

# Data Fusion of Infrastructure Condition with Project Planning, Prioritization, Execution

Leveraging an integrated data warehouse

Yousseff Abed, Arnika Chidambaram, Alan Deng,  
Stephanie Greco, Wai Lun Kwok, Renelda Lechner-Strand,  
Mazie Mauricio, Ann McConnell, Lauren Morita,  
Angel Rodas-Feng, Cebastian Santiago, Cliff Shang

August 8, 2023

**OFFICIAL USE ONLY**

May be exempt from public release under the Freedom of Information Act (5 U.S.C 552), exemption and category:  
Exemption 7 – Law Enforcement  
Department of Energy review required before public release  
Date: 3/20/2023  
Name.org: Cliff Shang/WCI  
Guidance: N/A

# BLUF

The art of infrastructure project planning presents a unique set of challenges for data fusion. Integrating site Computerized Maintenance Management System (CMMS) and supporting unique and evolving prioritization rules while developing justification for budget are just a few of the circumstances that face a modern enterprise when it comes to project planning, prioritization, and execution. How does a site level enterprise leverage BUILDER information to support infrastructure planning and execution projects?

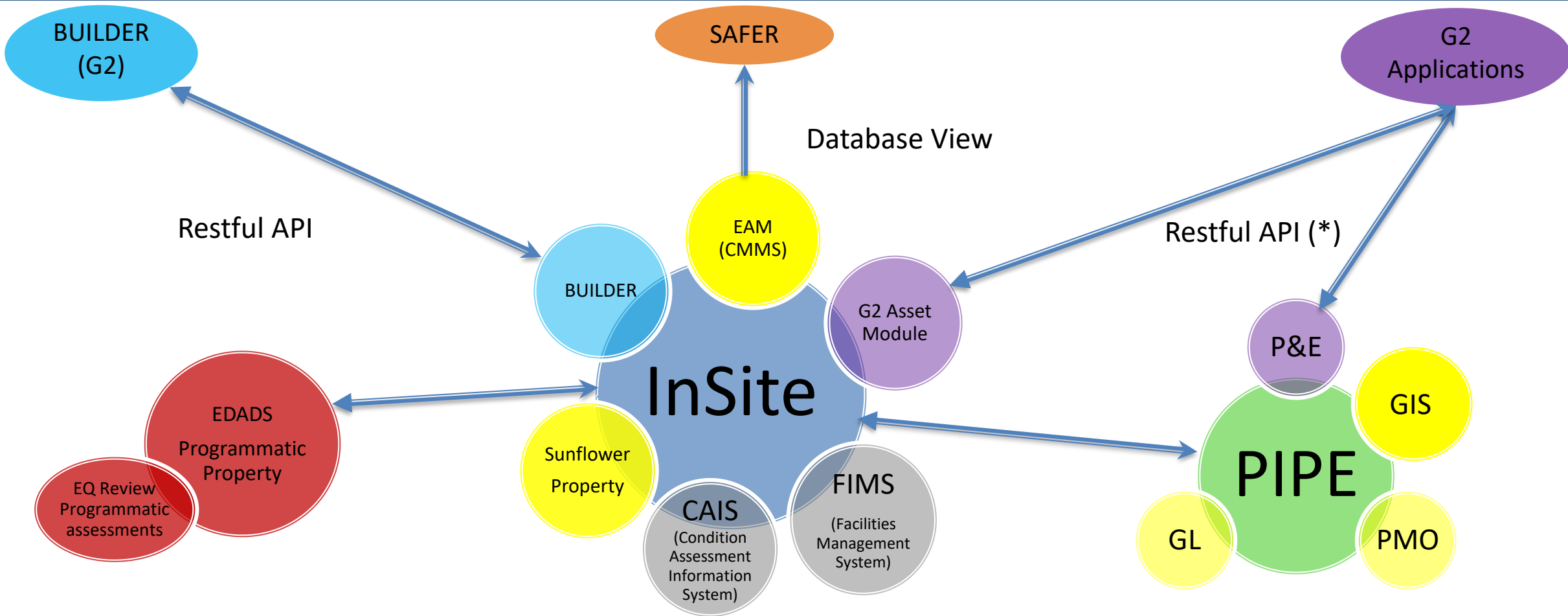
**InSite and PIPE work together to realize a computerized decision-making system that links condition with project prioritization**

# Why data fusion?

- Improve data-driven enterprise decision-making
- Improved data integrity/fidelity
- Support for a rigorous validation and verification process with known validated data pedigree data
- Provides a rich common analytic data source
- Improved source history functionality
- Insulates enterprise from application lifecycle changes
- Provides a scalable environment to accommodate rapidly evolving data sources and frameworks

Integration is a quest for pristine data

# Livermore enterprise infrastructure data overview



Many authoritative sources, one repository

# Data fusion across authoritative infrastructure data

---



# InSite integrates CMMS inspection and computed BUILDER condition data for improved decision making

- LLNL's InSite application provides an integrated bridge between LLNL's inventory assets and condition data (CMMS) with the NNSA BUILDER application through the interaction with DIGON's SPIRE Application Program Interface (API)
- InSite insulates LLNL's CMMS solution from changes in G2/BUILDER and insulates BUILDER from changes in LLNL's CMMS solution
  - InSite is not affected by changes to CMMS or G2 BUILDER
- InSite leverages LLNL infrastructure data to facilitate complex modeling using a graphical interface
- InSite allows LLNL to validate, verify, and translate asset inventory and inspection data for introduction to the BUILDER application

InSite data Warehouse provides a centralized data repository for infrastructure data

# InSite Authoritative Source Inventory (computerized decision-making system)

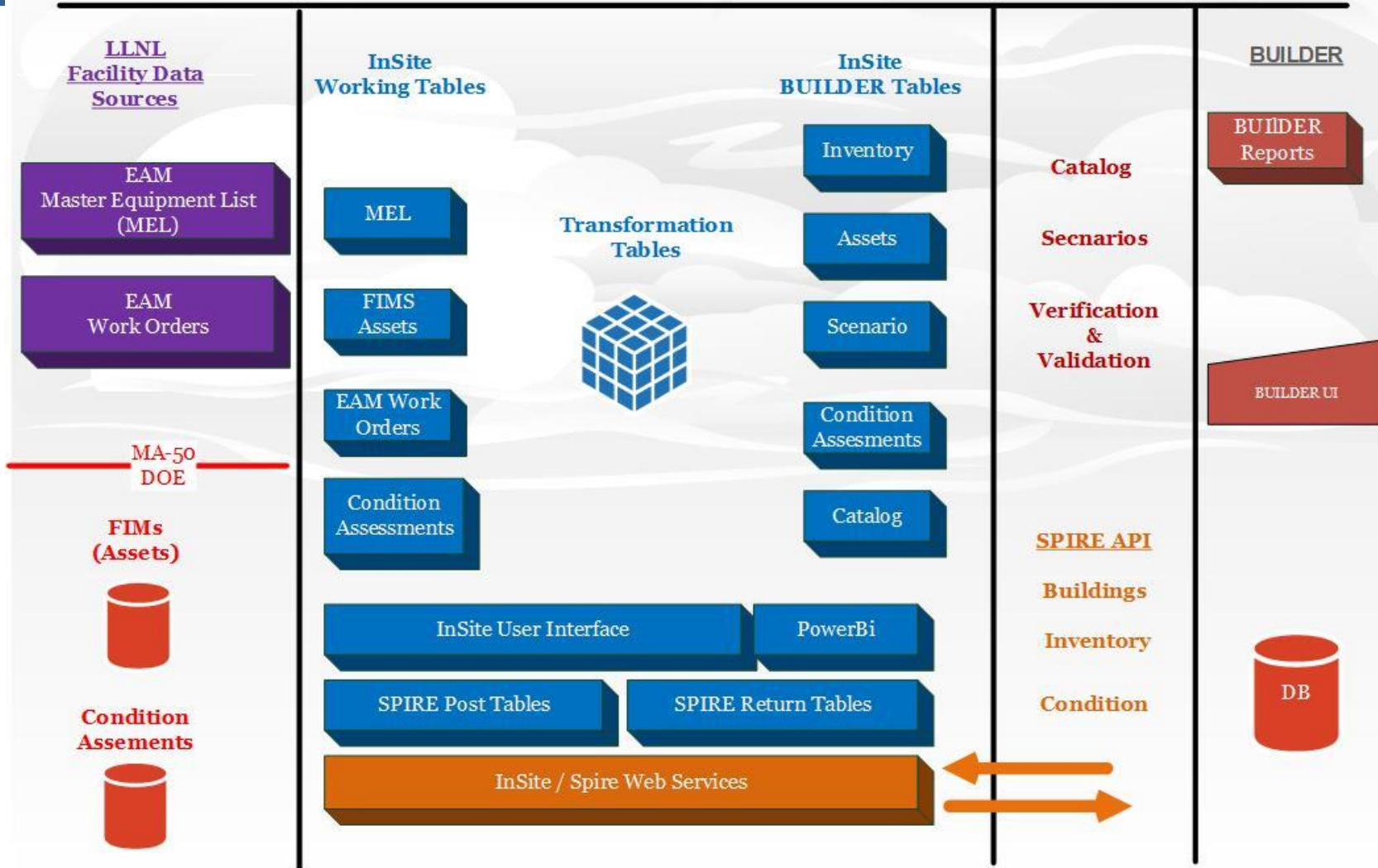
- **BUILDER (G2) (2 way)**
  - Assets
  - Inventory
  - Condition
  - Section data
  - Functionality \*\*
- **Condition Assessment Information System (CAIS)**
  - Inspection deficiency data (MA-50 view)
- **Facility Information Management System (FIMS)**
  - FIMS data through (MA-50 view)
- **InSite**
  - CMMS Transformations
  - BUILDER History (since 2018)
  - Processing history
  - Master Equipment List (MEL)
  - Asset extension table
  - EAM Assets
  - EAM Inspections(heartbeats)
  - EAM Work Orders
  - EAM ranking
  - Reporting Views
  - SAFER View
- **EDADS (PRWG Inventory) \***
  - Programmatic equipment condition
- **PIPE (G2) (2 way)\*\***
  - G2
    - Planning
    - Execution
    - Budget
    - Asset Module
  - Project Management Office Data (PMO)\*
  - General Ledger
  - Site Development Plan
  - Prioritization
  - Survey
  - Pre-FIMS

\* Requires manual data entry  
\*\* Possible Future

InSite relates equipment and building condition directly to projects and overall portfolio prioritization

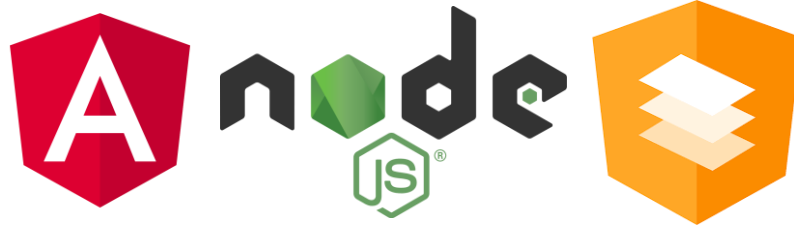


# Inventory Nexus Strategic Infrastructure Technology Enterprise



# InSite/PIPE technology stack is based on common industry standard frameworks

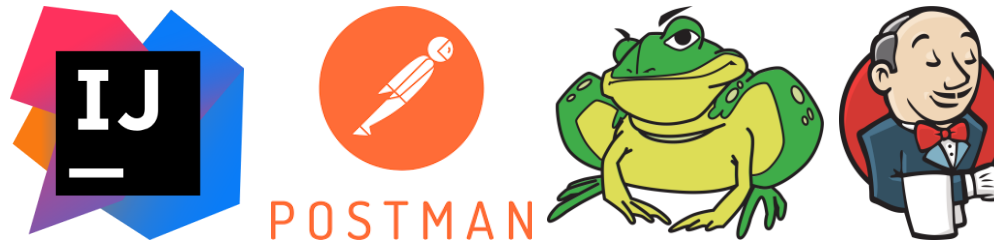
Front-End



Back-End



IDE/other



# DIGON/SPIRE Application Program Interface (API) enables communication between authoritative databases

Sync Processing Feature

- BUILDER Building
- BUILDER Inventory
- BUILDER Inventory Section
- BUILDER Condition

## ▪ SPIRE BUILDING

- Update
- Create
- Delete

## ▪ SPIRE Inventory

- Update
- Create
- Delete

## ▪ SPIRE Inventory Section

- Update (standard & replace)
- Create
- Delete

## ▪ SPIRE Condition

- Update
- Create
- Delete

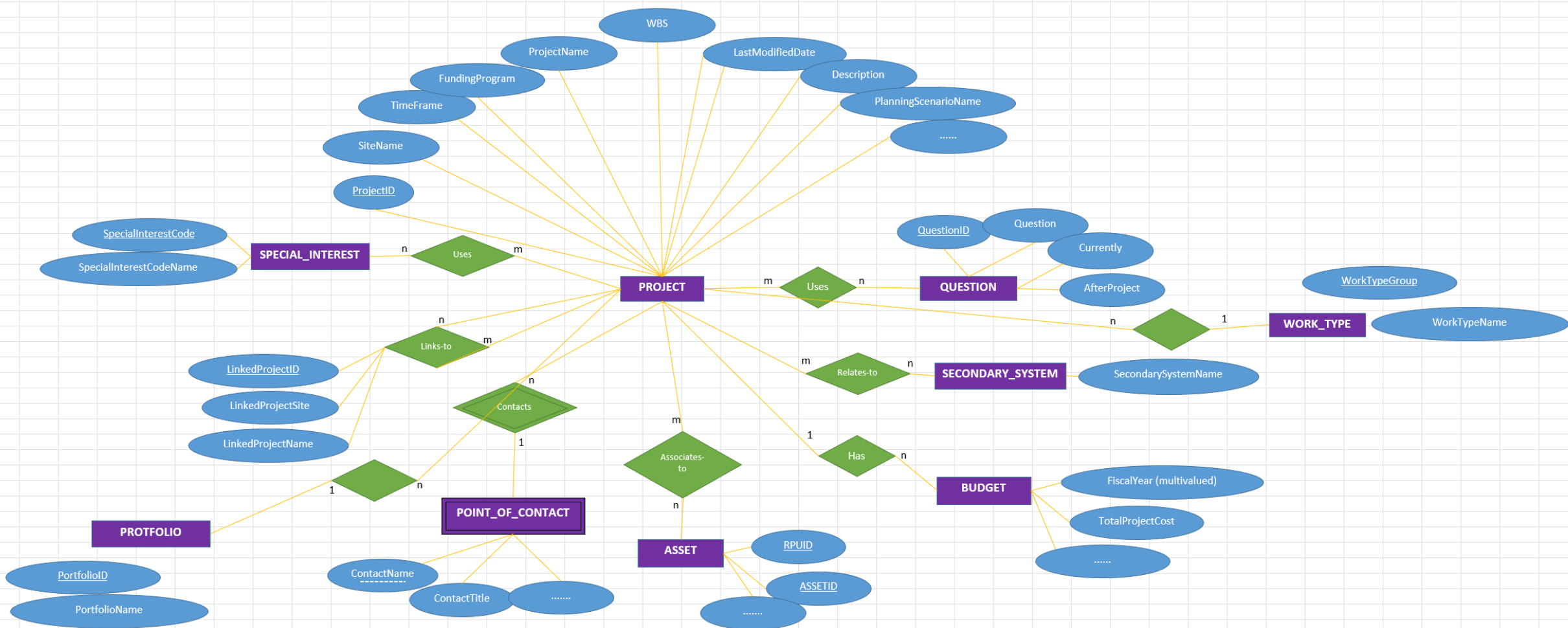
Each end-point has  
Post & Return tables  
that store the transaction

# Project Infrastructure Planning & Execution (PIPE)

Project Infrastructure Planning & Execution (PIPE) is the critical link between condition data/risk and project/portfolio/ prioritized

**PIPE**  
**PLAN • EXECUTE • DELIVER**

# PIPE relational data model spans the entire NNSA G2 project and portfolio planning data sets



# PIPE G2 Application Program Interface (API) supports the project planning, execution and asset module objects

## ■ Project Planning Objects

- Projects
- Project Details
- Portfolios
- Budget Details
- Linked Projects
- Contacts
- Questionnaires
- Scores
- Schedules
- Related Assets
- Capabilities

## Project Execution Objects

- Milestones
- Tasks
- Budget
- Schedule performance

## Asset Module Objects

- Asset Data
- Capabilities
- Dependencies
- ERI
- Assets to projects
- ECFWG

PIPE preserves and manages the inter relationship between a complex set of objects

# PIPE can customize and tailor interpretation of functionality based on unique “User Islands”

**PIPE**  
PLAN • EXECUTE • DELIVER

Yousseff Abed

Welcome, Yousseff Abed

**Dashboard**

**Recently Visited**

- Site Development Plan
  - SDP Home Page
  - Pre-Fims/Fims
  - Site Development Plan Survey
  - LLNL GIS

**Bookmarked**

- G2**
  - Reconciliation
  - G2 API
- Indirect**
  - Project Priorities
  - Indirect Survey
  - PMO Information
  - Indirect Reconciliation

Task/Project Deadline this month

  - STAR - New Environmental Safety & Health Office Bu...
  - Task: Project Closeout (2023-07-10)
- Direct**
  - Direct Reporting
  - Direct Survey

**Search All Projects**

Project Id	Project Name	Portfolio Name	Work Type Group
138	B151 Lab Refurbishment Rooms: 1318, 1322, 1326, 2109		
216	B131 High Bay HVAC Replacement		
85	(Angel)B142 Upgrade for Classified Office Space		
126	(Angel)B322 Plating Shop Utility & Safety Systems Renovation		
127	New Nondestructive Evaluation Building Replacement: New Construction		
129	B805 Classified Machine Shop Renovation		
128	Site 200 and 300 Site-wide Mechanical Utility Valves and Water Distribution Piping Replacement		
130	Site 300 Firing Site Support Systems Upgrade		
131	Electrical Utility SCADA Modernization		
133	(ANGEL)B331, B332 and B334 Electrical System Renovation		
135	HEAF Fume Hood Exhaust (FHE) Ventilation System Replacement		Recapitalization
136	B298 HED Physics Precision Target Micro Machining Refurbishment		
137	U291 Cooling Tower Upgrade		
384	N453 Mission Critical Chiller Replacement Project: B453		
386	U325 Cooling Tower Replacements CT06,07		
387	B331 INC 2 Mission Critical HVAC Ducting		
425	Bldg 321C Precision Machining Facilities upgrade		
428	321C EDM Shop & Machine Shops Revitalization		
429	Site 300 Road Upgrade		
433	B391 2 HVAC Chiller Replacements		
445	851 Outdoor Firing Facility Revitalization and Diagnostics		
446	Bldg 321 Chiller Reliability and Safety Exhaust System Redundancy Revitalization		
457	Bldg 132N Complex Revitalization		

**Actions**  
DATA DISPLAYED IS DEVELOPMENT TEST DATA

- Angel Rodas Feng reconciled G2\_INFRASTRUCTURE\_PLANNING\_PROJECTS on 03/05/2023:12:16
- Brian McClelland published Project 354 to PMO on 03/07/2023:09:16
- Brian McClelland updated Project 7099 prioritization on 04/07/2023:15:33
- Angel Rodas Feng deleted Project 354 on 05/01/2023:12:16
- Angel Rodas Feng updated Project 2121 core on 05/02/2023:18:17
- Alan Yang Deng updated Project 2222 assets on 05/03/2023:12:14

**Announcements**  
last updated: NaN

In development...

**Deadlines**  
last updated: NaN

In development...

# Examples of PIPE “User Islands”

Direct Budget Process



Site Development Plan



Indirect Budget Process



G2 Integration

# Conclusion

Using a central integrated infrastructure data warehouse to organize infrastructure information while automating your workflow by using a highly configurable Project Infrastructure Planning and Execution (PIPE) application to drive decision-making process can better position site enterprise investments to be realized.

This approach leads to investment decisions that are based on data driven integrated infrastructure knowledge rather than a notional understanding of needs.

Leveraging BUILDER information throughout the project planning phase allows the organization to make decisions based on assessments and BUILDER output. Add the creation of an open application architecture that interacts with various data sources such as Project Management Office (PMO), General Ledger (GL), Property, CMMS, BUILDER, Facilities Management System (FIMS), Condition Assessment Information System (CAIS), G2 Asset Module, G2 project Planning and Execution module, Site Development Plan, Geographic Information System (GIS) increases your chances of a well-planned and transparent data driven infrastructure project.

Creating this fused data infrastructure environment paves the way for a highly effective, realistic decision-making environment that can be used to drive infrastructure investments as well as provide sound project justification.



**Disclaimer**

This document was prepared as an account of work sponsored by an agency of the United States government. Neither the United States government nor Lawrence Livermore National Security, LLC, nor any of their employees makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or Lawrence Livermore National Security, LLC. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or Lawrence Livermore National Security, LLC, and shall not be used for advertising or product endorsement purposes.

# Abstract

## Problem Statement (50 words or less):

The art of infrastructure project planning presents a unique set of challenges for data fusion. Integrating site Computerized Maintenance Management System (CMMS) and supporting unique and evolving prioritization rules while developing justification for budget are just a few of the circumstances that face a modern enterprise when it comes to project planning and execution. How does a site level enterprise leverage BUILDER information to support infrastructure planning and execution projects?

## Approach, Results, Conclusions (500 words or less):

Using a central integrated infrastructure data warehouse to organize infrastructure information while automating your workflow by using a highly configurable Project Infrastructure Planning and Execution (PIPE) application to drive decision-making process can better position site enterprise investments to be realized. This approach leads to investment decisions that are based on data driven integrated infrastructure knowledge rather than a notional understanding of needs. Leveraging BUILDER information throughout the project planning phase allows the organization to make decisions based on assessments and BUILDER output. Add the creation of an open application architecture that interacts with various data sources such as Project Management Office (PMO), General Ledger (GL), Property, CMMS, BUILDER, Facilities Management System (FIMS), Condition Assessment Information System (CAIS), G2 Asset Module, G2 project Planning and Execution module, Site Development Plan, Geographic Information System (GIS) increases your chances of a well-planned and transparent data driven infrastructure project. Creating this fused data infrastructure environment paves the way for a highly effective, realistic decision-making environment that can be used to drive infrastructure investments as well as provide sound project justification.

**InSite is LLNL's centralized data warehouse drives infrastructure decisions**