BUILDING INNOVATION
Emerging Technologies Series

Data Orchestration:

The real challenges to achieving Twinness

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Learning Objectives

What are the data challenges in an AEC Project?

Different approaches to orchestrating data.

Creating a plan to meet Data needs.

Understanding Motivations of Project Participants.

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Introduction

Dirty secrets about Owner/Operators and the AEC industry in general

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Things I learned along my journey

66 *…the truth is most owners don't have their data as organized as everyone thinks they do.*

national brick & mortar retailer

66 *we have good data*

except they didn't have all the data…

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Things I heard

building a Digital Twin platform

" *Can it help us replace all the drawings we lost in a fire?*

healthcare facilities team

" *You want us to make what visible to the 'internet'?!*

healthcare operator

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BUILDING INNOVATION
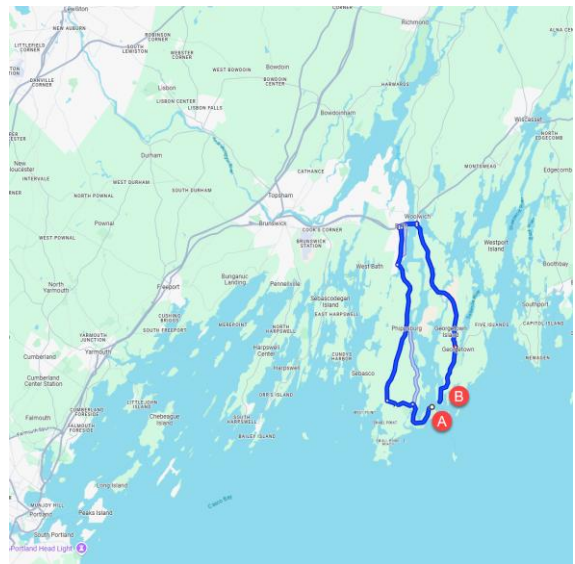*Emerging Technologies Series*

Data Quality

"You can't get theyah from heah."

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Data Quality

- Know what you have (A)
- Know what you need (B)

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Data Quality

- Know what you have (A)

- Know what you need (B)

- Know what the plan is to get from A to B
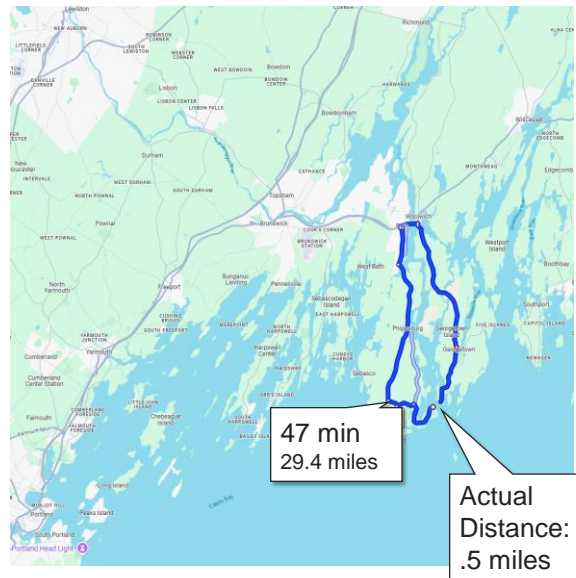

47 min
29.4 miles

Actual
Distance:
.5 miles

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Data Quality

- Know what you have (A)

- Know what you need (B)

- Know what the plan is to get from A to B
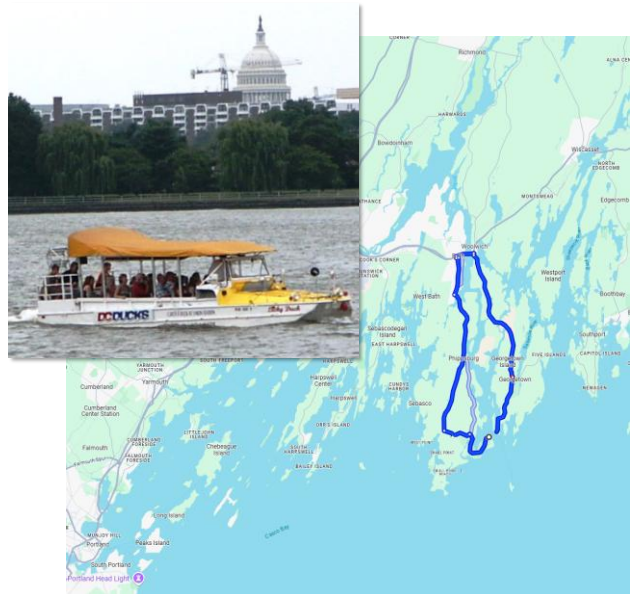
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Team Member Alignment

<u>Presently</u>, what is the core motivation of most AECO teams?

- Design
- Permit
- C of O
- Cost

Where in that list are the members motived to collaborate around mapping and tracking data for a digital twin?

Failure to Capture Data

- System Design
- Control System Implementation
- Hand-off

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Failure to Capture Data

- This person hold the keys

- No one thinks to keep the keys.

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Converting Data

'Physical' Manifestation of Business Needs

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What is the business of AE?

All the verbs and adjectives can be narrowed to a simple concept.

Converting ~~Business~~ LEGAL Needs to Physical Requirements

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Narrative Requirements

Specifications

RIB
SpecLink

A. Galvanized Steel Threaded Base Security Bollards.
  1. Footing: [Outside diameter: 4 inch, Height: 32 inches, Footing: Galvanized steel threaded base, 2 bolt] or [Outside diameter: 5.5 inch, Height: 42 inches, Footing: Galvanized steel threaded base, 3 bolt].
  2. Material: [Galvanized steel: Schedule 40].
  3. Wall thickness: [0.120 inches], [0.237 inches], or [0.337 inches].
  4. Cap style: Dome.
  5. Security level: Low.

Converting Narrative Text into Data:

- Each 'section' stored as a unique record.

- Specification Structure provides dimensions to the data.

Narrative Requirements

Specifications

RIB
SpecLink

REQUIREMENTS

ID	Div. No.	Div. Name	Text
1	055000	Metal Fabrications	Footing: [Outside…
2	055000	Metal Fabrications	Material: [Galvan…
3	055000	Metal Fabrications	Wall thickness: […
4	055000	Metal Fabrications	Cap style: Dome.

Converting Narrative Text into Data:

- Tag or identify which are 'important'.

- What 'tier' is of value?

- Should it be grouped?

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Linking Data

REQUIREMENTS

ID	Div. No.	Div. Name	Text
10	055000	Metal Fabrications	Footing: [Outside…
12	055000	Metal Fabrications	Material: [Galvan…
13	055000	Metal Fabrications	Wall thickness: […
14	055000	Metal Fabrications	Cap style: Dome.

Data:

- Requirements

- "Things"

OBJECTS

ID	Name	Height	Description
1	36" Bollard	36"	Metal bollard with..
2	Stop Sign	10'	Traffic control sig…
3	48" Bollard	48"	Metal bollard with..
4	VAV Box	24"	300 CFM VAV wit..

Linking Data

REQUIREMENTS

ID	Div. No.	Div. Name	Text
10	055000	Metal Fabrications	Footing: [Outside…
12	055000	Metal Fabrications	Material: [Galvan…
13	055000	Metal Fabrications	Wall thickness: […
14	055000	Metal Fabrications	Cap style: Dome.

Nothing Automatic:

- Someone needs to make the decision.

- Maybe AI can do this. *likely in the future*

OBJECTS

ID	Name	Height	Description
1	36" Bollard	36"	Metal bollard with..
2	Stop Sign	10'	Traffic control sig…
3	48" Bollard	48"	Metal bollard with..
4	VAV Box	24"	300 CFM VAV wit..

Linking Data

REQUIREMENTS

ID	Div. No.	Div. Name	Text
10	055000	Metal…	Fo…
12	055000	Metal…	Ma…
13	055000	Metal…	Wa…
14	055000	Metal…	Ca…

OBJECTS

ID	Name	Height	Description
1	36" Bollard	36"	Metal bollard with..
2	Stop Sign	10'	Traffic control sig…
3	48" Bollard	48"	Metal bollard with..
4	VAV Box	24"	300 CFM VAV wit..

SPACE

ID	No.	Name
1	036C	Loading Dock
2	1102	Office
3	1001	Warehouse
4	1105	Break Room
5	037C	Loading Dock

ENTITIES

ID	Comments
1	Some comment
2	Other comment
3	Another comment
4	*null*

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Linking Data

REQUIREMENTS

ID	Div. No.	Div. Name	Text

Narrative Description
of Performance

OBJECTS

ID	Name	Height	Description

Definition of different 'things'

INSTANCES OF OBJECTS

ID	Physical Plant

Physical (real) 'things'

SPACE

ID	No.	Name

Association to
specific 'places'

ENTITIES

ID	Comments

Specific Occurrences
of 'things'.

ROOMS

ID	No.	Name

INSTANCES

ID

3D Modeling

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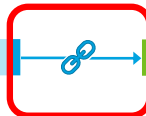
20

Linking Data

REQUIREMENTS

ID	Div. No.	Div. Name	Text

Narrative Description of Performance

OBJECTS

ID	Name	Height	Description

Definition of different 'things'

INSTANCES OF OBJECTS

ID	Physical Plant

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ID	No.	Name

Association to specific 'places'

ENTITIES

ID	Comments

Specific Occurrences of 'things'.

ROOMS

ID	No.	Name

INSTANCES

ID	3D Modeling

Geometric Representation / Definition

Is this a Digital Twin?

REQUIREMENTS

ID	Div. No.	Div. Name	Text

Narrative Description
of Performance

OBJECTS

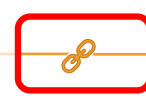| ID	Name	Height	Description

Definition of different 'things'

INSTANCES OF OBJECTS

ID	Physical Plant

Physical (real) 'things'

SPACE

ID	No.	Name

Association to
specific 'places'

ENTITIES

ID	Comments

Specific Occurrences
of 'things'.

ROOMS

ID	No.	Name

INSTANCES

ID

3D Modeling

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Geometric Representation / Definition

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Connecting the Dots

Drawing straight lines from A -> B -> C

Man in the Middle

Source Catalog

ID	Name	Price	...
99	Name of Obj.	$100.00	...

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Man in the Middle

**Source
Catalog**

*❝ What 'we' want and
how much of it.*
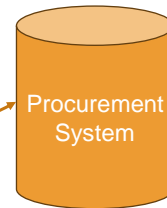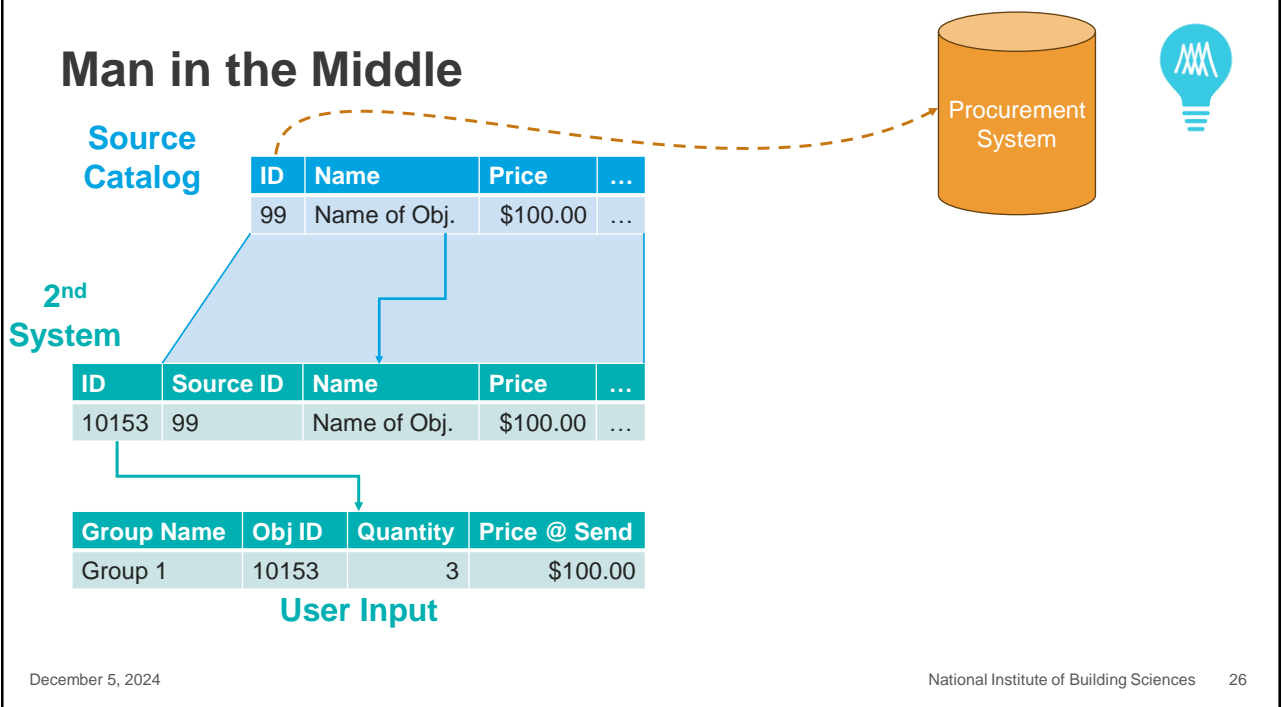
Procurement
System

ID	Name	Price	…
99	Name of Obj.	$100.00	…

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Man in the Middle

Source Catalog

ID	Name	Price	…
99	Name of Obj.	$100.00	…

2nd System

ID	Source ID	Name	Price	…
10153	99	Name of Obj.	$100.00	…

Group Name	Obj ID	Quantity	Price @ Send
Group 1	10153	3	$100.00

User Input

Procurement System

Man in the Middle

Source Catalog

ID	Name	Price	…
99	Name of Obj.	$100.00	…

2nd System

ID	Source ID	Name	Price	…
10153	99	Name of Obj.	$100.00	…

Group Name	Obj ID	Quantity	Price @ Send
Group 1	10153	3	$100.00

User Input

Procurement System

easy

"groupName": "Group 1",
"groupContents": ["10153", "10254"],
"objects":{
  "10153": {
    "Source ID": 99,
    "Quantity": 3,
    "Price": 100.00
  },
  "10254":{
    "Source ID": 235,
    "Quantity": 2,
    "Price": 55.50
  }
 }
}

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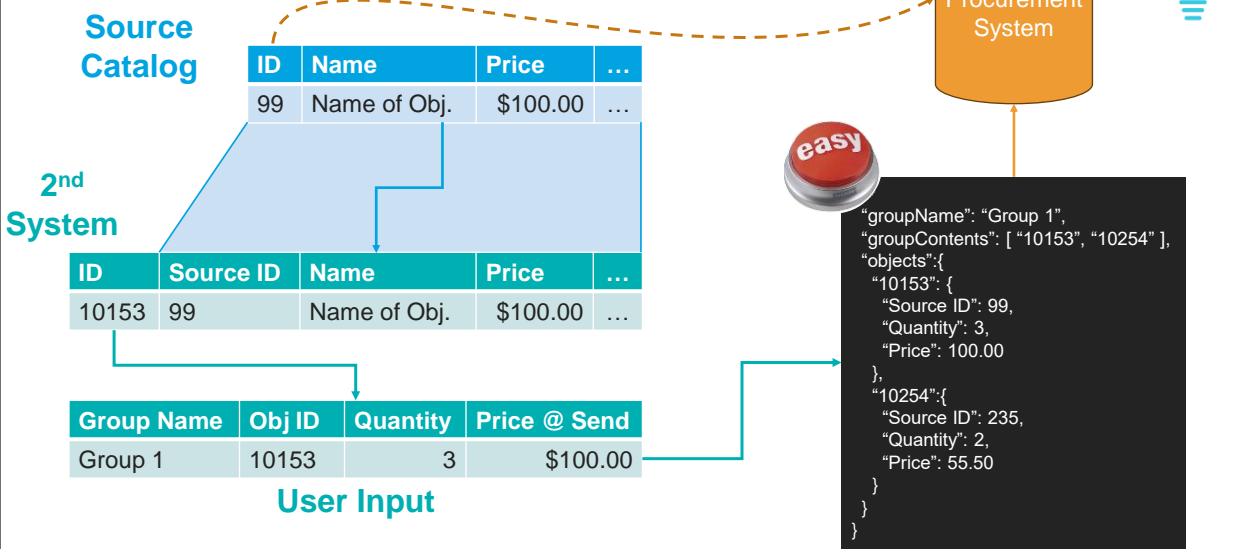
Building an infrastructure

Thinking about how the puzzle pieces connect.

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Connect Two Systems

- Customer has two databases.

- Both with definitions of Rooms

- Each authoritative sources of some data.

- **Automate updating of data.**

Archibus

ID	Bldg. Code	Floor Code	Room Code	[data…]
1	**13**	05	**341**	…
2	14	06	103	…

Bldg.Room = unique value per room
13.**341**
14.103
[…]

Digital Twin Database

ID	Bldg. Code	Floor Code	Room Code	[data…]
143	13	05	341	…
145	14	06	103	…

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Connect Two Systems

- Cannot assume manually entered data is 100% correct.

- With automated processes need to 'handle' exceptions.

- Allow for error correction 'over-time'

Archibus

ID	Bldg. Code	Floor Code	Room Code	[data…]
1	13	05	341	…
2	14	06	103	…

Bldg.Room = unique value per room

13.341
14.103
[…]

Digital Twin Database

ID	Bldg. Code	Floor Code	Room Code	[data…]
143	13	05	341	…
145	14	06	103	…

Manually Entered

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Connect Two Systems

- Cannot assume manually entered data is 100% correct.

- With automated processes need to 'handle' exceptions.

- Allow for error correction 'over-time'

Result of sync process.

DATABASE	PROJECTS
No Databases or Projects were updated.	
---------------	---------------

RESULT	COUNT
Updated Rooms	0
Room Update Errors	0
Matched Archibus	6781
Duplicate Archibus Rooms	735
Rooms with no match	2421
Archibus Rooms with no match	4840
Room duplicate composite ID	11

↩ Reply   ↩ Reply all   → Forward

Address discrepancy

- Isolate exceptions
- Alert 'data owners'
- Provide feedback

Result of sync process.

—	—
DATABASE	PROJECTS
No Databases or Projects were updated.	
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Archibus Rooms with no match	4840
Room duplicate composite ID	11

↩ Reply   ↩ Reply all   → Forward

rooms_updated.csv
341 bytes

only_rooms.csv
907 KB

rooms_errors.csv
337 bytes

dupe_rooms_in_archibus.csv
89 KB

duplicate_composite_id.csv
9 KB

archibus_rooms_no_match.csv
425 KB

Other Considerations

- Minimize the amount of data being updated.

- Fallback Strategies

  - Presently using a composite ID

  - Client wants to move towards mapping the actual IDs

- Build Systems

Result of sync process.

	—
DATABASE	PROJECTS
No Databases or Projects were updated.	
----------------	---------------
RESULT	COUNT
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9 KB

archibus_rooms_no_match.csv
425 KB

Conclusions

" *…the truth is most owners don't have their data as organized as everyone thinks they do.*

Build systems that facilitate organizing data.

" *we have good data*

Understand where decision making occurs, facilitate capturing those choices.

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Keep the orchestra in harmony.

Identify your goal.
- What is the outcome you're looking for?
- What questions do want to answer?

Identify data sources.
- Where does the data come from?
- Ensure that critical data is captured.

Identify human input.
- Where in the chain do humans have input?
- How is it captured?