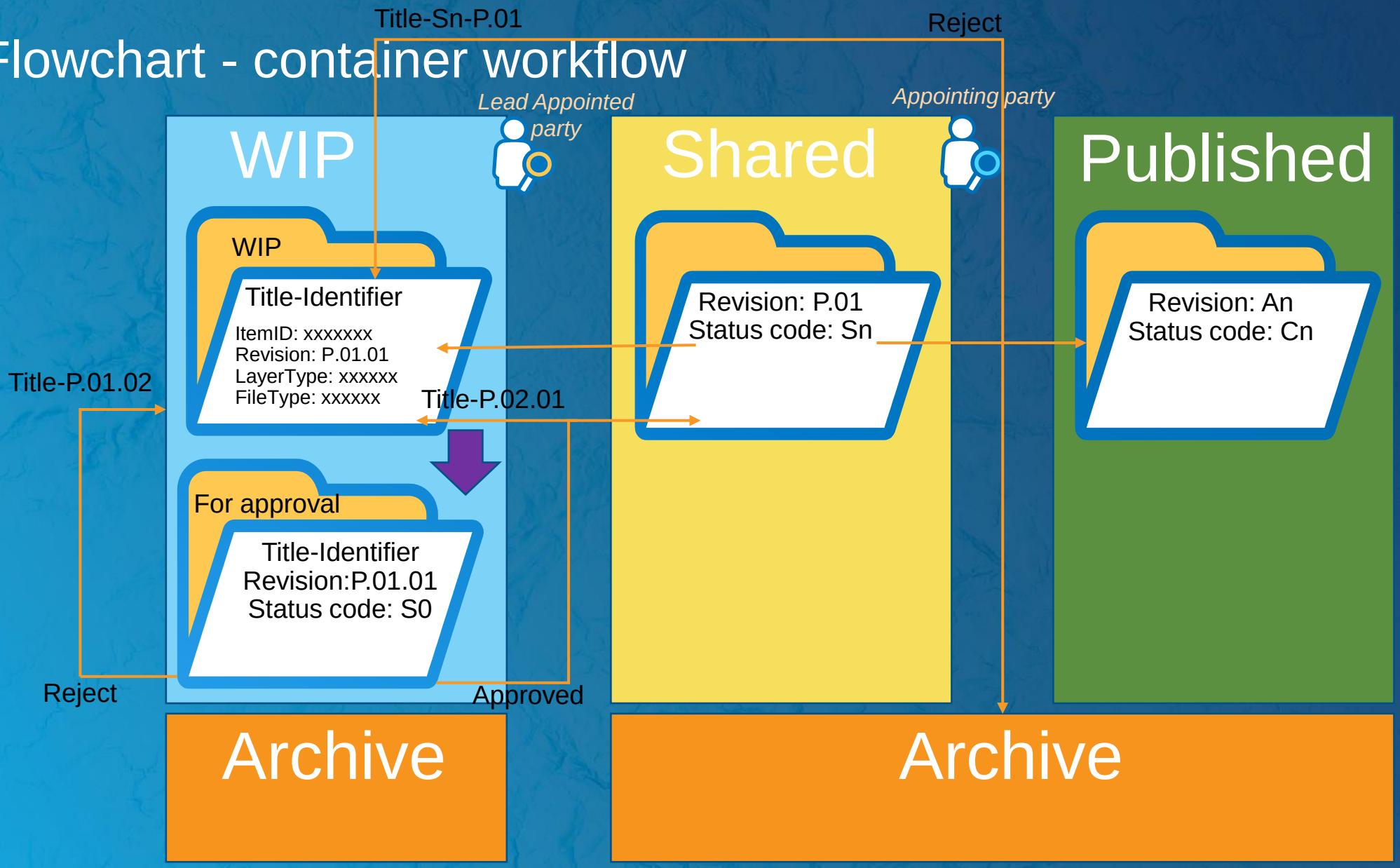
ISO 19650 Part - 2
Information management activities and process



CDE components

- The ability of each information container to transition between states (WIP, shared, published)
- The ability for each information container to have attributes assigned (status, revisions, and classification)
- Controlled access at an information container level (possible).
- Audit trail (information container history)

Flowchart - container workflow



Inspired by: YouTube link and

ISO 19650-2 Table NA.1 - Status codes for information containers within a CDE (Kemp, 2020)

File’s naming conventions according to British national annex

Container Name	Description	Status	Revision	Author	Submittal Date	Container Classification
7001-BBH-ZZ-ZZ-DR-A-00301	First Floor Plan	S3	P04	Joe Blogs	12/11/2017	PM_40_30 : Design information
7001-BBH-ZZ-ZZ-DR-A-00312	West Elevation	A3	C06	Joe Blogs	12/11/2017	PM_40_30 : Design information

Container Name / ID Field

Additional Container Metadata Assignments

Figure 4: An example of a range of metadata that can be assigned in a cloud based CDE solution

File identifier: ProjectCode - ItemID

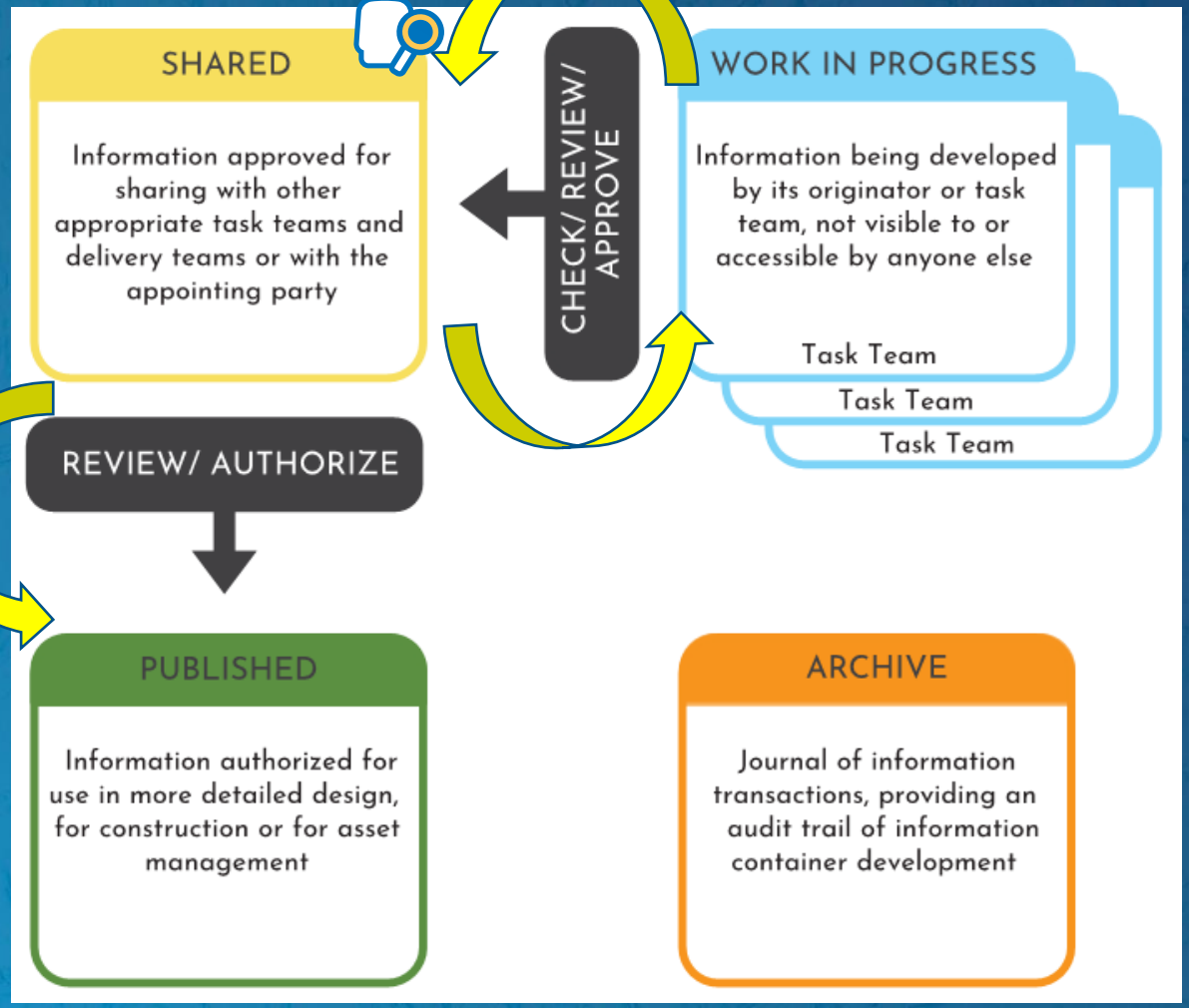
Attributes
Revision: P.01.01
CDE area: WIP/Shared/Approved
MostUpToDate: Required
LayerType: xxxxxx

Code	Description	Revision
Work in progress (WIP)		
S0	Initial status	Preliminary revision and version
Shared (non-contractual)		
S1	Suitable for coordination	Preliminary revision
S2	Suitable for information	Preliminary revision
S3	Suitable for review and comment	Preliminary revision
S4	Suitable for stage approval	Preliminary revision
S5	Withdrawn*	N/A
S6	Suitable for PIM authorization	Preliminary revision
S7	Suitable for AIM authorization	Preliminary revision
Published (contractual)		
A1, An, etc.	Authorized and accepted	Contractual revision
B1, Bn, etc.	Partial sign-off (with comments)	Preliminary revision
Published (for AIM acceptance)		
CR	As constructed record document	Contractual revision

ISO 19650-2 Table NA.1 - Status codes for information containers within a CDE (Kemp, 2020)

ISO 19650 standards solution & technical requirements

ISO 19650 CDE workflow & technical requirements



Uneditable data

Appointing party

At the end of a phase

Data production

Appointed party

Has

Lead Appointed party

Common data environment (CDE) concept (ISO 19650-1:2018, Figure 10) – modified

Status codes system (British national annex)

Code	Description	Revision
Work in progress (WIP)		
S0	Initial status	Preliminary revision and version
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S1	Suitable for coordination	Preliminary revision
S2	Suitable for information	Preliminary revision
S3	Suitable for review and comment	Preliminary revision
S4	Suitable for stage approval	Preliminary revision
S5	Withdrawn*	N/A
S6	Suitable for PIM authorization	Preliminary revision
S7	Suitable for AIM authorization	Preliminary revision
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A1, A*n*, etc.	Authorized and accepted	Contractual revision
B1, B*n*, etc.	Partial sign-off (with comments)	Preliminary revision
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