IV&V Program

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Introduction to the Analysis and Management Framework

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Agenda

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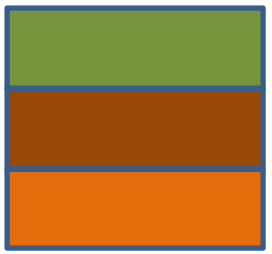
- Problem Space
- The NASA IV&V AMF
- N-Tier Architectures
- Domain Modeling



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Problem Space

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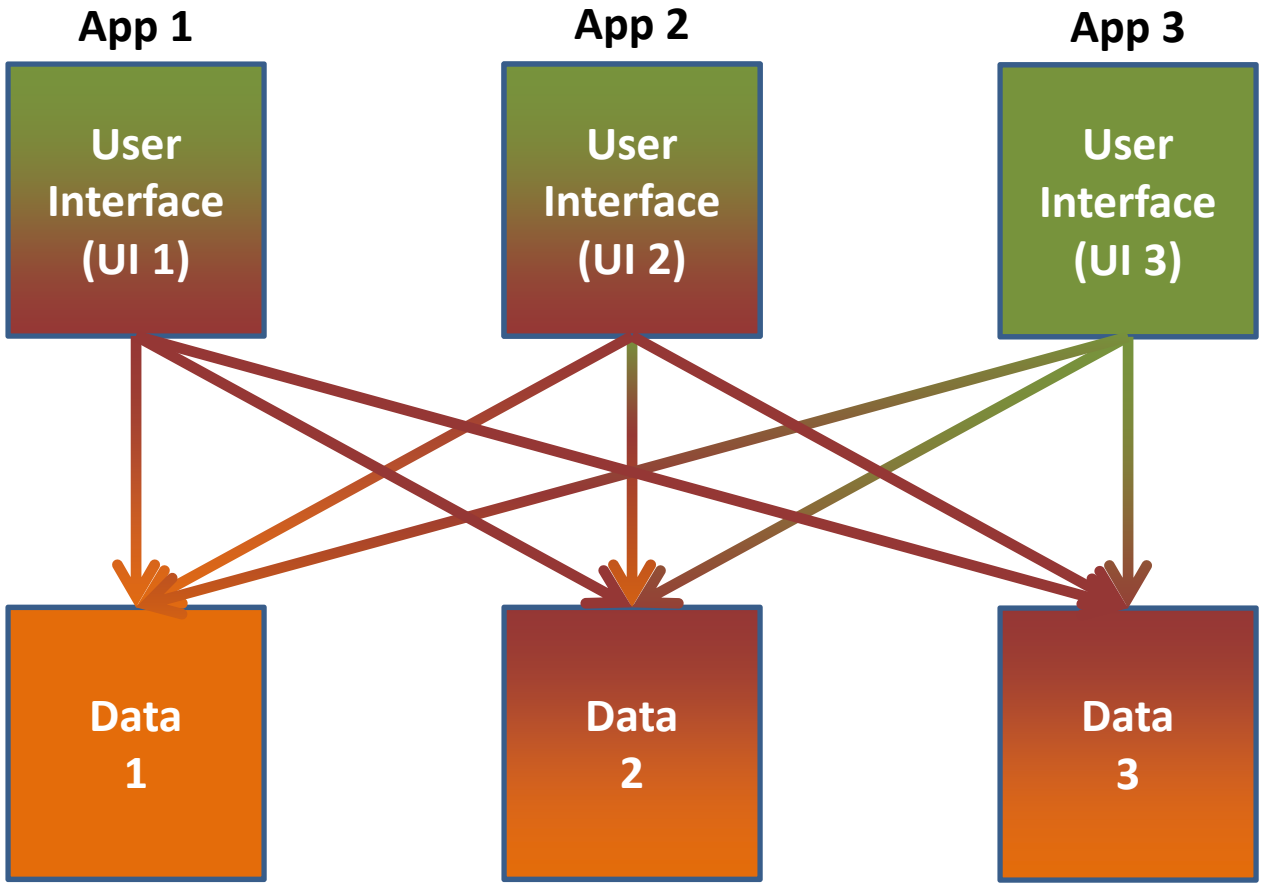
These apps found themselves all being used by the same organization with a different purpose and use.



These apps wanted to share data, it was available, convenient and provided more powerful results.

Some connections required some degree of customization…
Some required more customization…
Some required much more customization.

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Problem Space

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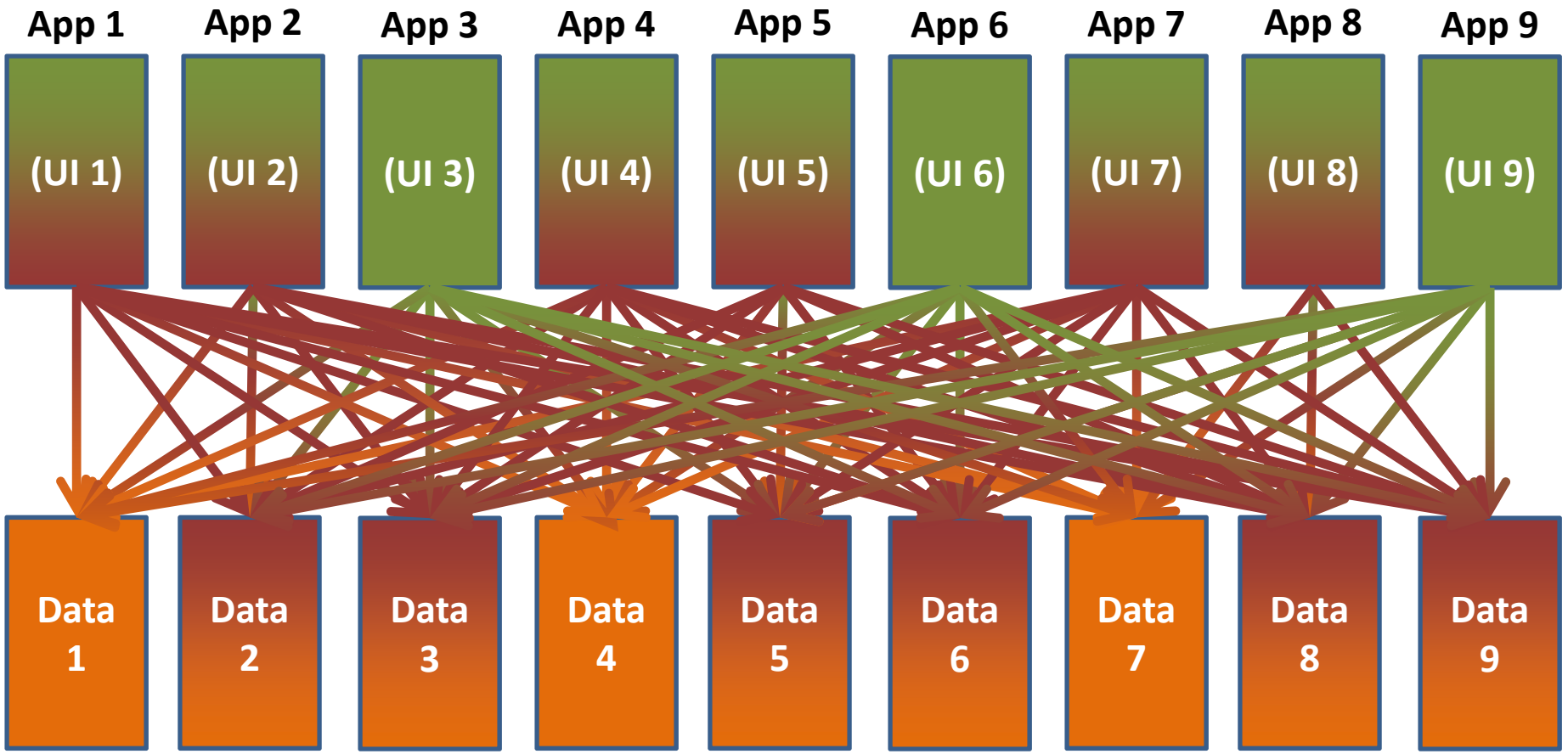
This went on for a while…



… it got ugly
… very ugly

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NASA IV&V Solution - AMF

Concept

Provide a program wide evidence based assurance capability taking advantage of the three-layered analysis framework (data, business & user interface) utilized by MSL and SMAP and implemented in the Analyst Workbench applying best practices of information system development.

AMF Goals

The AMF provides a framework for organizing and communicating IV&V assurance data. The AMF will leverage existing IV&V tools and resources to develop IV&V Program concepts and definitions of evidence; create methods for refining IV&V assurance data into information and assurance statements; and provide a common set of process assets, Catalog of Methods inputs, and educational materials.

AMF Objective

- To create a domain model to standardize the representation of artifact analysis. This model will be implemented in software class libraries in order to facilitate rapid development of tools to assist in improving both internal and external communication of IV&V's software assurances.

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- N-Tier Architectures
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N-Tier Architectures

- An industry standard solution to this problem
- Logically separates presentation, processing and data management functions (layers / tiers)
- Three tier architectures are the most common multi-tier architecture
- The logical structure often referred to as layers, while implementation uses tiers to identify the physical structure
- 1000's of implementations

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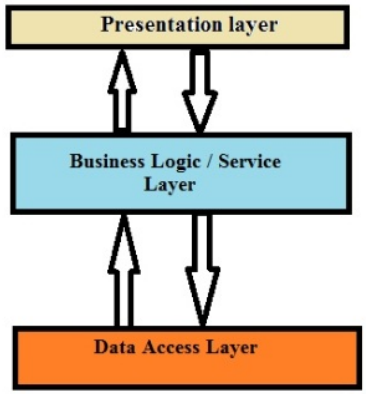
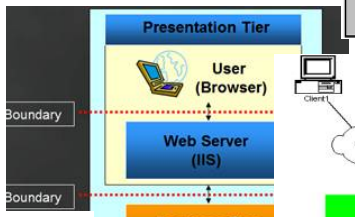
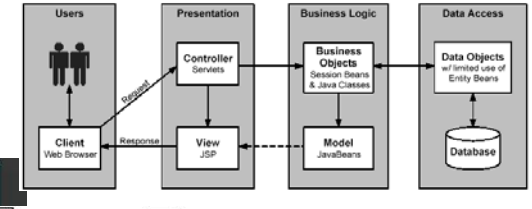
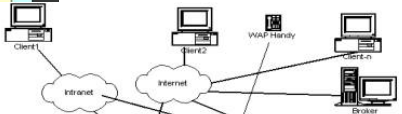
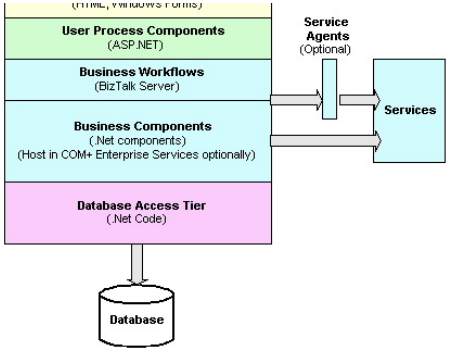
N-Tier Architectures

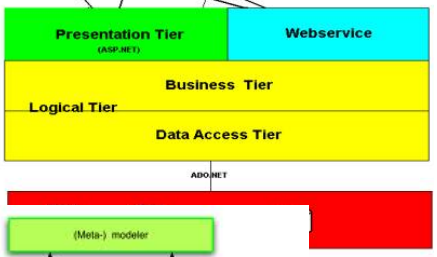


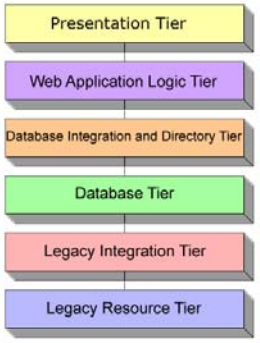


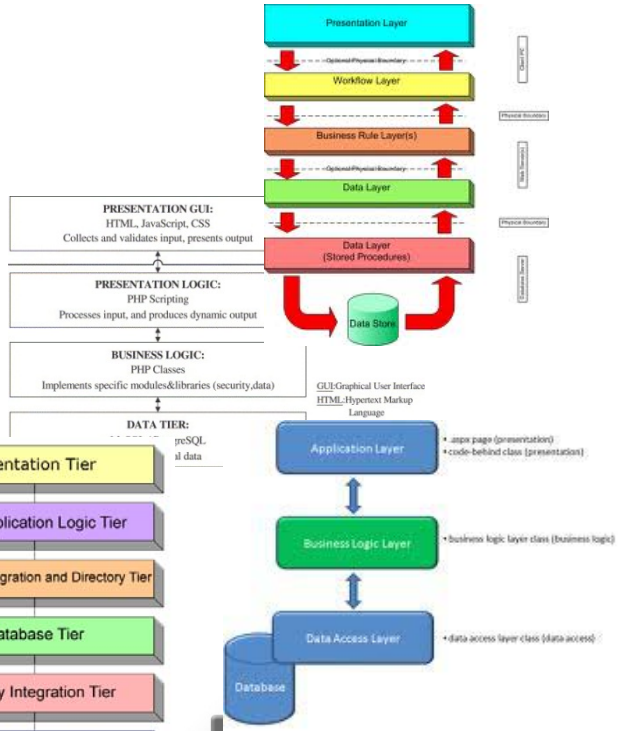


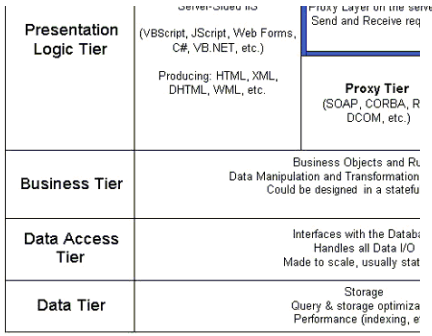


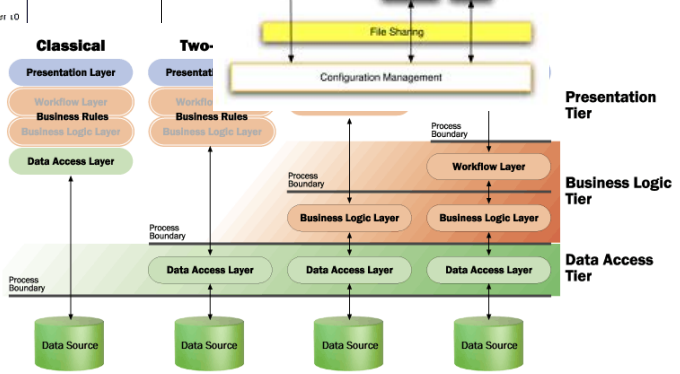


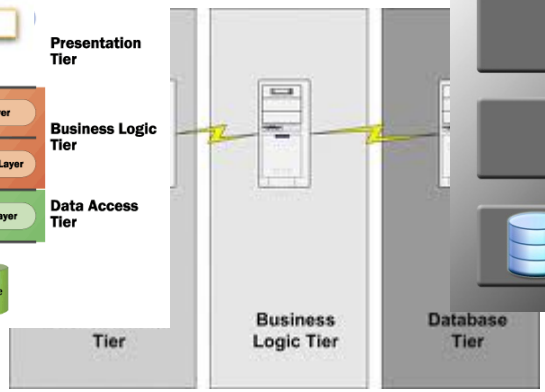


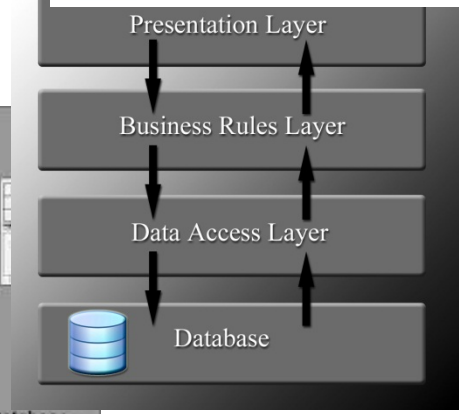












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N-Tier Applied to Problem Space

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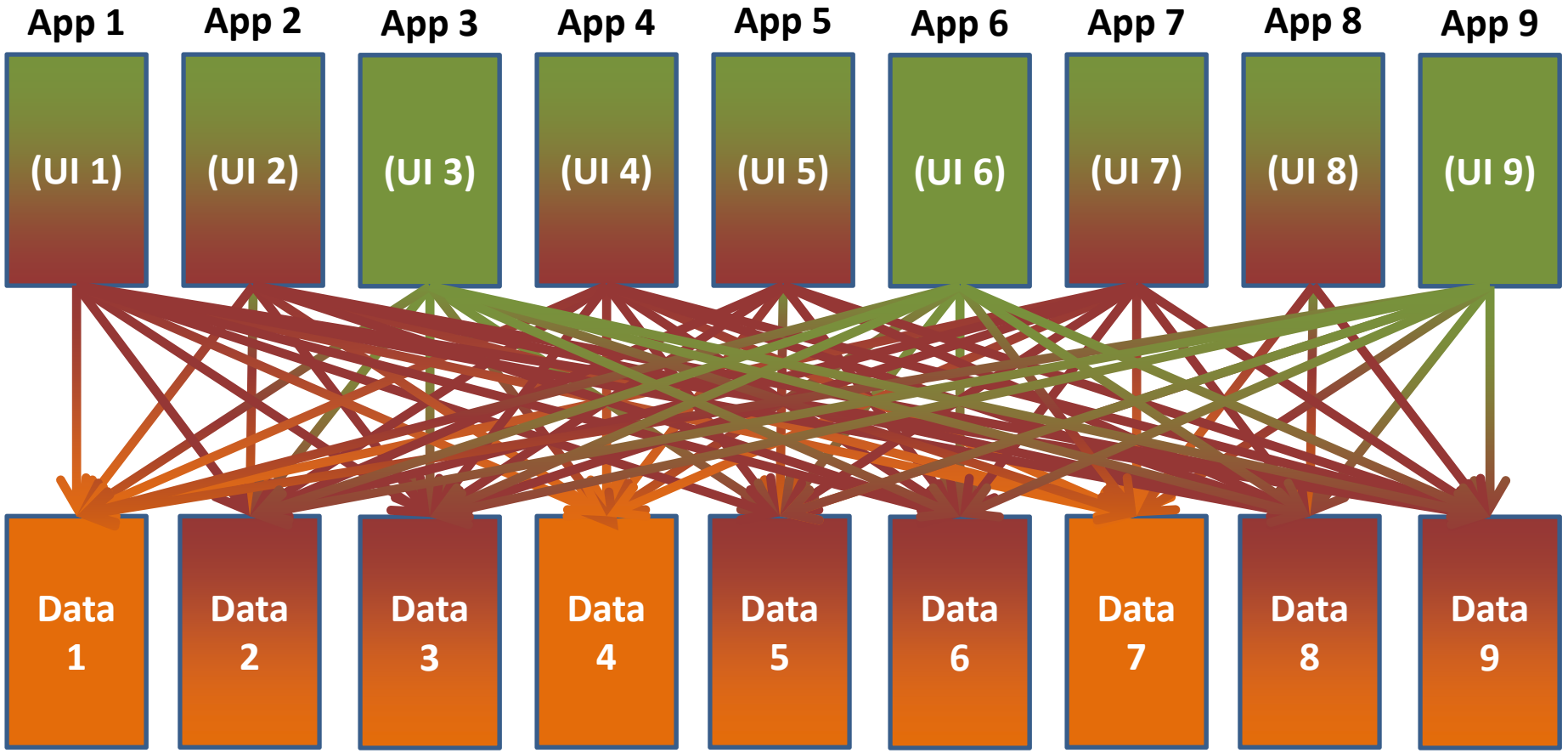

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The Business Layer is the Activities of IV&V

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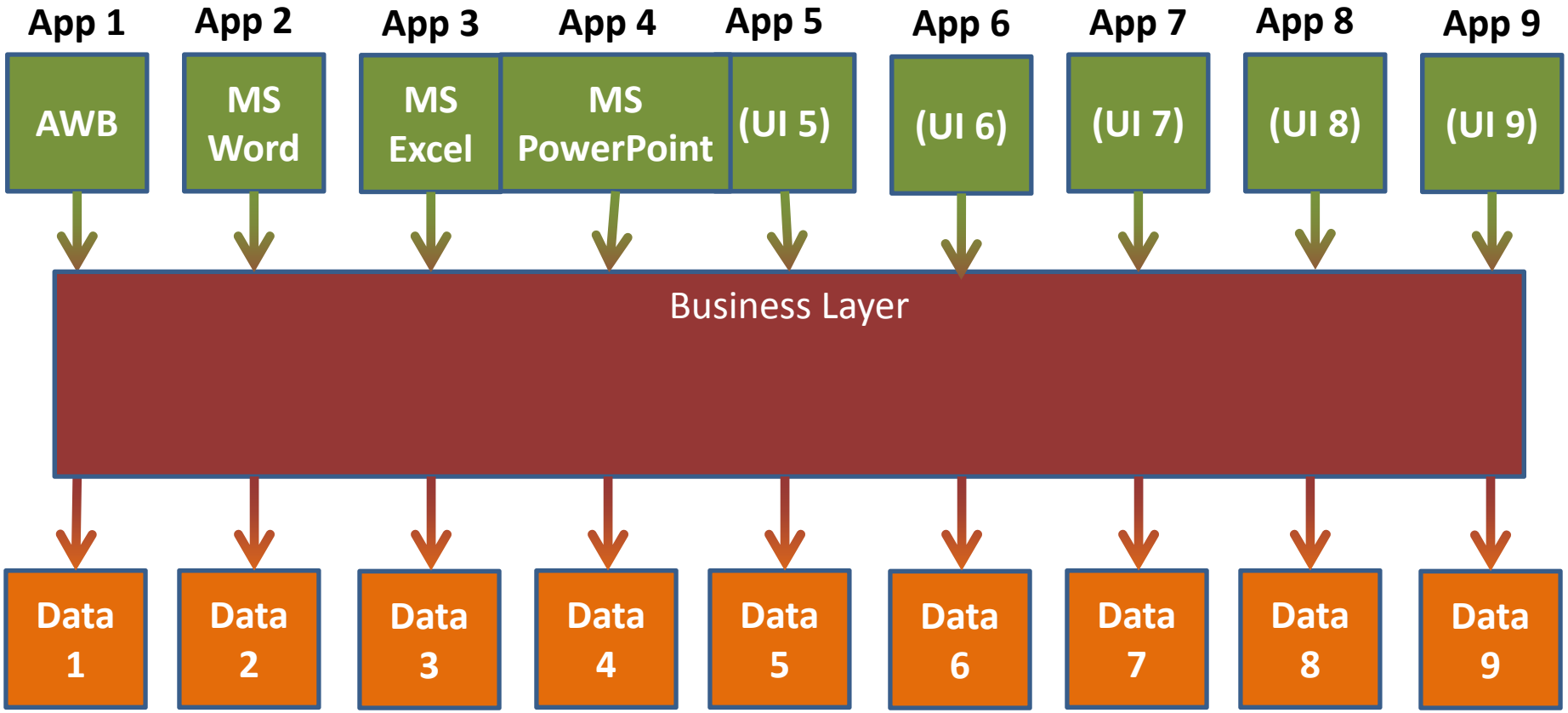

… a lot fewer interfaces

… a lot fewer types of interface

… promotes reuse

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The AMF Layers

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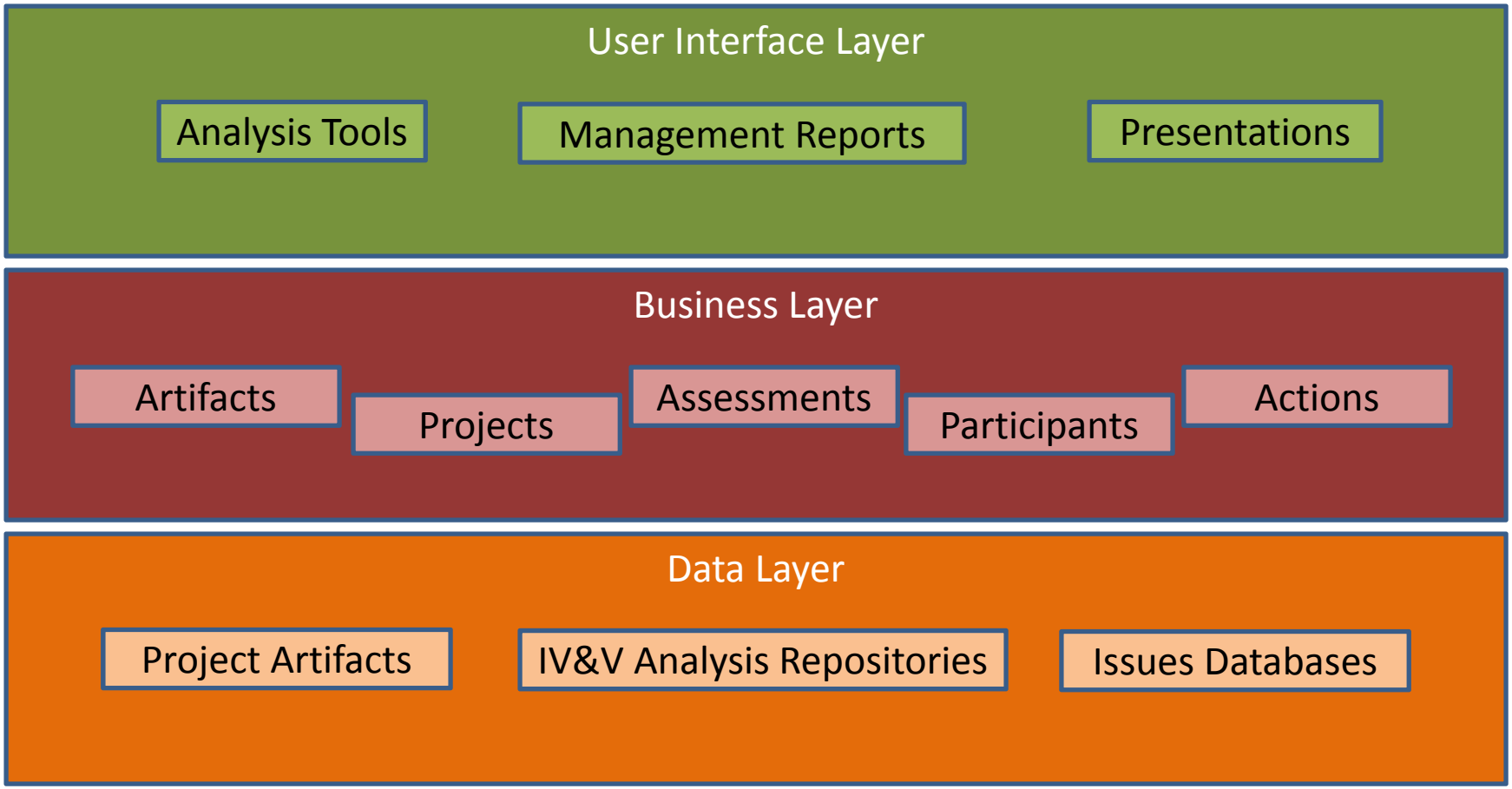

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User Interface Layer

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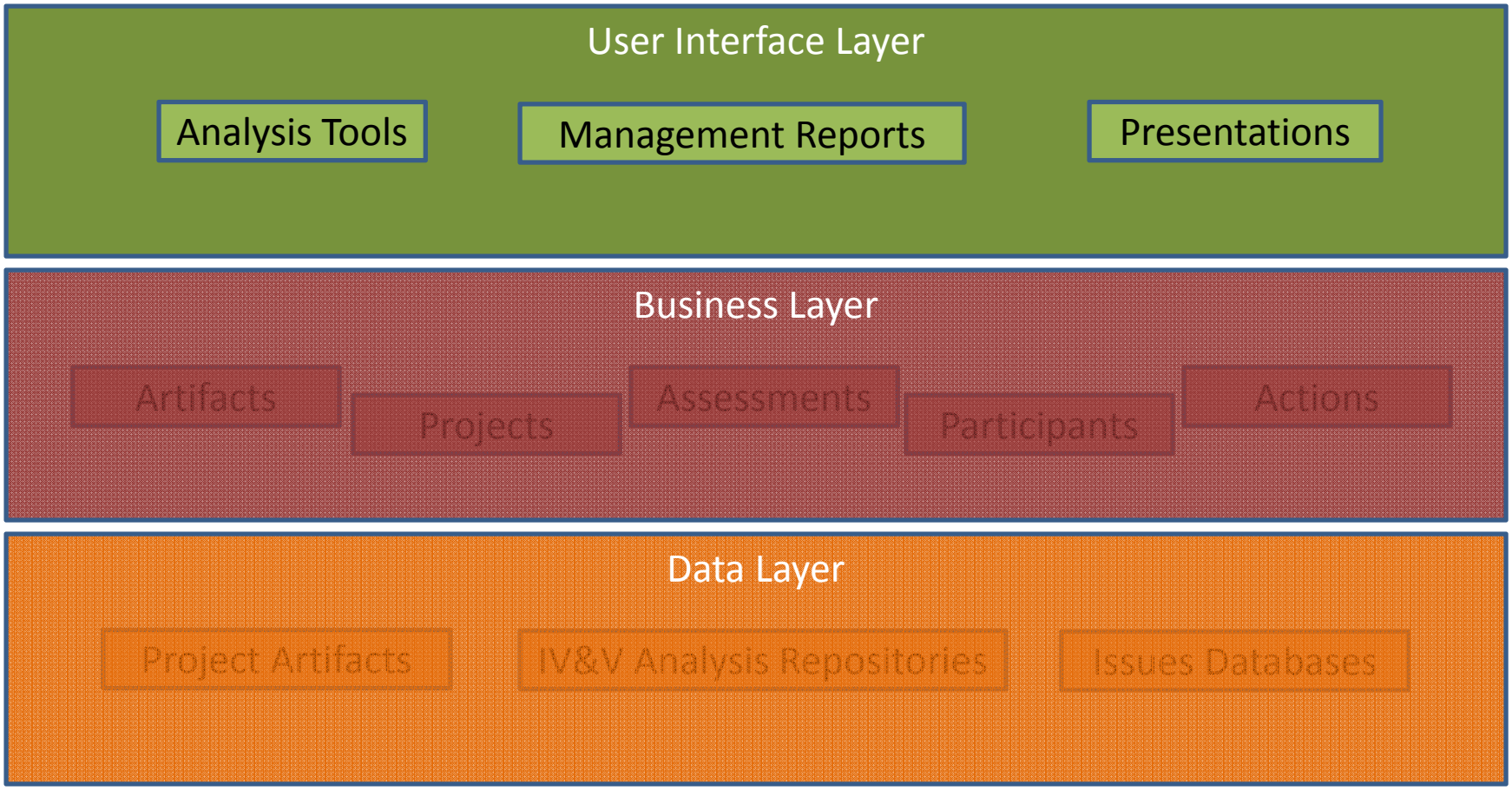

Interfaces IV&V Analysts and Managers interact with to do the job of IV&V.

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User Interface Layer

User Interface Layer

Analysis Tools – any automated or manual product supporting the evaluation of software-intensive systems to ensure safety and risk mitigation. Sample analysis tools: Analyst Workbench (AWB), SMART, ORBIT, DOORS, Excel, etc…

Management Reports - To write a management report you must first analyze the information that you are going to put in the report. You then arrange it so that the numbers can be evaluated easily. Sample management reports: metrics presented in a Word, PDF or Excel file.

Presentations – illustrative materials, such as slides, graphs, etc. delivered as part of a verbal report. Sample presentations: PowerPoint slides or dynamic webpages

In simple terms it's a layer which users can access directly such as a web page, or an operating systems GUI.

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Business Layer

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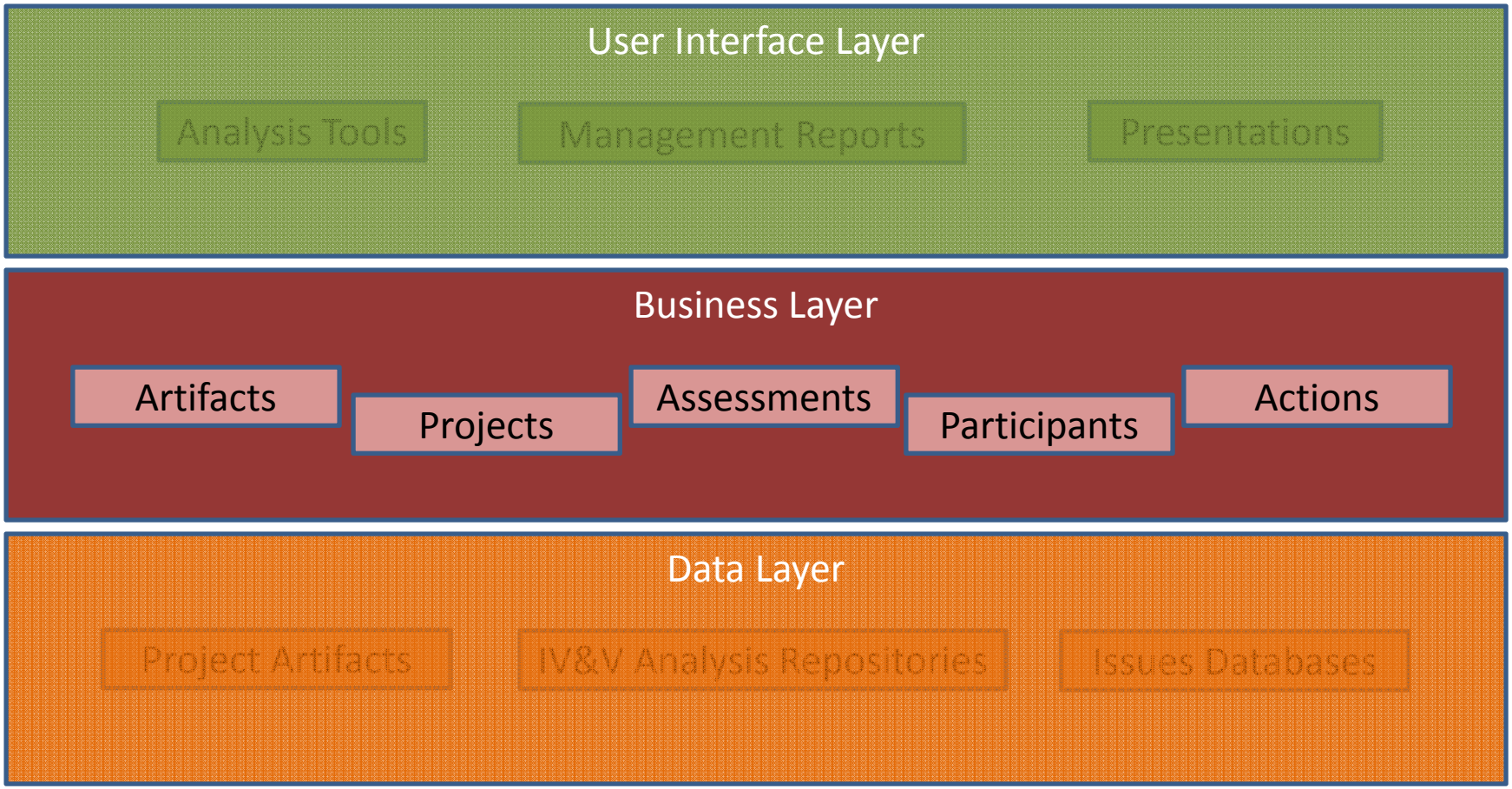

Business Layer objects are typically partitioned into two categories: business process objects (business activities or behaviors) and business entities (real world business objects).

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Business Layer

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Business Layer

Artifacts – Anything examined by an IV&V analyst. Some examples include; a requirement, a DOORS drop, a paragraph in a design document, the design document itself, source code, a block of source code, test case, etc.

Assessments – Anything produced by an IV&V analyst. Some examples include; TIMs, Risks, Review of other analyst's work, Technical Reference, Assurance Case, etc.

Actions – Anything identifying work performed by an IV&V analyst. Some examples include; Process, method (from catalog of methods), tasks, etc.

Projects – NASA development projects (or other development projects) that is the recipient of IV&V technical services as defined in a Formal Agreement. Some examples include; SMAP, MSL, ECTP, etc.

Participants – people or groups involved with the project. Some example include: the person that is the source of an artifact, the analyst working on an assessment, or civil servant managing a project.

Business process objects are typically implemented as controllers, i.e., they contain no data elements and only expose behaviors and activities that represent business processes. Business entities typically correspond to entities in a domain model rather than a database model.

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Some Artifact Types

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ID	NAME	DESCRIPTION
1	GENERIC	This is a default artifact type when the type of the artifact is unknown. Data and behavior that is common to all artifacts are described under the GENERIC artifact type.
2	TOPLEVEL	Artifacts are organized in a tree like hierarchy using artifact traces. To help the user interface layer, the TOPLEVEL artifact tells the UI to start the tree here.
3	MODULE	Artifacts that are planned or delivered representing a set of source code files under version control that can be manipulated together as one.
4	REQUIREMENT	Artifacts describing the agreed upon need, desire, want, capability, capacity, or demand for personnel, equipment, facilities, or other resources or services by specified quantities for specific periods of time or at a specified time expressed as a "shall" statement.
5	DESIGN	Artifacts that plan for Implementation (of Hardware, Software, Systems, Subsystems, User Interfaces, Software Interfaces, Databases, Data Packets, Components, etc.)
6	RELEASE	Milestones planned or delivered for a particular version of a configuration item that is made available for a wider community.
7	DICTIONARY	Artifact that contains a list of codes, terms, keys, etc., and their meanings, used by a computer program or system.
8	DATA_DROP	Used to differentiate between versions of an Artifact
9	DOCUMENT	A general artifact for any written item, such as a book, article, paper, or letter, especially of a factual or informative nature.
10	SECTION	Artifacts that are a distinct part or subdivision of any other artifact.
11	FOLDER	An artifact that mimics the folder structure of a computer system or project.
12	IMPLEMENTATION	Artifacts representing the planned or delivered software components of a system.
13	INTERFACE	Artifacts representing a planned or delivered boundary across which information is passed.
14	STANDARD	Artifacts that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.
15	CAPABILITY	A system provides a capability to satisfy a stated need or objective by combining one or more of the following: processes, hardware, software, facilities, and people. These relationships require that IV&V processes consider interactions among all system elements.
16	SMART_REQUIREMENT_TYPE	The SMART Analyst product uses Requirement Type in various combinations to classify a requirement. Each SMART Requirement Type is represented as an Artifact to allow multiple assignments in the AMF structure.

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Some Assessment Types

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ID	NAME	DESCRIPTION
1	GENERIC	for when the specialization is unknown or undefined
2	SEMANTIC	for assessment of code or other implementation artifact
3	REQUIREMENT	for assessment of a requirement or set of requirements
4	DESIGN	for assessment of design artifacts like FDDs, ICDs etc.
5	TEST	for assessment of test artifacts like plans and procedures
6	RISK	for recording a risk against the development or IV&V project
7	ISSUE	for recording an issue identified by an assessment
8	OBSERVATION	for recording an observation discovered performing an assessment
9	REVIEW	The inspection or examination of an assessment (similar to Res Chrons in ORBIT).
10	COMMENT	General information that supports or refutes an assessment or review of an assessment.
11	TOPLEVEL	Begin navigating assessment data here.

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Some Action Types

ID	NAME	DESCRIPTION
1	GENERIC	A placeholder for actions where the specialization is unknown or undefined.
2	TASK	A unit of work. Used for scheduling and tracking completion.
3	PROCESS	A systematic series of actions directed to some end.
4	METHOD	A procedure, technique, or way of doing something, especially in accordance with a definite plan. Used to capture methods from the catalog of methods.
5	STEP	An act toward some end in the general course of a method.
6	TOPLEVEL	Begin navigation actions here.

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Data Layer

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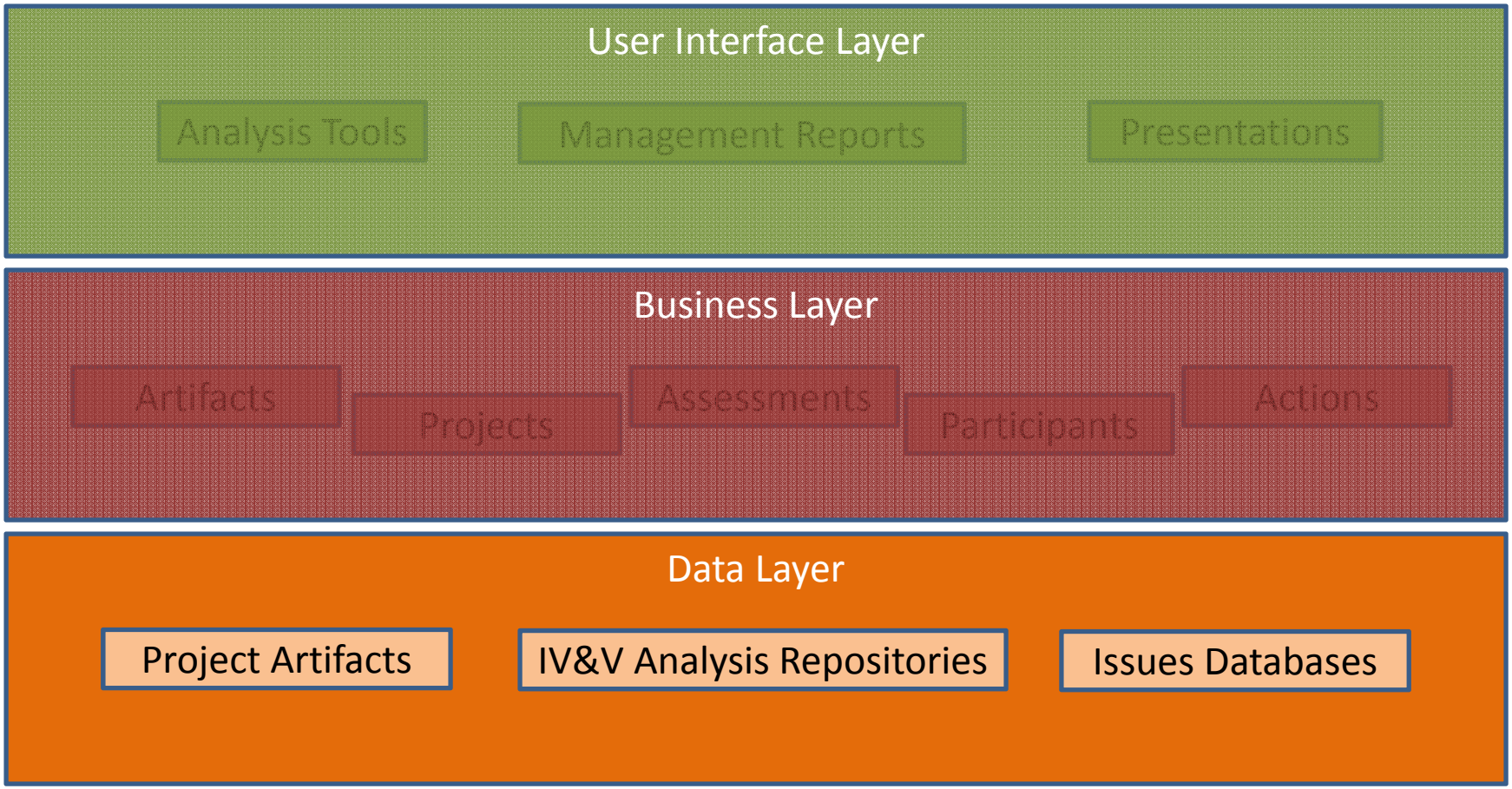

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The Data Layer is where information is stored and retrieved.

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Data Layer

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Data Layer

Project Artifacts – the native format of a deliverable from a project. Some examples include; DOORS drops, confluence documentation, Word Documents, PDFs, Presentations, Code Drops, etc…

IV&V Analysis Repositories – a database utilized by IV&V to store data. Some examples include; SQL Server (AWB & SMART), DOORS, Klockwork, etc.

Issues Databases – IV&V customized database structure to track issues. The example here is; MKS Integrity (ORBIT) – this could be thought of as another IV&V Analysis repository.

Giving data its own layer improves scalability and performance.

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Initial Tier Implementations

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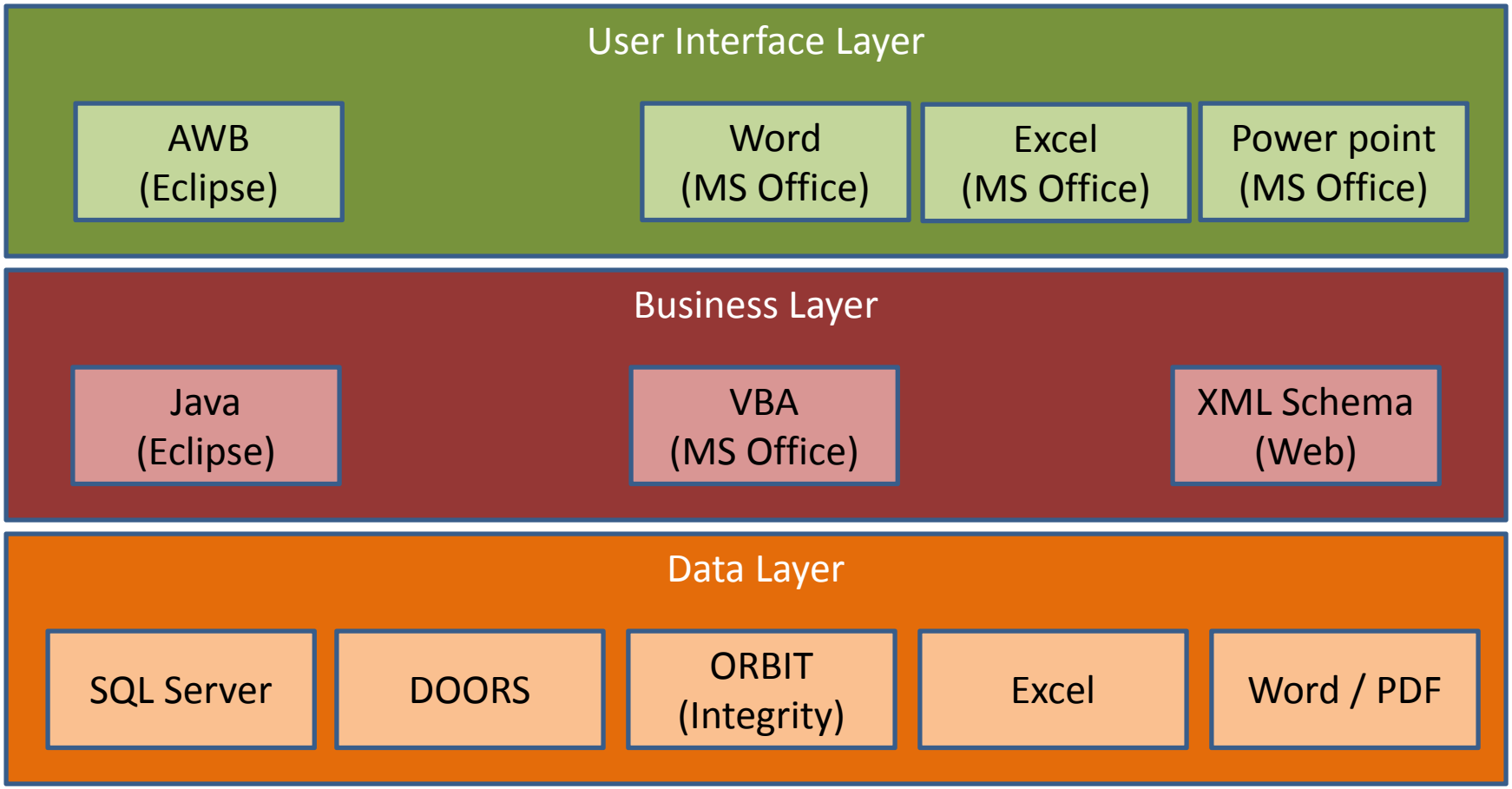

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Additional technologies can be added as needed.

Agenda

- Problem Space
- The NASA IV&V AMF
- N-Tier Architectures
- Domain Modeling

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Domain Modeling

- A domain model in problem solving and software engineering is a conceptual model of all the topics related to a specific problem.
- It describes the various entities, their attributes, roles, and relationships, plus the constraints that govern the problem domain.
- An industry standard practice
- Also referred to as Problem Domain or Domain Layer
- Usually represented via the UML class diagram
- The AMF Business Layer is defined using a domain model

Analyst Use Case

- Building and Presenting an Assurance Case
- Tracing the evidence for an Issue
- Risk tracking dashboards
- Performing a Goodness Assessment
- Showing proof of work

Project Manager Use Case

- Establishing the Technical Reference
- Putting together an MPSR
- Assembling a Technical Report for a Review
- Evidence Driven Checkpoint Review Preparation

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The Project Domain

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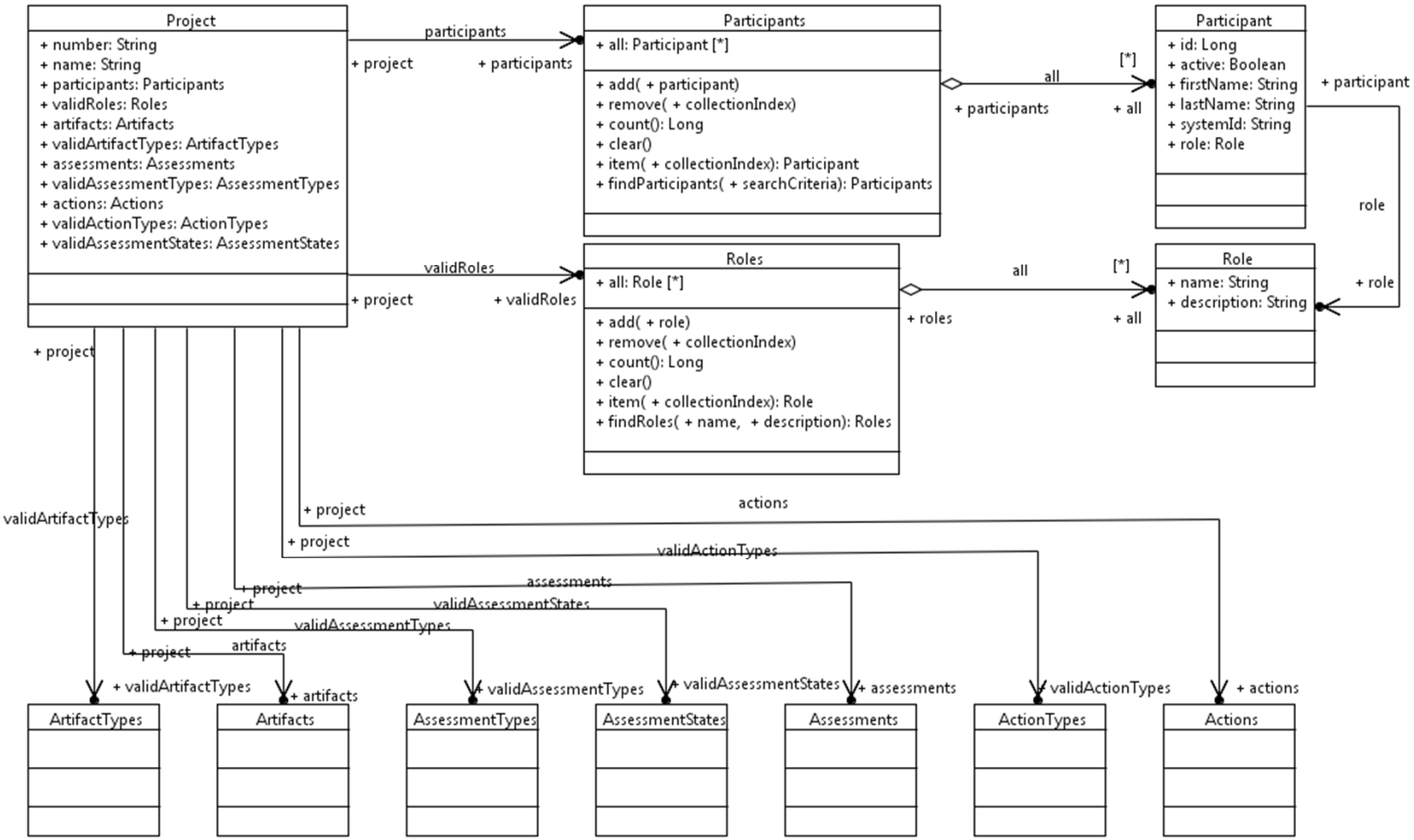

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Thank you

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- Friends of the AMF:
  - Phil Loftis
  - Zachary Seamon
  - Travis Dawson
  - Chris Williams
  - John Connolly
  - Ryan Starn
  - Steve Husty
  - Rich Finley
  - Frank Huy
  - Jeremy Fienhold
  - Rick Hess

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