



The Importance of Metadata

Leveraging Strategies



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Peter Aiken, Ph.D.

- I've been doing this a long time
- My work is recognized as useful
- Associate Professor of IS (vcu.edu)
- Institute for Defense Analyses (ida.org)
- DAMA International (dama.org)
- MIT CDO Society (iscdo.org)
- Anything Awesome (anythingawesome.com)
- Experienced w/ 500+ data management practices worldwide
- 12 books and dozens of articles
- Multi-year immersions
 - US DoD (DISA/Army/Marines/DLA)
 - Nokia
 - Deutsche Bank **\$1,500,000,000.00 USD**
 - Wells Fargo
 - Walmart
 - HUD ...



Program overview

The Importance of Metadata Leveraging Strategies



- Defining metadata in the context of data management
 - Defining data management
 - What do we mean by using data as metadata and why is this important? (Hint: leverage)
 - Specific teachable example using iTunes/Music™
- S1: Metadata is a gerund—do not treat it as a noun
 - Metadata is a use of data, not a type of data
- S2: Enforce metadata to be the language of data governance
 - Make metadata the language of data governance
- S3: Treat glossaries/repositories as capabilities not technology
 - Cyclic approaches do not start with technologies
- S4: Build from metadata building blocks
 - Many many many resources available to jump-start metadata efforts
- Benefits, application & sources
 - Understand that metadata defines organizational interoperability
- Take Aways, References and Q&A



Henri La Fontaine
Nobel Peace Prize, 1913



Paul Otlet

The Mundaneum was an institution which aimed to gather together all the world's knowledge and classify it according to a system called the Universal Decimal Classification. It was developed at the turn of the 20th century by Belgian lawyers Paul Otlet and Henri La Fontaine. The Mundaneum has been identified as a milestone in the history of data collection and management, and (somewhat more tenuously) as a precursor to the Internet.

https://en.wikipedia.org/wiki/Mundaneum#/media/File:Mundaneum_Ti%C3%A4ng_Karteikaarten.jpg | <http://www.mundaneum.org/en>



Meta Data, Meta-data, Metadata

- In the history of language, whenever two words are pasted together to form a combined concept initially, a hyphen links them
- With the passage of time, the hyphen is lost. The argument can be made that that time has passed
- So, the term is "metadata"
- By-the-way, there is a copyright on the term "metadata," but it has not been enforced

Check Status (TARR contains current status, correspondence address and attorney of record for th return to TESS)

Typed Drawing

Word Mark	METADATA
Goods and Services	IC 009. US 038, G & S: COMPUTER PROGRAMS. FIRST USE: 1981092
Mark Drawing Code	(1) TYPED DRAWING
Serial Number	73561844
Filing Date	October 7, 1985
Current Filing Basis	1A
Original Filing Basis	1A
Published for Opposition	June 24, 1986
Registration Number	1409260
Registration Date	September 16, 1986
Owner	(REGISTRANT) MEGADYNE INFORMATION SYSTEMS CORPORAT BOULEVARD SANTA MONICA CALIFORNIA 90401 (LAST LISTED OWNER) METADATA INC. LIMITED LIABILITY COM BRENTWOOD TENNESSEE 37027
Assignment Recorded	ASSIGNMENT RECORDED
Attorney of Record	RICHARD L. BERNACCHI
Type of Mark	TRADEMARK
Register	PRINCIPAL
Affidavit Text	SECT 15. SECT 8 (6-YR).
Live/Dead Indicator	LIVE



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Misunderstanding Data Management

DEPOT BOOKS HERE

WHEN DATA MODELERS GO BAD

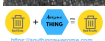
THE DOOR

HOUSE

THE DOG

EMAIL TO A FRIEND

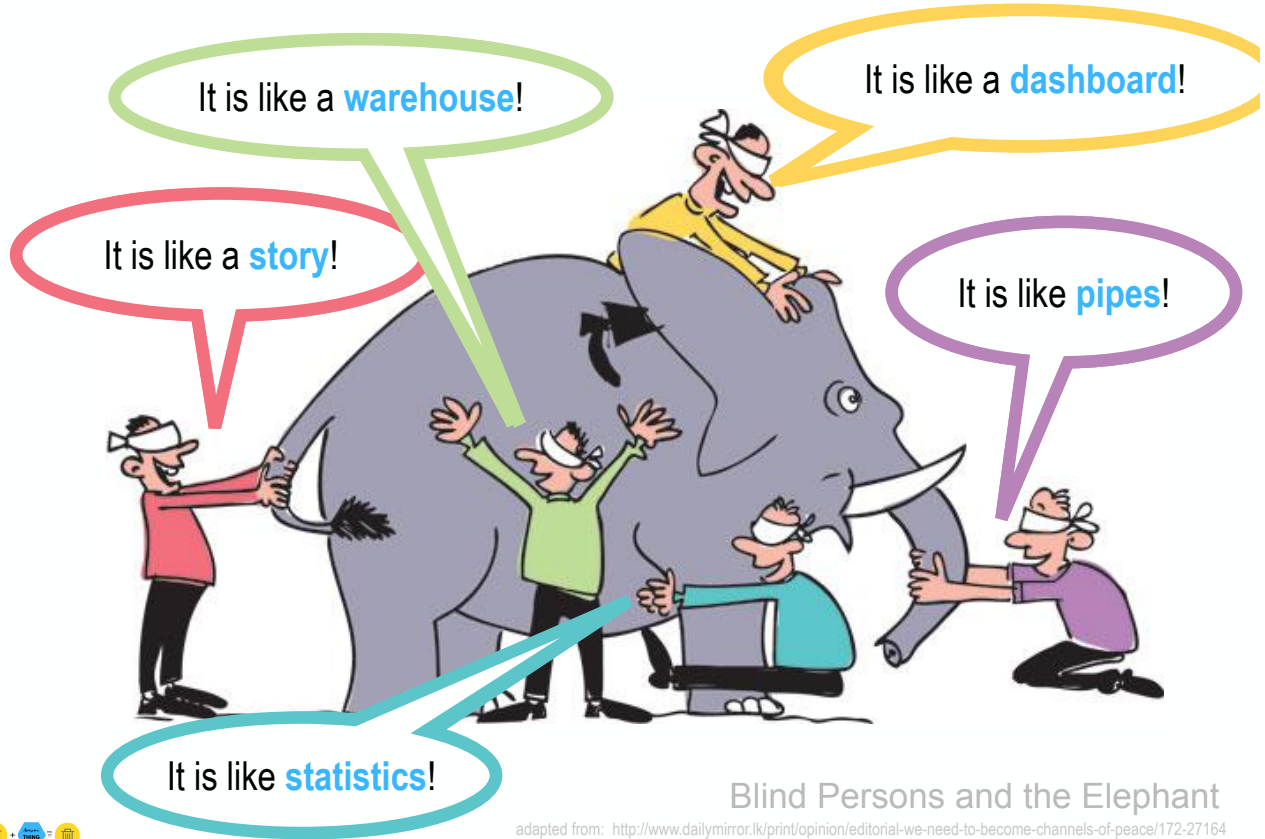
"Now! That should clear up a few things around here!"



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Data Is Not Broadly or Widely Understood



Unrefined
data management
definition

Sources

Data Management

Uses



More refined
data management
definition

Sources

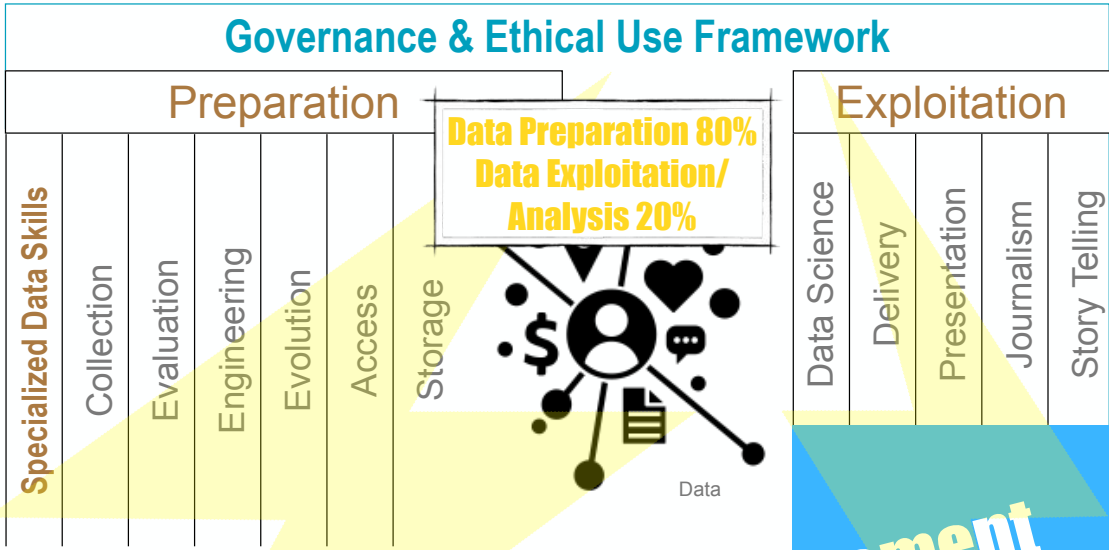
→
Data Management

→
Reuse



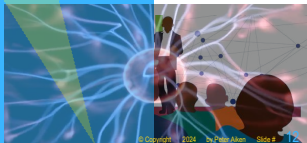
Sources

Better Still Data Management Definition



↓
Reuse

Formal Data Reuse Management



The Prefix Meta-

Meta

1. Situated behind: metacarpus.
2. a. Later in time: metestrus.
b. At a later stage of development: metanephros.
3. a. Change; transformation: metachromatism.
4. **a. Beyond; transcending; more comprehensive: metalinguistics.**
b. At a higher state of development: metazoan.
5. Having undergone metamorphosis: metasomatic.
6. a. Derivative or related chemical substance: metaprotein.
b. Of or relating to one of three possible isomers of a benzene ring with two attached chemical groups, in which the carbon atoms with attached groups are separated by one unsubstituted carbon atom: meta-dibromobenzene.

Definition of the prefix *meta*- (Emphasis added – source: *American Heritage English Dictionary* © 1993 Houghton Mifflin).



Analogy: a Library Card Catalog

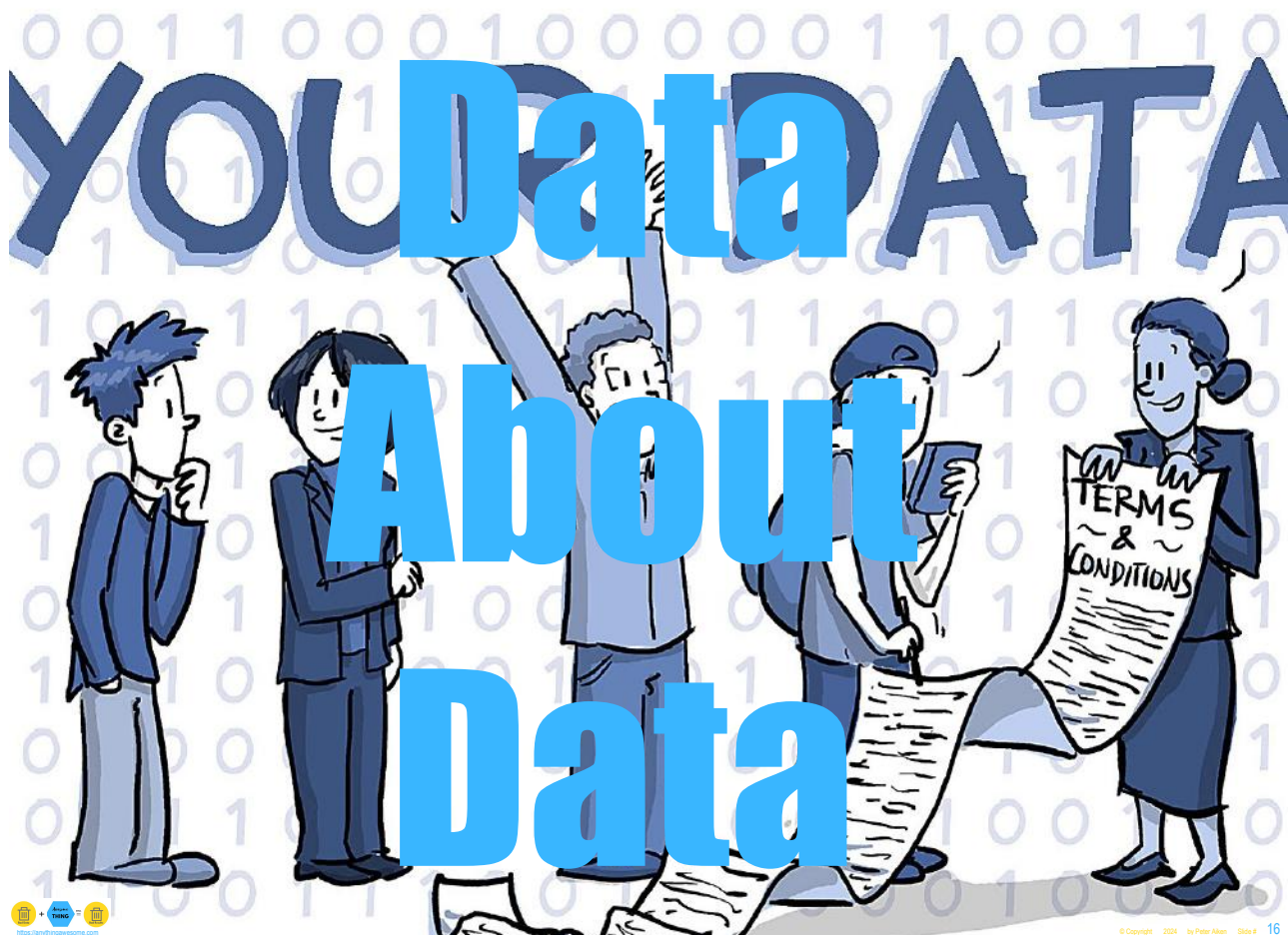
- Identifies
 - What books are in the library, and
 - Where they are located
 - Search by
 - Subject area
 - Author, or
 - Title
 - Catalog shows
 - Author
 - Subject tags
 - Publication date and
 - Revision history
 - Determine which books will meet the reader's requirements
 - Without the catalog, finding things is difficult, time consuming and frustrating
- from *The DAMA Guide to the Data Management Body of Knowledge* © 2009 by DAMA International

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PS357  
.R5355  
F57 1991  
  
Grisham, John  
  
The firm / John Grisham. 1st. ed.  
New York : Doubleday, c1991.  
421p. ; 24 cm.  
  
1. Government investigators--Fiction.  
2. Organized crime--Fiction.
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PS357 Government investigators--Fiction  
.R5355  
F57 1991  
  
Grisham, John  
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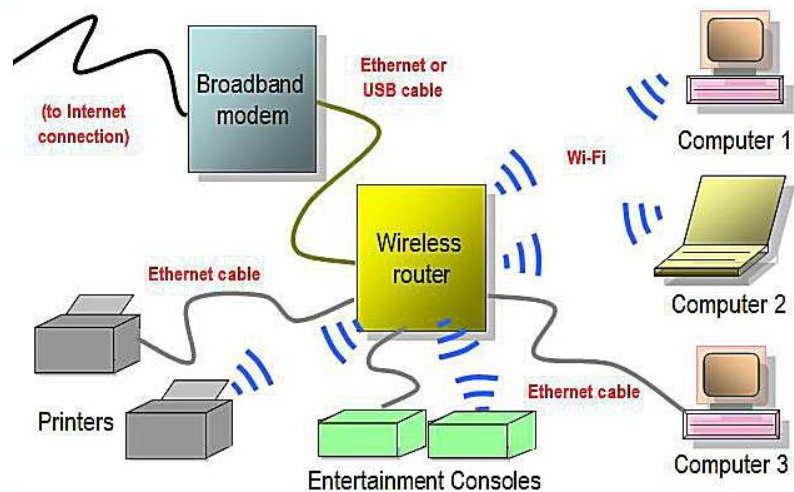
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2. Organized crime--Fiction.
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The Most Likely Managed Metadata in Your Organization

- Tracking network users and access points is metadata
- Your organization's networking group allocates the responsibility for knowing (at least):
 - All the devices permitted to logon to your network
 - Locations of all permitted access points
- This responsibility belongs to a named individual(s)

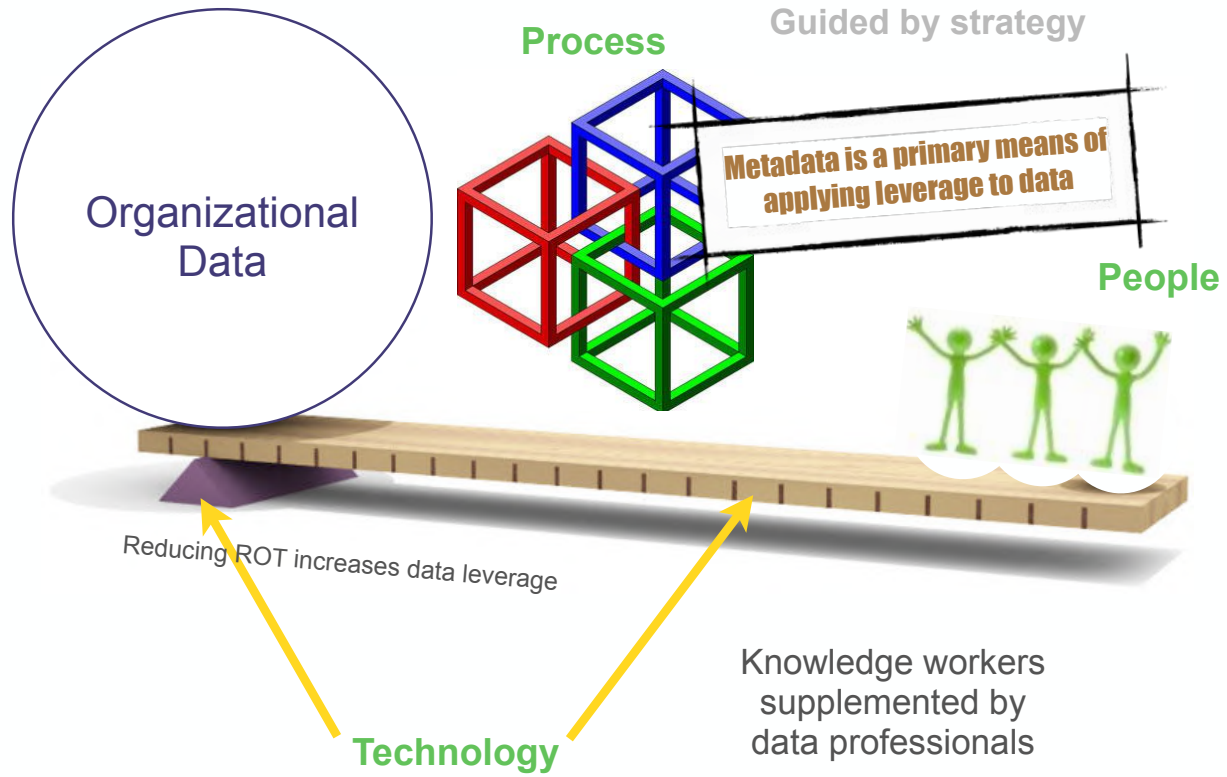


Leverage Is an Engineering Concept

- Using proper engineering techniques, a human can lift a bulk that is weighs much more than the human



A Wholistic Approach to Obtaining Data Leverage



<https://www.computerhope.com/jargon/ff/framework.htm>

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Separating the Wheat From the Chaff



Is well organized data worth more?

DATA ROT EXPLAINED



Pre-Information Age Metadata



- Examples of information architecture achievements that happened well before the information age:

- Page numbering
- Alphabetical order
- Table of contents
- Indexes
- Lexicons
- Maps
- Diagrams



"While we can arrange things with the intent to communicate certain information, we can't actually make information. Our users do that for us."

Example from: *How to make sense of any mess* by Abby Covert (2014) ISBN: 1500615994

https://www.youtube.com/watch?v=60oD1TDzAXQ&feature=emb_logo

<https://www.youtube.com/watch?v=r10Sod44rME&t=1s>

<https://www.youtube.com/watch?v=XD2OkDPAI6s>

DATA ROT EXPLAINED



Remove the Structure and Things Fall Apart Rapidly

- Better organized data increases in value

DATA ROT EXPLAINED



Separating the Wheat From the Chaff

- Better organized data increases in value
- Poor data management practices are costing organizations money/time/effort
- 80% of organizational data is **ROT**
 - Redundant
 - Obsolete
 - Trivial
- The question is which data to eliminate?
 - Most enterprise data is never analyzed

Metadata:

- Is required for valid identification of data assets
- Focuses organizational attention on repairing common data elements
- Permits value to be ascribed to data at a necessarily granular level

DATA ROT EXPLAINED



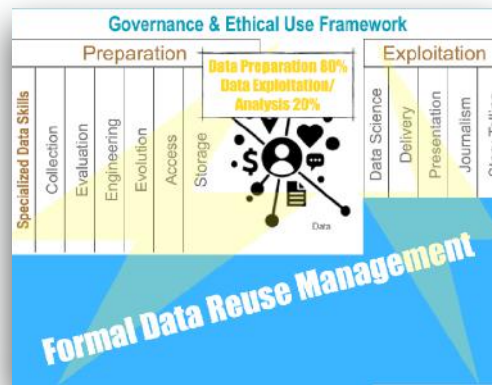


Data Leverage Is a Multi-Use Concept

- Permits organizations to better manage their data
 - Within the organization, and
 - With organizational data exchange partners
 - In support of the organizational mission
- Leverage is enabled by metadata
 - Obtained by implementation of data-centric technologies, processes, and human skill sets
 - Focus on the non-ROT data
 - The bigger the organization, the greater potential leverage exists
- Treating data more asset-like simultaneously
 - Lowers organizational IT costs and
 - Increases organizational knowledge worker productivity



Metadata Yields ...

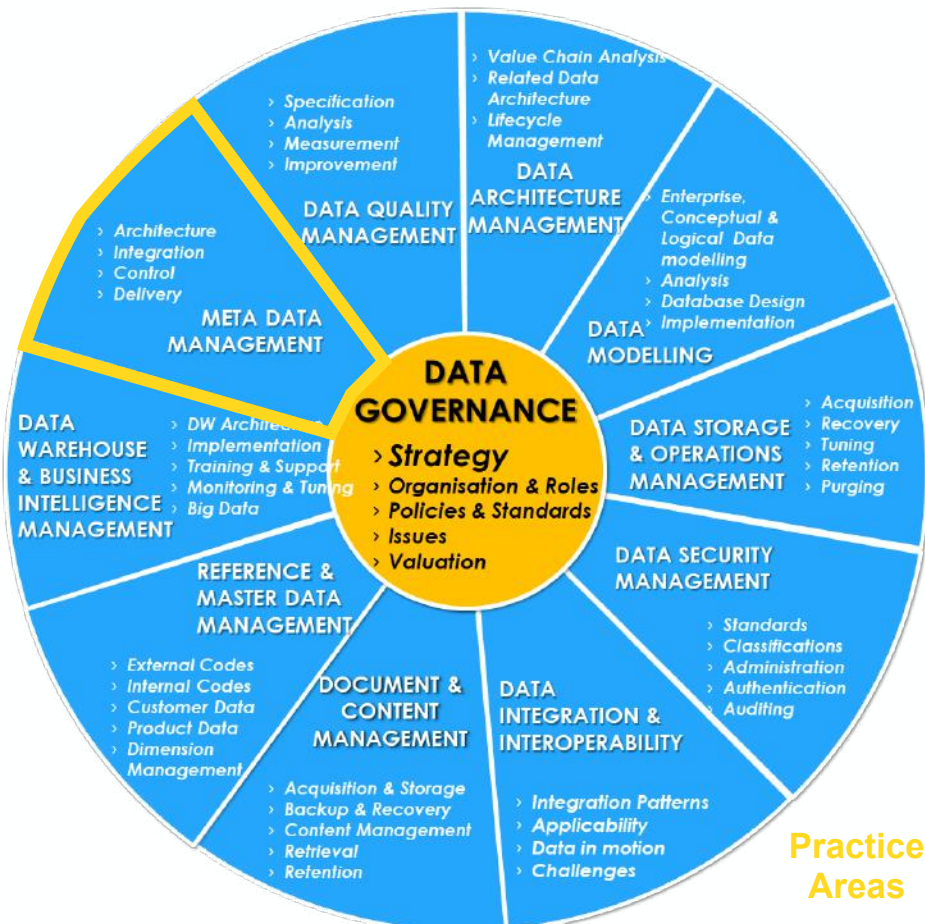


Valuable information about your data assets:

- Do we have these specific (or this class of) data assets? **Yes!**
- What is the quality of ... **Not suitable!** **35¢/apiece**
- What will be the cost to improve this class of data assets?
- Can these data assets be provided more granularly? **Not easily!**
- ... (increasing insight)



Data Management Body of Knowledge (DM BoK V2)



Practice Areas



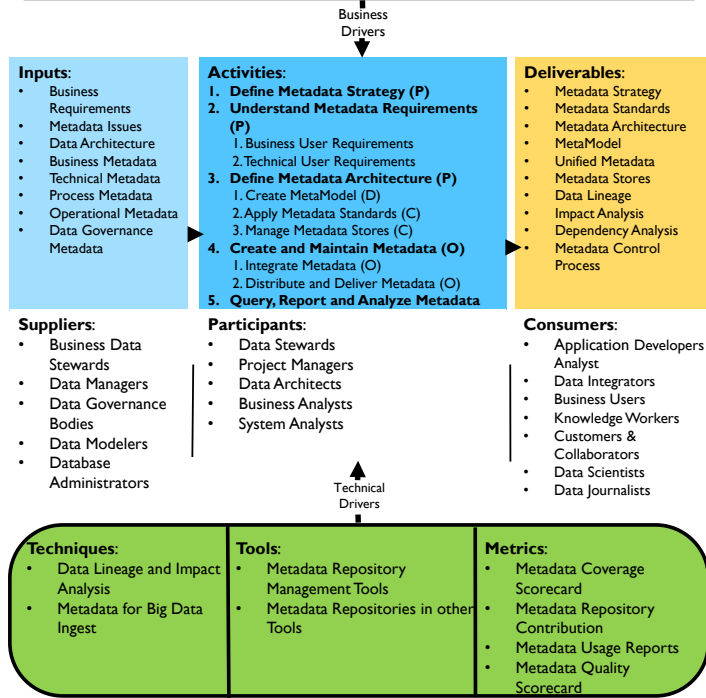
Metadata Management

Metadata Management

Definition: Planning, Implementation, and control activities to enable access to high quality, integrated metadata

Goals:

1. Provide organizational understanding of business terms and usage.
2. Collect and integrate metadata from diverse sources.
3. Provide a standard way to access metadata.
4. Ensure metadata quality and security.



(P) Planning, (C) Control, (D) Development, (O) Operations



Example:
iTunes → Music™ app

- Example:
 - Music Metadata
- Insert a recently purchased CD
- Music can:
 - Count the number of tracks (25)
 - Determine the length of each track

Name	Time	Artist	Album	Genre
1 ✓ Track 01	2:34			
2 ✓ Track 02	3:14			
3 ✓ Track 03	3:20			
4 ✓ Track 04	3:12			
5 ✓ Track 05	2:36			
6 ✓ Track 06	2:49			
7 ✓ Track 07	3:10			
8 ✓ Track 08	3:02			
9 ✓ Track 09	3:07			
10 ✓ Track 10	2:18			
11 ✓ Track 11				
12 ✓ Track 12				
13 ✓ Track 13				
14 ✓ Track 14				
15 ✓ Track 15				
16 ✓ Track 16				
17 ✓ Track 17				
18 ✓ Track 18				
19 ✓ Track 19				
20 ✓ Track 20				
21 ✓ Track 21				
22 ✓ Track 22	4:24			
23 ✓ Track 23	4:49			
24 ✓ Track 24	3:47			
25 ✓ Track 25	4:23			



Example: Music Metadata

- When connected to the Internet Music connects to the Gracenote(.com) Media Database and retrieves:
 - CD Name
 - Artist
 - Track Names
 - Genre
 - Artwork
- Sure would be a pain to type in all this information

Name	Time	Artist	Album	Genre
1 ✓ Move	2:34	Miles Davis	The Complete Birth Of The Cool	Jazz
2 ✓ Jeru	3:14	Miles Davis	The Complete Birth Of The Cool	Jazz
3 ✓ Moon Dreams	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz
4 ✓ Venus De Milo	3:12	Miles Davis	The Complete Birth Of The Cool	Jazz
5 ✓ Budo	2:36	Miles Davis	The Complete Birth Of The Cool	Jazz
6 ✓ Deception				
7 ✓ Godchild				
8 ✓ Boplicity				
9 ✓ Rocker				
10 ✓ Israel				
11 ✓ Rouge				
12 ✓ Darn That Dream				
13 ✓ Birth Of The Cool...				
14 ✓ Symphony Sid Ann...				
15 ✓ Move (Live)				
16 ✓ Why Do I Love You...				
17 ✓ Godchild (Live)				
18 ✓ Symphony Sid Intr...				
19 ✓ S'il Vous Plait [Live]				
20 ✓ Moon Dreams [Live]				
21 ✓ Budo (Hallucinatio...				
22 ✓ Darn That Dream [...]				
23 ✓ Move (Live)				
24 ✓ Moon Dreams (Live)				
25 ✓ Budo (Hallucinatio...				

25 songs, 1.3 hours, 801.7 MB

Example: Music Metadata

- To organize my Music library
 - I create a "New Smart Playlist" for Artist's containing "Miles Davis"

Smart Playlist

Match the following rule:

Artist contains Miles Davis

Limit to 25 items selected by random

Match only checked items

Live updating

Cancel OK

Name	Time	Artist	Album	Genre
1 ✓ Move	2:34	Miles Davis	The Complete Birth Of The Cool	Jazz
2 ✓ Jeru	3:14	Miles Davis	The Complete Birth Of The Cool	Jazz
3 ✓ Moon Dreams	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz
4 ✓ Venus De Milo	3:12	Miles Davis	The Complete Birth Of The Cool	Jazz
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11 ✓ Rouge	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz
12 ✓ Darn That Dream	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz
13 ✓ Birth Of The Cool...	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz
14 ✓ Symphony Sid Ann...	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz
15 ✓ Move (Live)	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz
16 ✓ Why Do I Love You...	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz
17 ✓ Godchild (Live)	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz
18 ✓ Symphony Sid Intr...	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz
19 ✓ S'il Vous Plait [Live]	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz
20 ✓ Moon Dreams [Live]	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz
21 ✓ Budo (Hallucinatio...	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz
22 ✓ Darn That Dream [...]	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz
23 ✓ Move (Live)	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz
24 ✓ Moon Dreams (Live)	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz
25 ✓ Budo (Hallucinatio...	3:20	Miles Davis	The Complete Birth Of The Cool	Jazz

25 songs, 1.3 hours, 801.7 MB

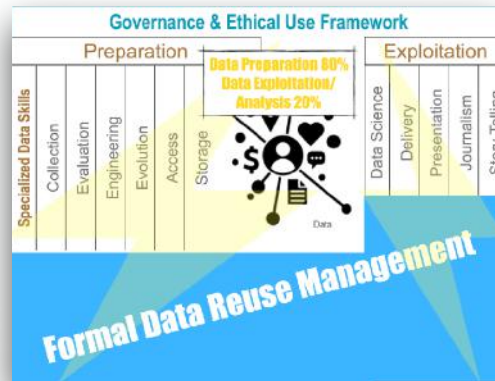
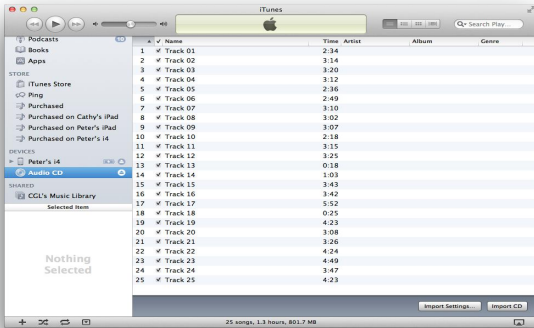
Example: Music Metadata

- Notice I didn't get the desired results
- I already had another Miles Davis recording, "Live at the Fillmore East"
- Must fine-tune the smart playlist request to get the desired results
 - Now specify that Album must also contain "The complete birth of the cool"
- Now I can move the smart playlist "Miles Davis" to a folder
- Or not?

Example: Music Metadata

- Your knowledge of:
 - Interface
 - Processing
 - Data Structures
- are applied to
 - Podcasts
 - Movies
 - Books
 - .pdf files
- Economies of scale are enormous

Metadata Yields ...



Valuable information about your Music™ assets:

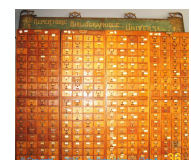
- Do we have these specific Miles Davis recordings? **Yes!**
- Most my played Miles Davis recording **Bitches Brew**
- What will be the cost to acquire more of this class of data assets? **\$1.29/each**
- Can I listen to the entire album before dinner? **Not easily!**



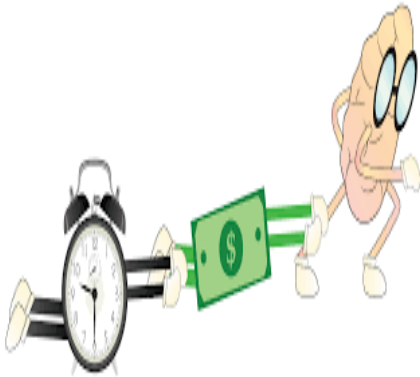
Program overview

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 - Specific teachable example using iTunes/Music™
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- S2: Enforce metadata to be the language of data governance
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- Benefits, application & sources
 - Understand that metadata defines organizational interoperability
- Take Aways, References and Q&A

The Importance of Metadata
Leveraging Strategies



Comprehension by others is critical!



- If others do not understand what you do then you are perceived with a **cost** bias
- If others understand what you do then you can be perceived with a **value** bias

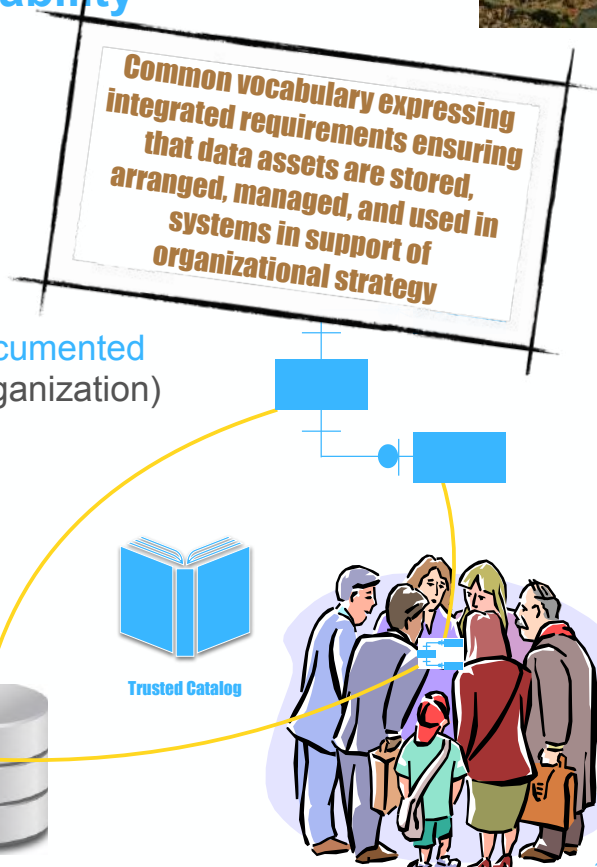
Understanding = Interoperability



- All organizations have architectures
 - Business
 - Process
 - Systems
 - Security
 - Technical
 - Data/Information
- Some are better **understood** and **documented** (and therefore more **useful** to the organization)
- 'Understanding an architecture'
 - Documented and articulated as a (digital) blueprint illustrating the commonalities and interconnections among the architectural components
- Ideally the understanding is shared by
 - Business
 - Technical
 - Systems



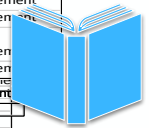
deviantart.com



Business Glossary

- aka
 - data dictionary
 - data item dictionary
 - data directory
 - data catalog
 - data repository
 - metadata repository
 - data resource dictionary
 - data asset dictionary
 - data definition dictionary
 - data structure dictionary
 - data element dictionary
 - enterprise repository
 - term bank
- Start of Enterprise Taxonomy
- Defines Initial Entities for Conceptual Data Model
- Engages the Business Community to Validate Entities and provide meaningful, agreed upon business definitions

Entity	Description	Domain Area
Donor	Funder	Business Development
Solicitations	Need for Work	Business Development
Solicitations Proposal	Response to Need for Work	Business Development
Pre-Positioning	Intelligence Gathering	Business Development
Award/Sub-Award	Funding Vehicle	Business Development
Terms Conditions	Details about a Funding Vehicle	Business Development
Budget	Amount of Money Available	Business Development
Work Plan	Set of Activities to Complete	Business Development
PMP	Monitoring Plan for Activities	Business Development
Project	An NGO Project is defined as a self-contained set of interventions or activities with the following characteristics: a) an external client; b) purchase order, contract or agreement; c) expected deliverables, outcomes and results; d) a beginning and end date of implementation; e) an approved budget; and full and/or part time NGO staff	Project Management
Geographic Area	Location in which a Central Office resides	Project Management
Office Locations		Project Management
Project Roles		Project Management
Project Artifacts		Project Management
Project Budget		Project Management
Project Work Plan		Project Management
Milestones	Schedule of completed activities	Project Management
Monitoring	Plan to measure Activities	Project Management
Evaluation	Assessment of Activities	Project Management
Indicators	Target of Outcome	Project Management
Outcomes	Statement of what needs to be accomplished	Project Management
Acct Receivable	Payments to NGO	Financial Management
Chart of Accounts	Defined Accounts	Financial Management
Payroll	Process to Pay Worker	Financial Management
Supplier	Provider of Goods or Service	Financial Management
Contract	Binding Agreement	Financial Management
Purchase Order	Statement of Good or Service	Financial Management
Performance	Level of Success	Talent Management
Benefits		Talent Management
Skills		Talent Management
Worker	Person who has been hired by NGO	Talent Management
Candidate	Potential hire of NGO	Talent Management

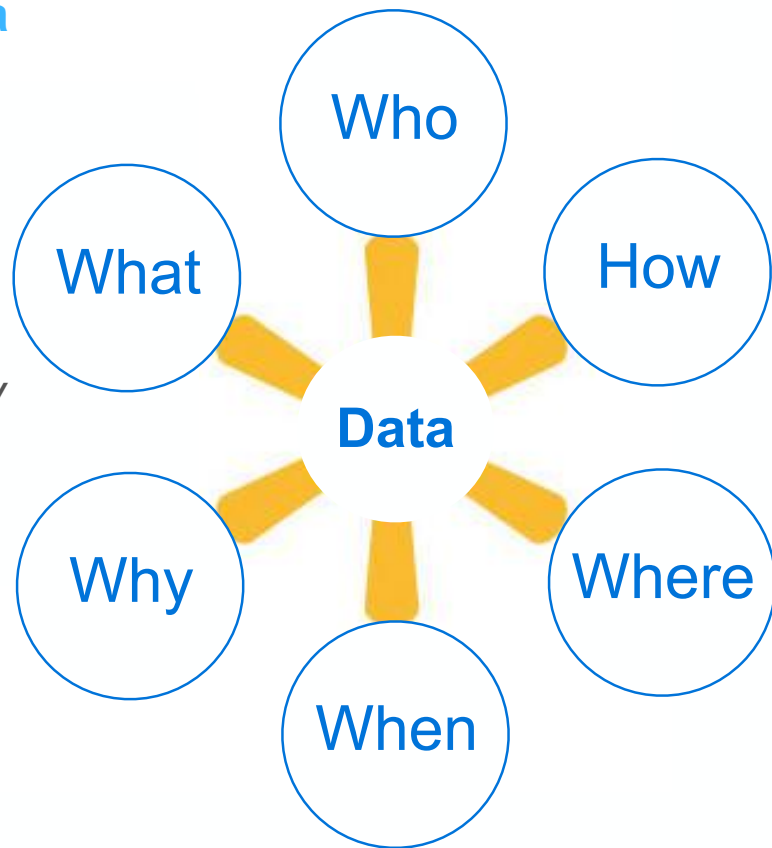


Your **spark** makes us
Walmart



Defining Metadata

Metadata is any combination of any circle and the data in the center that unlocks the value of the data!



<https://anythingawes.com>

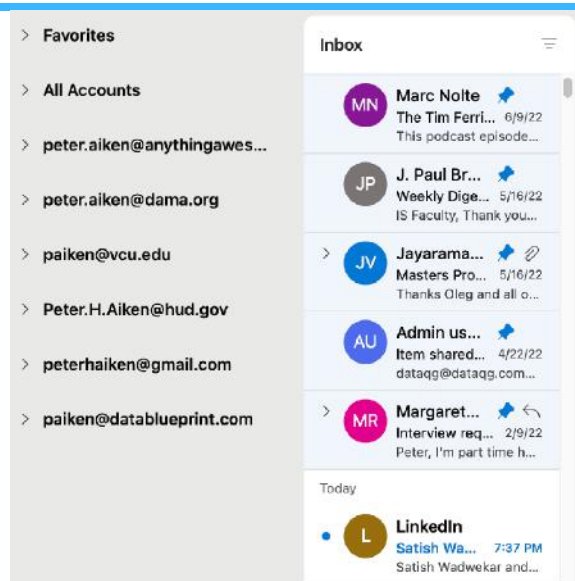
Adapted from Brad Melton

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InBox Example

Metadata is used to navigate/manage email

What: "Subject"
How: "Priority"
Where: "USERID/Inbox",
"USERID/Personal"
Why: "Body"
When: "Sent" & "Received"



- Find the important stuff/weed out junk
- Organize for future access/outlook rules
- *Imagine how managing e-mail (already non-trivial) would change if Outlook did not make use of metadata Who: "To" & "From?"*

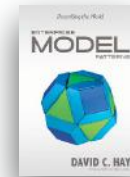


<https://anythingawes.com>

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Definitions

- Metadata is
 - Everywhere in every data management activity and integral to all IT systems and applications.
 - To data what data is to real life. Data reflects real life transactions, events, objects, relationships, etc. Metadata reflects data transactions, events, objects, relations, etc.
 - The data that describe the structure and workings of an organization's use of information, and which describe the systems it uses to manage that information.
[quote from David Hay's book, page 4]
 - Data describing various facets of a data asset, for the purpose of improving its usability throughout its life cycle [Gartner 2010]
 - **Metadata unlocks the value of data, and therefore requires management attention** [Gartner 2011]
- Metadata Management is
 - The set of processes that ensure proper creation, storage, integration, and control to support associated use of metadata



Metadata ...

- Isn't
 - Is not a noun
 - One person's data is another's metadata
- Is more of a verb?
 - Represents a use of existing facts, rather than a type of data itself
- It is a **gerund**
 - a form that is derived from a verb but that functions as a noun
 - e.g., the word *asking* in do you mind my *asking* you?
- Therefore, metadata describes a use of data, not a type of data
 - The use of some attributes of data to understand or manage that same data from a different (usually higher) level of abstraction



ger·und
/ˈjɛrənd/ 

noun GRAMMAR



Case Study

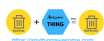
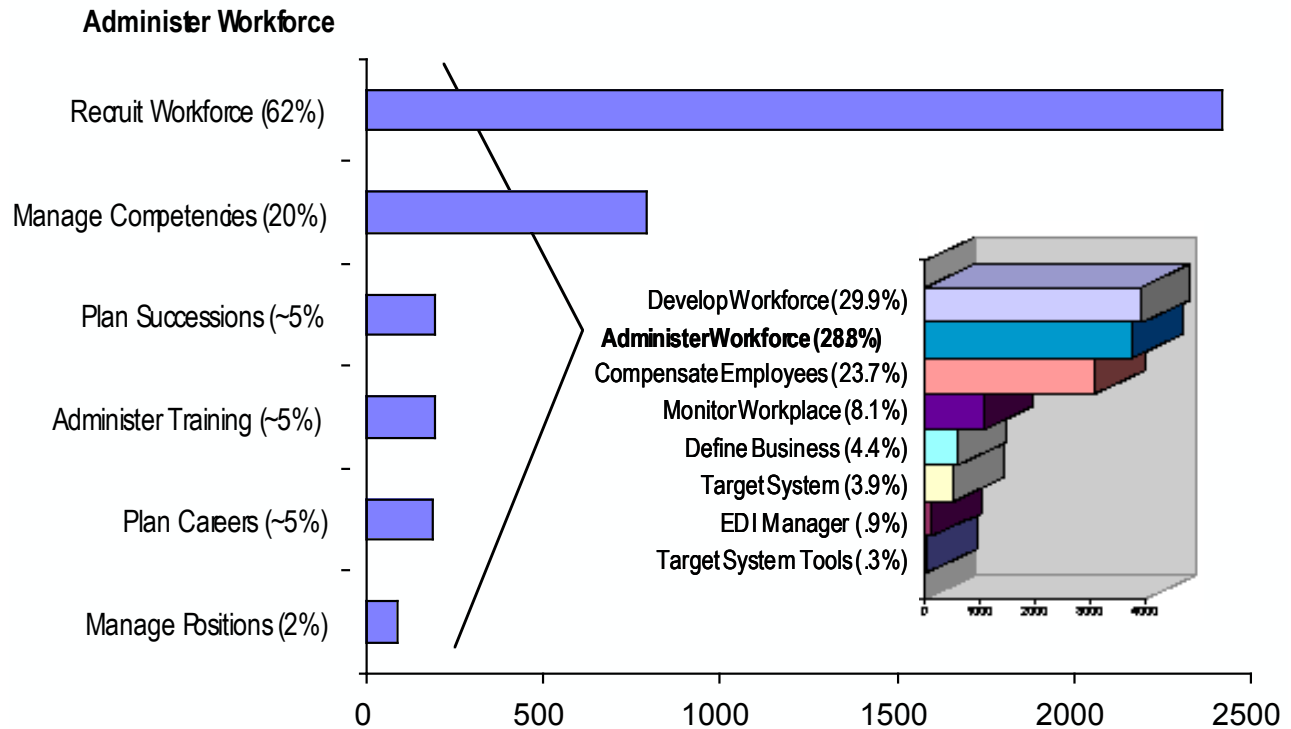
Reverse-engineering a commercial client-server system from PeopleSoft yielded a valuable resource and proved to be cost-effective. The authors describe the motivations for, approach to, and results of this project, commissioned by the Commonwealth of Virginia's government.

Reverse-Engineering New Systems for Smooth Implementation

Peter Aiken and Ojelanki K. Ngwenyama, Virginia Commonwealth University
Lewis Broome, Innovative Business Solutions



Metadata Uses

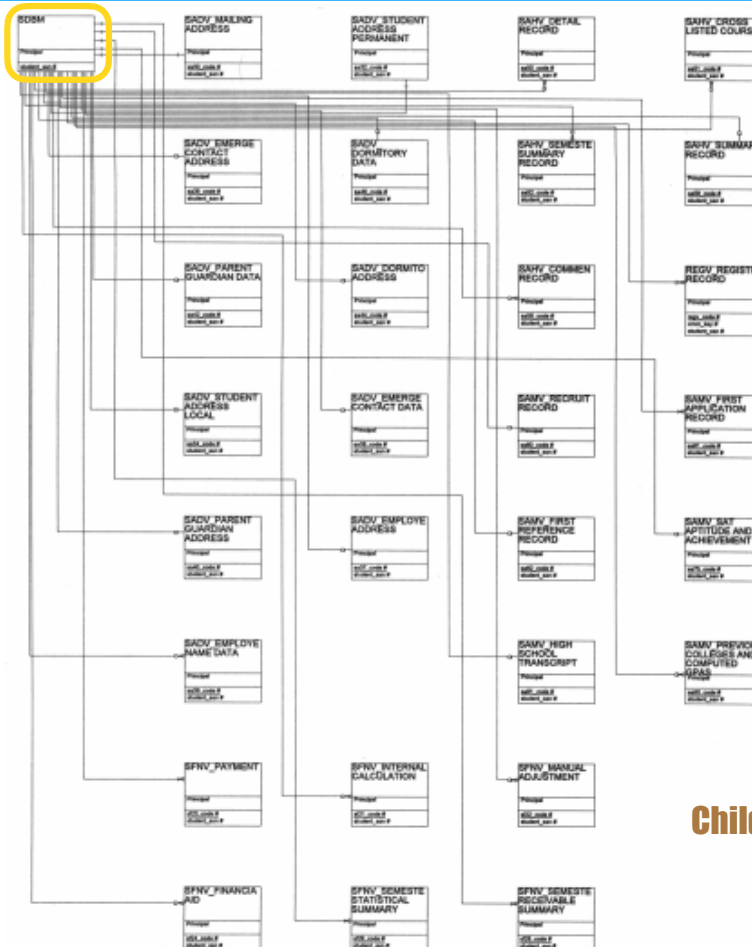


Line	Student Name	Student ID	Col	Cls	Maj	Registration Status
1	AKHTAR, HASINA		BUS	JR	ISY	Enrolled
2	BATDORF, MARK A.		BUS	JR	BFO	Enrolled
3	BOWKER, ASHLEY		BUS	UC	ISY	Enrolled
4	BRINKLEY, STEPHEN C		BUS	UC	ACC	Enrolled
5	DANIELSEN, ANTHONY		BUS	UC	ISY	Enrolled
6	DAUGHTRY, DAVID L		BUS	UC	ISY	Enrolled
7	DAWSON, STEFANI P		BUS	SR	FIN	Enrolled
8	DEBERRY, CHERYL M		BUS	UC	ISY	Enrolled
9	DIDDEN, CHRISTOPHER		BUS	UC	ISY	Enrolled
10	DIGGS, SAMUEL		DUO	US	DHU	Enrolled
11	DIXON, BRIAN		BUS	UC	ISY	Enrolled
12	GRANT, JAMES T		BUS	SR	ISY	Enrolled
13	HAAS, MICAH P		CHS	SR	MAS	Enrolled
14	HAMILTON, GARY M		BUS	UC	ISY	Enrolled
15	HOLICKY, JOSEPH J, III		BUS	UC	ISY	Enrolled



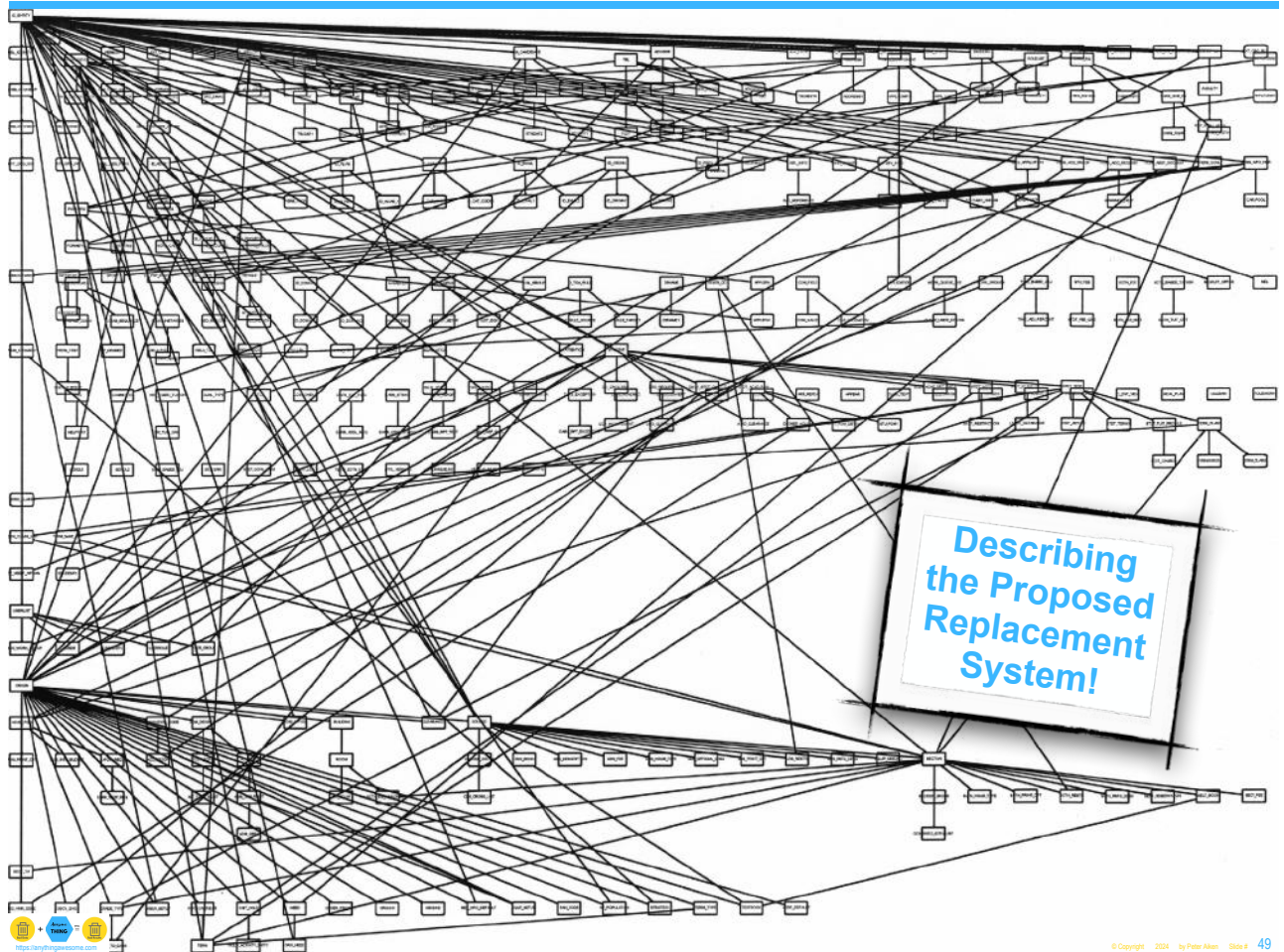
Parent

Student
Data
Base
Master



Children





Application Build Model

Defines the tools, parameters and environment required to build an automated Business Application.

Applications Structure Model

Defines the overall scope of an automated Business Application, the components of the application and how they fit together.

Business Goals Model

Defines the mission of the enterprise, its long-range goals, and the business policies and assumptions that affect its operations.

Business Rules Model

Records rules that govern the operation of the business and the Business Events that trigger execution of Business Processes.

Data Structures Model

Defines the data structures and their elements used in an automated Business Application.

DB2 Model

Refines the definition of a Relational Database design to a DB2-specific design.

Derivations/Constraints Model

Records the rules for deriving legal values for instances of Entity-Relationship Model components, and for controlling the use or existence of E-R instance.

Enterprise Structure Model

Defines the scope of the enterprise to be modeled. Assigns a name to the model that serves to qualify each component of the model.

Entity-Relationship Model

Defines the Business Entities, their properties (attributes) and the relationships they have with other Business Entities.

Extension Support Model

Provides for tactical Information Model extensions to support special tool needs.

Flow Model

Specifies which of the Entity Relationship Model component instances are passed between Process Model components.

Global Text Model

Supports recording of extended descriptive text for many of the Information Model components.

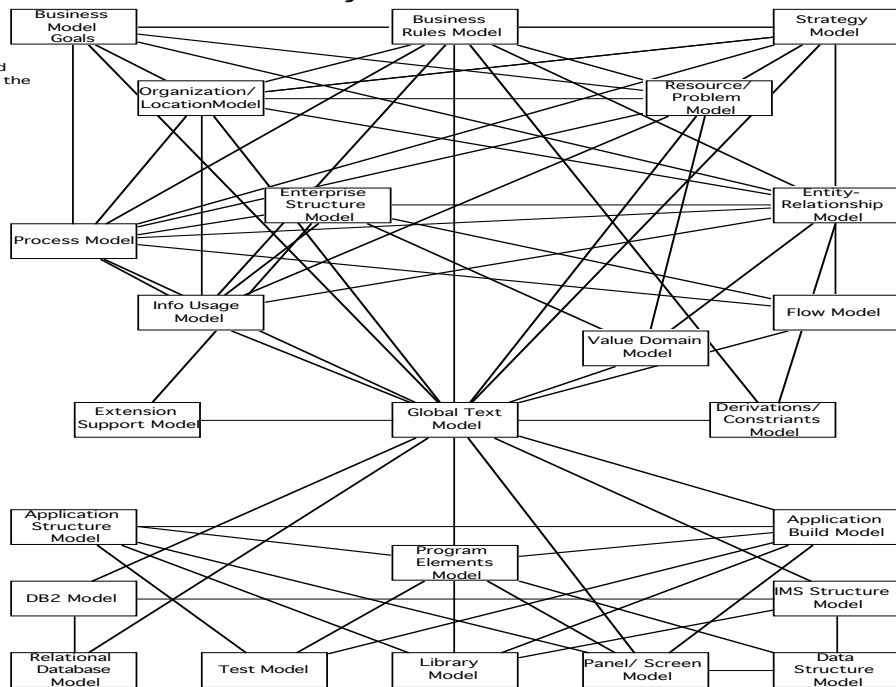
IMS Structures Model

Defines the component structures and elements and the application program views of an IMS Database.

Info Usage Model

Specifies which of the Entity-Relationship Model component instances are used by other Information Model

IBM's AD/Cycle Information Model



Library Model

Records the existence of non-repository files and the role they play in defining and building an automated Business Application.

Organization/Location Model

Records the organization structure and location definitions for use in describing the enterprise.

Panel/Screen Model

Identifies the Panels and Screens and the fields they contain as elements used in an automated Business Application.

Process Model

Defines Business Processes, their sub processes and components

Program Elements Model

Identifies the various pieces and elements of application program source that serve as input to the application build process.

Resource/Problem Model

Identifies the problems and needs of the enterprise, the projects designed to address those needs, and the resources required.

Relational Database Model

Describes the components of a Relational Database design in terms common to all SAA relational DBMSs.

Strategy Model

Records business strategies to resolve problems, address goals, and take advantage of business opportunities. It also records the actions and steps to be taken.

Test Model

Identifies the various file (test procedures, test cases, etc.) affiliated with an automated business Application for use in testing that application.

Value Domain Model

Defines the data characteristics and allowed values for information items.

Keep the Proper Focus



- Wrong question:
 - Is this metadata?
- Right question:
 - Would we obtain value if we include it in the scope of our metadata practices?
- Value proposition
 - Is this aspect of our data worth including within the scope of our metadata practices?



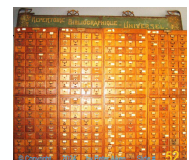
<https://anyringuadone.com>

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Program Overview

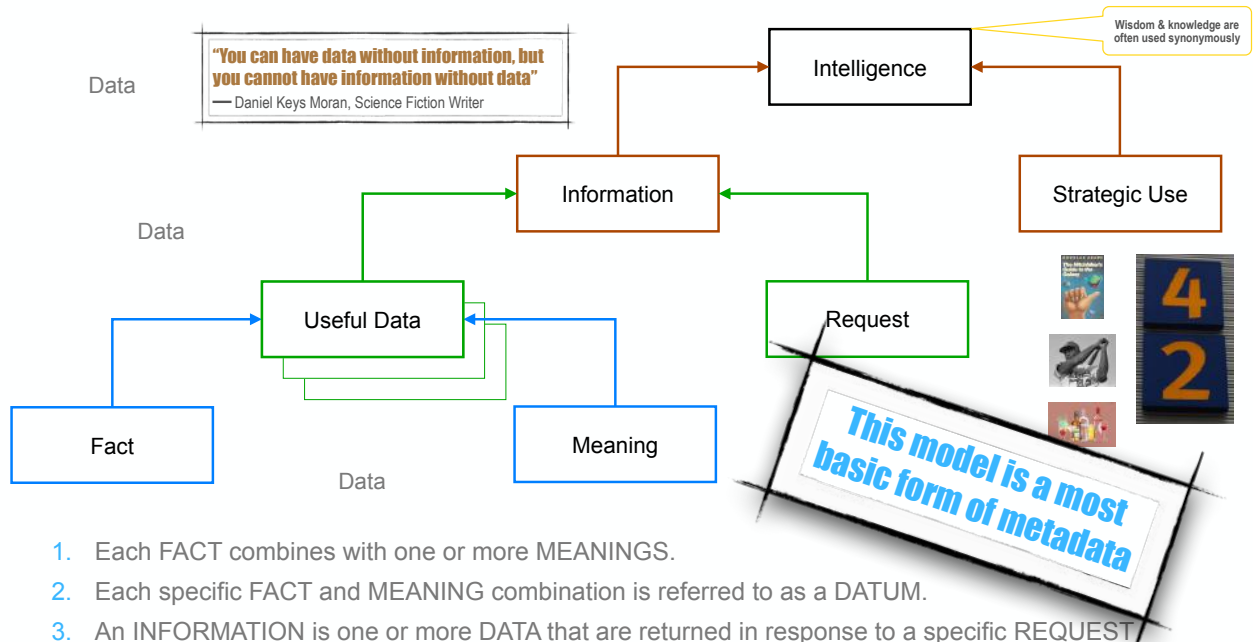
- Defining metadata in the context of data management
 - Defining data management
 - What do we mean by using data as metadata and why is this important? (Hint: leverage)
 - Specific teachable example using iTunes/Music™
- S1: Metadata is a gerund—do not treat it as a noun
 - Metadata is a use of data, not a type of data
- S2: Enforce metadata to be the language of data governance
 - Make metadata the language of data governance
- S3: Treat glossaries/repositories as capabilities not technology
 - Cyclic approaches do not start with technologies
- S4: Build from metadata building blocks
 - Many many many resources available to jump-start metadata efforts
- Benefits, application & sources
 - Understand that metadata defines organizational interoperability
- Take Aways, References and Q&A

The Importance of Metadata
Leveraging Strategies



<https://anyringuadone.com>

A Model Precisely Defining 3 Important Concepts

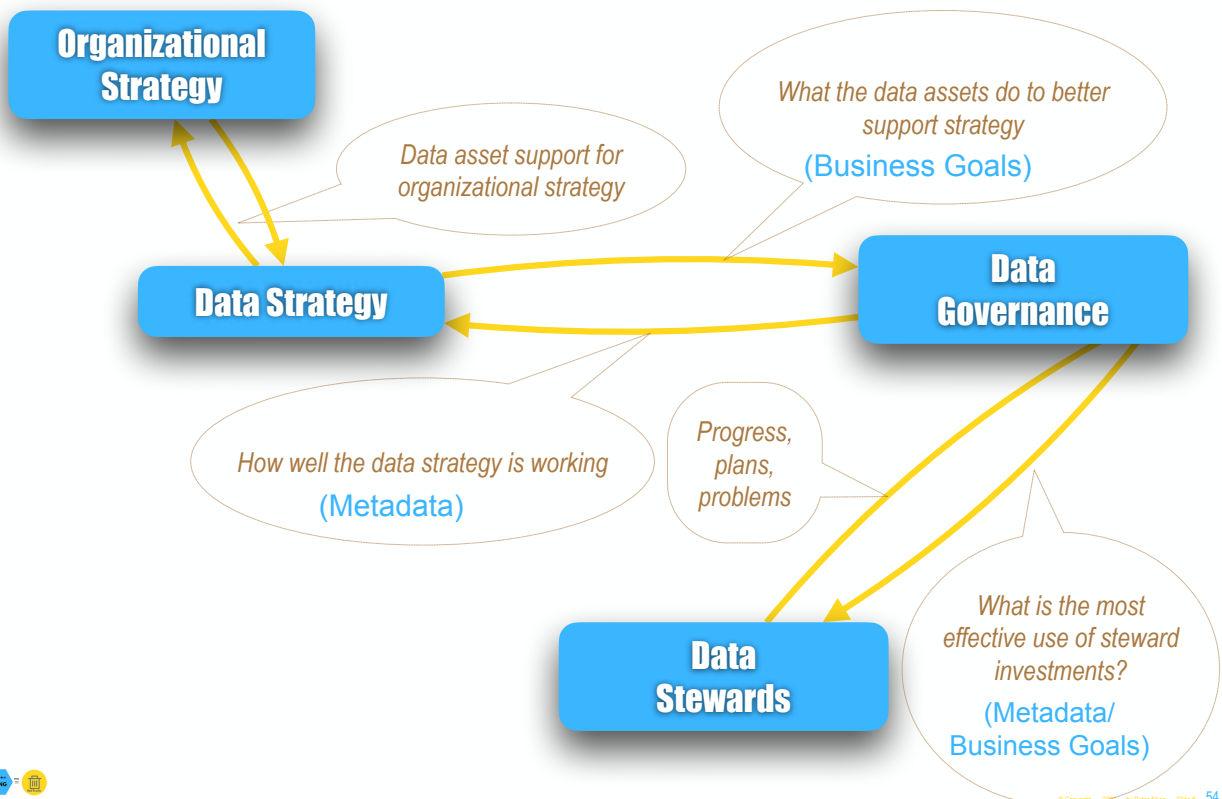


1. Each FACT combines with one or more MEANINGS.
2. Each specific FACT and MEANING combination is referred to as a DATUM.
3. An INFORMATION is one or more DATA that are returned in response to a specific REQUEST.
4. INFORMATION REUSE is enabled when one FACT is combined with more than one MEANING.
5. INTELLIGENCE is INFORMATION associated with its STRATEGIC USES.
6. DATA/INFORMATION must formally arranged into an ARCHITECTURE.

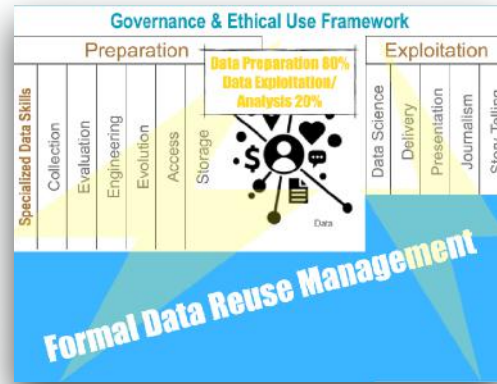
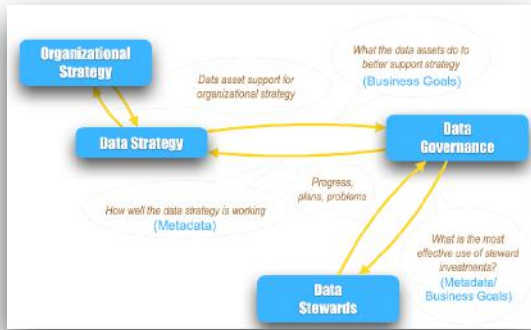
[Built on definitions from Dan Appleton. 1983]



Data Strategy and Governance in Strategic Context



Metadata Yields ...



Valuable information about your data governance assets & processes:

- Do we have a shared understanding of our goals? **Yes!**
- Are we and IT focused on similar goals **Yes**
- How cost effective are we being? **2¢/each**
- What kind of metadata do we find most valuable?
- ... (increasing insight)

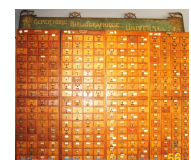
Supply Chain



Program overview

- Defining metadata in the context of data management
 - Defining data management
 - What do we mean by using data as metadata and why is this important? (Hint: leverage)
 - Specific teachable example using iTunes/Music™
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The Importance of Metadata
Leveraging Strategies





WIKIPEDIA
The Free Encyclopedia

- Main page
- Contents
- Featured content
- Current events
- Random article
- Donate to Wikipedia
- Wikipedia store
- Interaction
- Help
- About Wikipedia
- Community portal
- Recent changes

Bed Definition of Bed

From Wikipedia, the free encyclopedia

For other uses, see [Bed \(disambiguation\)](#).

A **bed** is a piece of furniture which is used as a place to **sleep** or **relax**.^{[1][2]}

Most modern beds consist of a soft, cushioned **mattress** on a **frame**, the **solid base**, **base**. **inner-mattress-springs** provide additional support and



Bedroom on the [Detmold Open-air Museum](#) premises

1. All data models are incomplete without definitions
2. Purpose statements are generally better than definitions
3. All is metadata



Purpose Statement Incorporates Motivational Metadata

Entity:	BED
Data Asset Type:	Principal Data Entity
Purpose:	Beds are the primary means to be used to track patients within the Facility. Each bed will track exactly 1 patient.
Source:	Maintenance Manual for File and Table Data (Software Version 3.0, Release 3.1)
Attributes:	Bed.Description Bed.Status Bed.Sex.To.Be.Assigned Bed.Reserve.Reason Bed.Id
Associations:	>0-+ Room ←
Status:	DRAFT

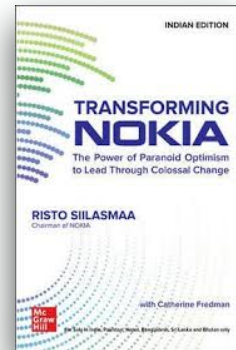


- A purpose statement describing**
- Why the organization is maintaining information about this business concept;
 - Sources of information about it;
 - A partial list of the attributes or characteristics of the entity; and
 - Associations with other data items(read as "One room contains zero or many beds.")



(Pre Microsoft Acquisition)

- Tires, rubber products
- Consumer electronics
- Mobile phones
 - Finns are bilingual (2% of population speaks Swedish)
 - Nokia wanted to play internationally
 - English mandated in all business settings
 - Lots of words were unknown
 - Culturally: Bad to not ask questions
 - Culturally: Good to build common vocabulary
- When an unfamiliar term was used
 - Group: Access NTB to see if there existed a golden definition
 - Group: If not, vote whether to submit it for inclusion in the NTB
 - Weekly: the NTB group reviewed submissions
 - Weekly: the NTB group published new versions of the NTB
 - NTB = Nokia Term Bank



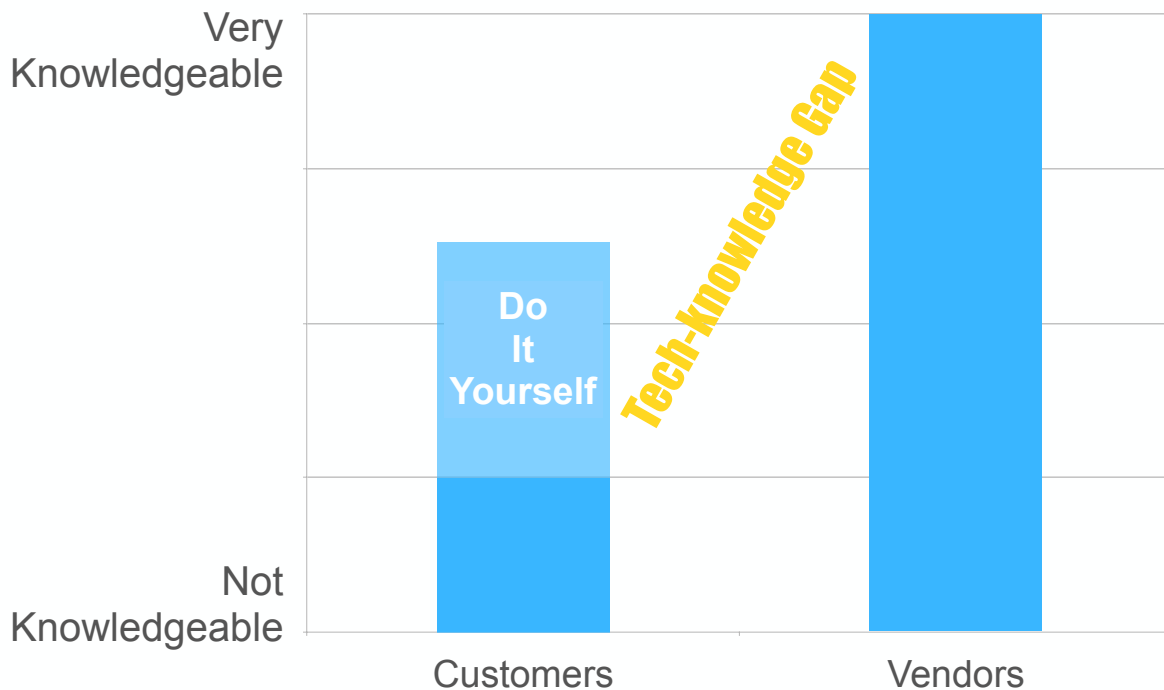
NTB = Trusted Catalog

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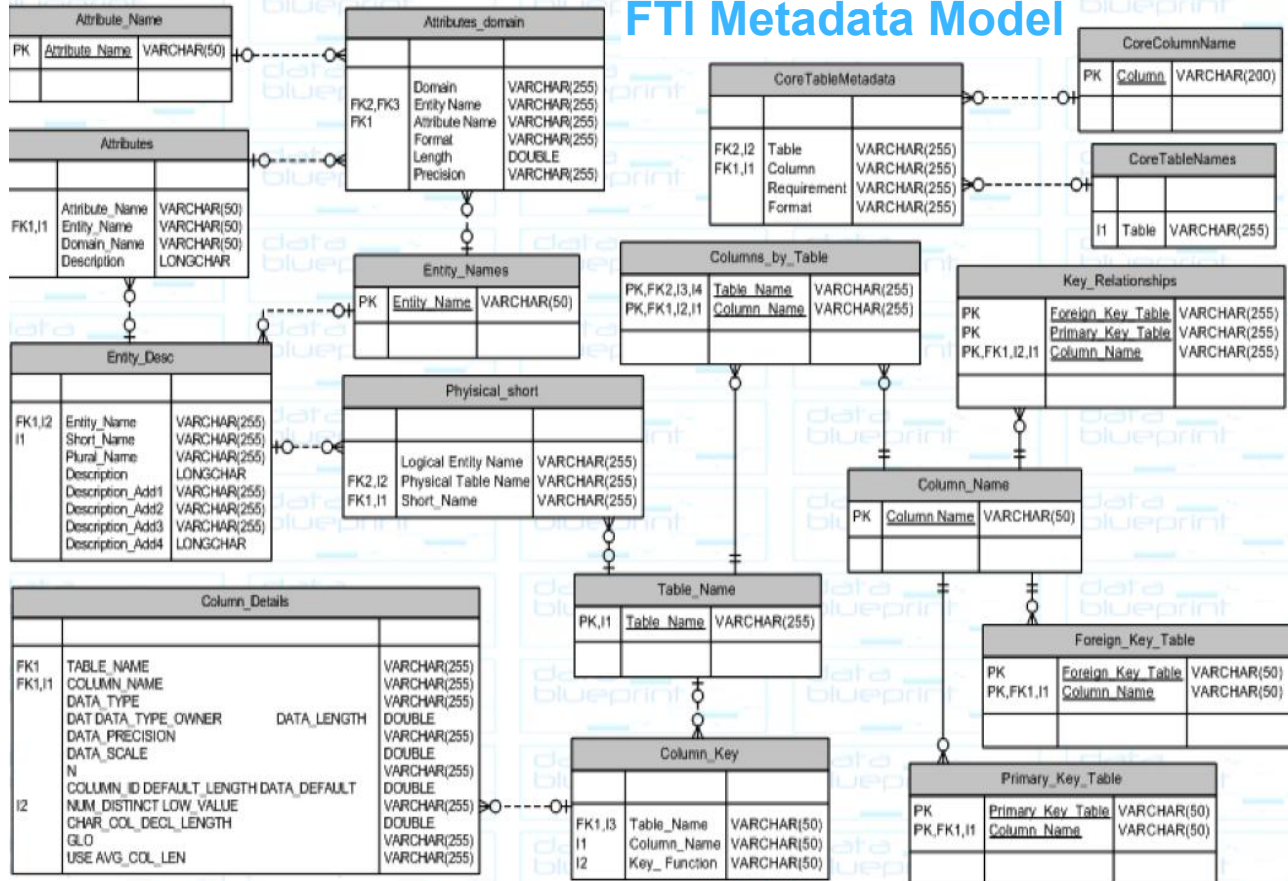
Unequal Conversations



<https://anytingaustone.com>

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FTI Metadata Model



Build Your Own Metadata Repository

Microsoft Access - [Table_Column: Form]

File Edit View Insert Format Records Tools Window Help

FTI METADATA REPOSITORY

Logical Construction

Select... *table of interest from the alphabetized drop down list.* *Double-click column name selection for column metadata.*

Tables

FT T_ACCT

Entity to display name and description of associated table.

Domains to display names of entities and attributes for domains of interest.

Return to FTI Metadata Repository selections.

Column Name

Column_Name	Key_Function
ACCT_ID	Primary
BK_ID	Primary
ORG_ID	Primary
BK_ID	Foreign
ORG_ID	Foreign
PLNE_ORG_ID	Foreign
PLNE_PRODLN_ID	Foreign
INSTR_ID	Foreign
ACTP_ACCT_TYP	Foreign
ACTP_ORG_ID	Foreign
LAST_CHG_USER_ID	
LEV_SRVC_MNEM	
ACCT_RST_IND_TYP	
MRGN_DLNCY_IND	
DPSTRY_AFRM_TYP	
THPTY_AFRM_INST_ID	
NAME_SORT_KEY_TXT	
ACCT_NME	
ACCT_DESC	
ACCT_CLS_DTE	
ACCT_CLS_REAS_TYP	
ACCT_OPEN_DTE	

Form view



Double-click column name selection for column metadata.

Tables

FT_T_ABDP

Entity to display name and description of associated table.

Column Name

Column Name	Key_Function
ACTG_BAS_ID	Primary
INC_OWNER_BAS_TYP	
IV_OWNER_BAS_TYP	
LAST_CHG_USR_ID	
ACCRL_BAS_TYP	
CTL_ACCT_OF_IND	
DBL_ENTRY_ACTG_IND	
MULTI_IND	
PRIN_INC_OWN_IND	
MULT_ACCT_POST_TYP	
MAINT_CRVLCOVL_IND	
ACTG_BAS_DESC	
AC	

Column_Details

COLUMN_NAME: ACTG_BAS_ID

DATA_TYPE: CHAR

DATA_LENGTH: 4

DATA_PRECISION:

CHAR_COL: 4

DECL_LENGTH:

USE_AVG_COL_LEN: NO

DATA_SCALE:

GLO: NO

Y/N: N

NUM_DISTINCT: CHAR_CS

LOW_VALUE:

COLUMN_ID: 1

DEFAULT_LENGTH:

Primary Key Table Foreign Key Table Table Usage

Primary_Key_Table

Column Name: ACTG_BAS_ID

FTI data tables using this column as primary key...

Primary Key Table

Primary Key Table
FT_T_ABDP
FT_T_TEDF
FT_T_VCBP
*

Foreign_Key_Table

Column Name: ACTG_BAS_ID

FTI data tables using this column as key...

Foreign Key Table

Foreign Key Table
FT_T_IAIA
FT_T_ITER
FT_T_JECL
FT_T_TEDF
FT_T_TERS
FT_T_VCBP
*

Double-click column name selection for column metadata.

Tables

FT_T_ABDP

Entity to display name and description of associated table.

Column Name

Column Name	Key_Function
ACTG_BAS_ID	Primary
INC_OWNER_BAS_TYP	
IV_OWNER_BAS_TYP	
LAST_CHG_USR_ID	
ACCRL_BAS_TYP	
CTL_ACCT_OF_IND	
DBL_ENTRY_ACTG_IND	
MULTI_IND	
PRIN_INC_OWN_IND	
MULT_ACCT_POST_TYP	
MAINT_CRVLCOVL_IND	
ACTG_BAS_DESC	
AC	

Column_Details

COLUMN_NAME: ACTG_BAS_ID

DATA_TYPE: CHAR

DATA_LENGTH: 4

DATA_PRECISION:

CHAR_COL: 4

DECL_LENGTH:

USE_AVG_COL_LEN: NO

DATA_SCALE:

GLO: NO

Y/N: N

NUM_DISTINCT: CHAR_CS

LOW_VALUE:

COLUMN_ID: 1

DEFAULT_LENGTH:

Primary Key Table Foreign Key Table Table Usage

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FT_T_TEDF
FT_T_VCBP
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Column Name: ACTG_BAS_ID

FTI data tables using this column as key...

Foreign Key Table

Foreign Key Table
FT_T_IAIA
FT_T_ITER
FT_T_JECL
FT_T_TEDF
FT_T_TERS
FT_T_VCBP
*

Where Does This Key Function as a Primary Key?

Logical Construction

Double-click column name selection for column metadata.

Tables
FT_T_ABDP

Entity to display name and description of associated table.

Column Name

Column Name	Key_Function
▶ ACTG_BAS_ID	Primary
INC_OWNER_BAS_TYP	
IV_OWNER_BAS_TYP	
LAST_CHG_USR_ID	
ACCRL_BAS_TYP	
CTL_ACCT_OF_IND	
DBL_ENTRY_ACTG_IND	
MULTI_IND	
PRIN_INC_OWN_IND	
MULT_ACCT_POST_TYP	
MAINT_CRVLCOVL_IND	
ACTG_BAS_DESC	

Column_Details

COLUMN_NAME: ACTG_BAS_ID
DATA_TYPE: CHAR
DATA_LENGTH: 4
DATA_PRECISION:
CHAR_COL_DECL_LENGTH: 4
USE_AVG_COL_LEN: NO
DATA_SCALE:
GLO: NO
Y/N: N
NUM_DISTINCT_LOW_VALUE: CHAR_CS
COLUMN_ID: 1
DEFAULT_LENGTH:

Foreign_Key_Table

Column Name: ACTG_BAS_ID

FTI data tables using this column as key...

Foreign Key Table

Foreign Key Table
▶ FT_T_IAIA
FT_T_ITER
FT_T_JECL
FT_T_TEDF
FT_T_TERS
FT_T_VCBP
*

Primary_Key_Table

Column Name: ACTG_BAS_ID

FTI data tables using this column as primary key...

Primary Key Table

Primary Key Table
▶ FT_T_ABDP
FT_T_TEDF
FT_T_VCBP
*

Primary Key Table Foreign Key Table Table Usage

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Where Does This Key Function as a Foreign Key?

Logical Construction

Double-click column name selection for column metadata.

Tables
FT_T_ABDP

Entity to display name and description of associated table.

Column Name

Column Name	Key_Function
▶ ACTG_BAS_ID	Primary
INC_OWNER_BAS_TYP	
IV_OWNER_BAS_TYP	
LAST_CHG_USR_ID	
ACCRL_BAS_TYP	
CTL_ACCT_OF_IND	
DBL_ENTRY_ACTG_IND	
MULTI_IND	
PRIN_INC_OWN_IND	
MULT_ACCT_POST_TYP	
MAINT_CRVLCOVL_IND	
ACTG_BAS_DESC	

Column_Details

COLUMN_NAME: ACTG_BAS_ID
DATA_TYPE: CHAR
DATA_LENGTH: 4
DATA_PRECISION:
CHAR_COL_DECL_LENGTH: 4
USE_AVG_COL_LEN: NO
DATA_SCALE:
GLO: NO
Y/N: N
NUM_DISTINCT_LOW_VALUE: CHAR_CS
COLUMN_ID: 1
DEFAULT_LENGTH:

Foreign_Key_Table

Column Name: ACTG_BAS_ID

FTI data tables using this column as key...

Foreign Key Table

Foreign Key Table
▶ FT_T_IAIA
FT_T_ITER
FT_T_JECL
FT_T_TEDF
FT_T_TERS
FT_T_VCBP
*

Primary_Key_Table

Column Name: ACTG_BAS_ID

FTI data tables using this column as primary key...

Primary Key Table

Primary Key Table
▶ FT_T_ABDP
FT_T_TEDF
FT_T_VCBP
*

Primary Key Table Foreign Key Table Table Usage

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Where Does This Key Function as an Attribute?

Logical Construction

Double-click column name to display column metadata.

Tables
FT_T_ABDP

Entity to display name and description of associated table.

Column Name

Column Name	Key Function
ACTG_BAS_ID	Primary
INC_OWNER_BAS_TYP	
IV_OWNER_BAS_TYP	
LAST_CHG_USR_ID	
ACCRL_BAS_TYP	
CTL_ACCT_OF_IND	
DBL_ENTRY_ACTG_IND	
MULTI_IND	
PRIN_INC_OWN_IND	
MULT_ACCT_POST_TYP	
MAINT_CRVLCOVL_IND	
ACTG_BAS_DESG	

Foreign_Key_Table

Column Name: ACTG_BAS_ID

FTI data tables using this column as key...

Foreign Key Table

Foreign Key Table
FT_T_IAIA
FT_T_ITER
FT_T_JECL
FT_T_TEDF
FT_T_TERS
FT_T_VCBP

Primary_Key_Table

Column Name: ACTG_BAS_ID

FTI data tables using this column as primary key...

Primary Key Table

Primary Key Table
FT_T_ABDP
FT_T_TEDF
FT_T_VCBP

Primary Key Table Foreign Key Table Table Usage

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Metadata Yields ...

FTI METADATA REPOSITORY

Select a table of interest from the alphabetical drop-down list. Double-click column name selection for column metadata.

Logical Construction

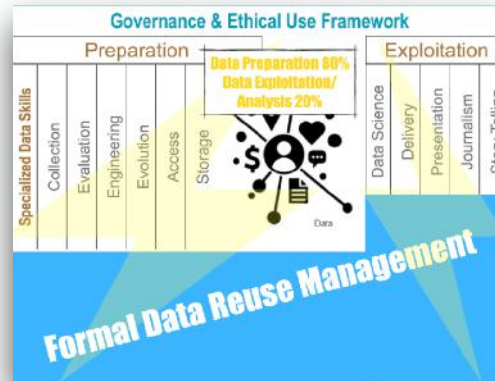
FTI data tables using this column as a foreign key...

Foreign Key Table

FTI data tables using this column as primary key...

Primary Key Table

idr research



Valuable information about your data assets:

- Do we have these specific (or this class of) data assets? **Yes!**
- Is this data item used elsewhere? **Nowhere!**
- What did cost to acquired this set of assets? **35¢/apiece**
- Can these data assets be share securely? **Not easily!**
- ... (a model for how your information should be managed)

Program overview

The Importance of Metadata Leveraging Strategies

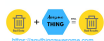


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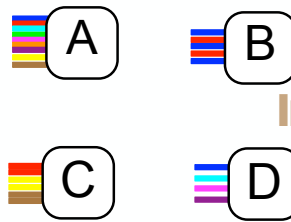
Architecture

- Things
 - (components)
data structures
- The functions of the things
 - (individually)
sources and uses of data
- How the things interact
 - (as a system, towards a goal)
Efficiencies/effectiveness

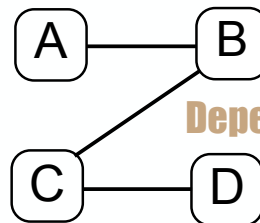
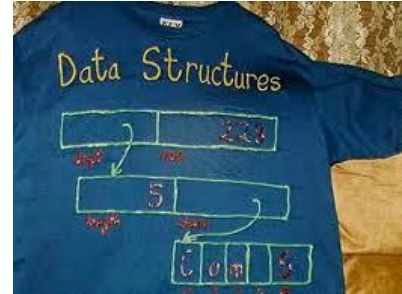


How Are Components Expressed as Architectures?

- Details are organized into larger components
- Larger components are organized into models
- Models are organized into architectures (composed of architectural components)

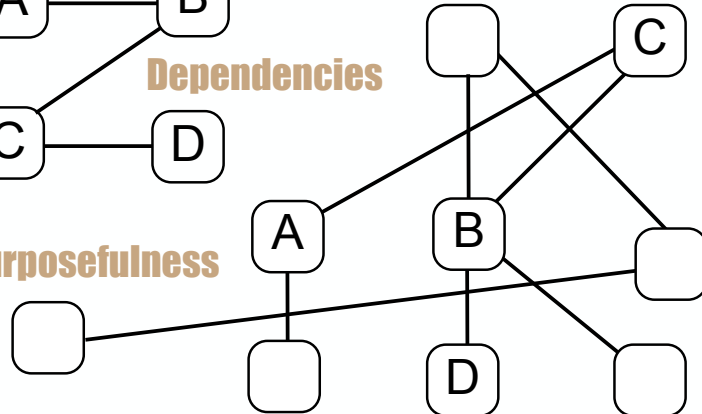


Intricate



Dependencies

Purposefulness



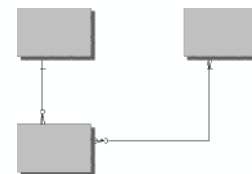
How Are Data Structures Expressed as Architectures?

- **Attributes** are organized into entities/objects
 - Attributes are characteristics of "things"
 - Entities/objects are "things" whose information is managed in support of strategy
 - Example(s)
- **Entities/objects** are organized into models
 - Combinations of attributes and entities are structured to represent information requirements
 - Poorly structured data, constrains organizational information delivery capabilities
 - Example(s)
- **Models** are organized into **architectures**
 - When building new systems, architectures are used to plan development
 - More often, data managers do not know what existing architectures are and - therefore - cannot make use of them in support of strategy implementation
 - *Why no examples?*

Intricate

THING
Club.Id #
Club.Description
Club.Status
Club.Sex.To.Be.Assigned
Club.Reserve.Reason

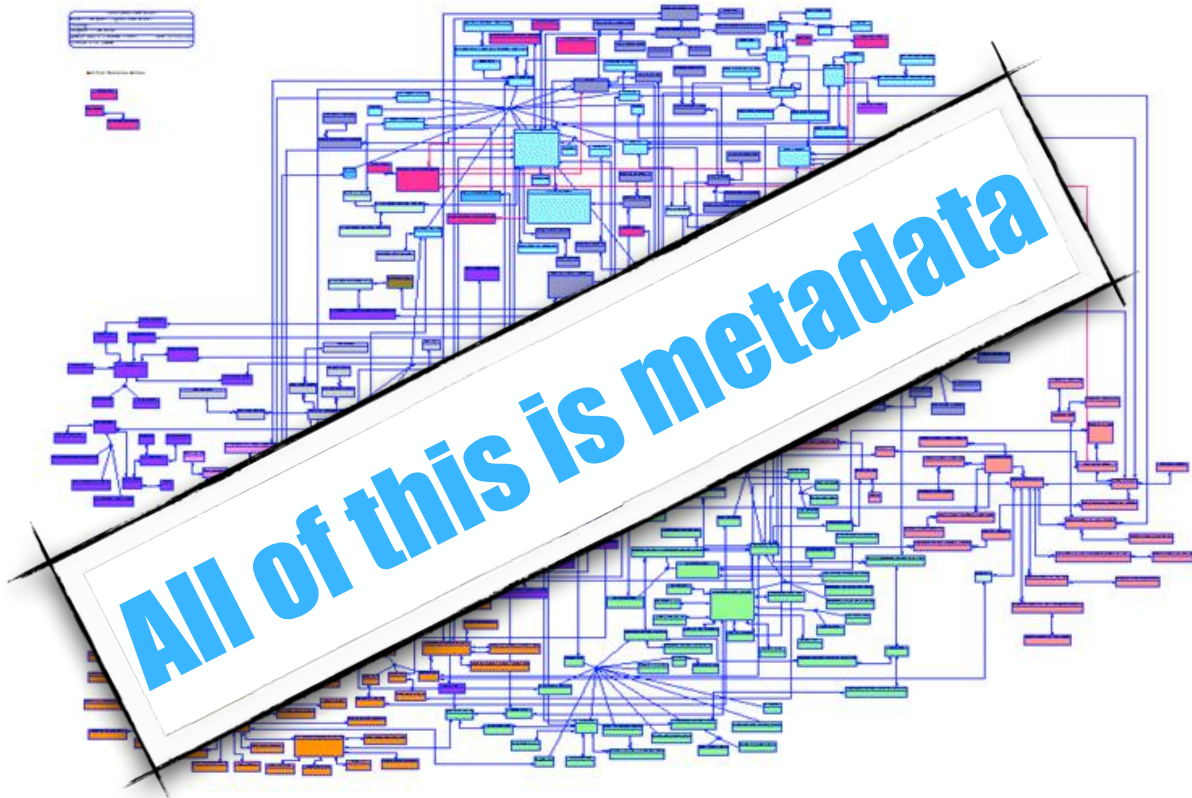
Dependencies



Purposefulness

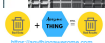
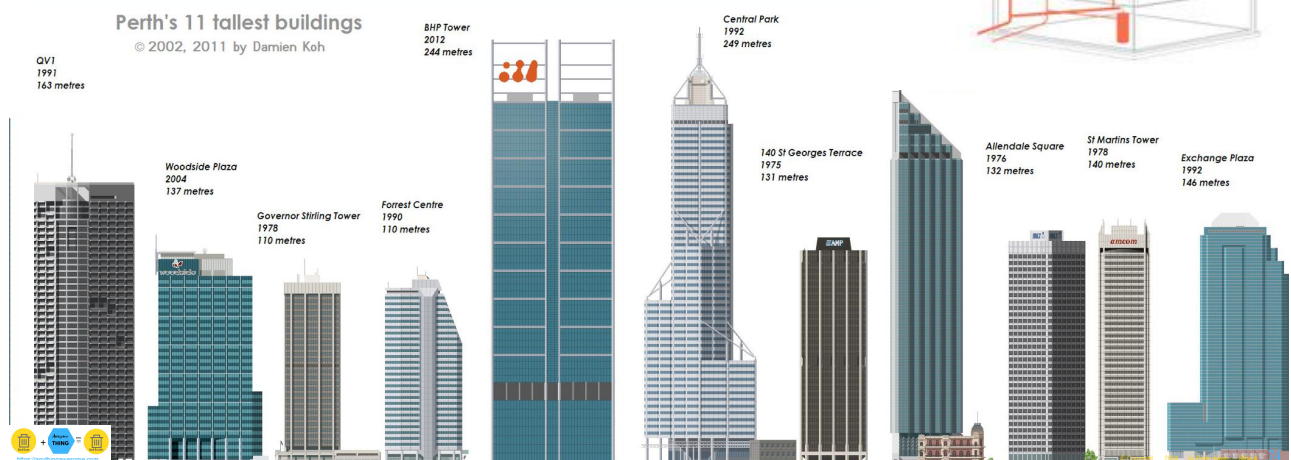


Data Architectures Are Composed of Data Models

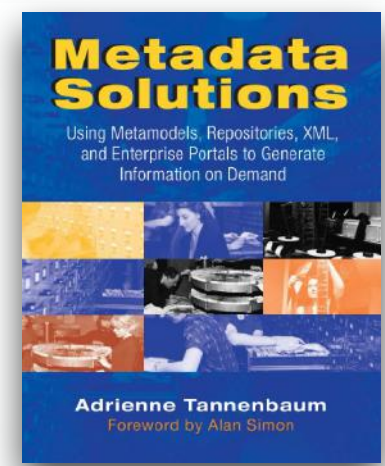
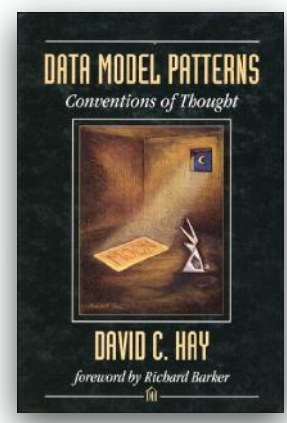
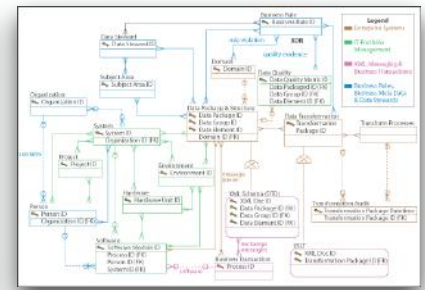
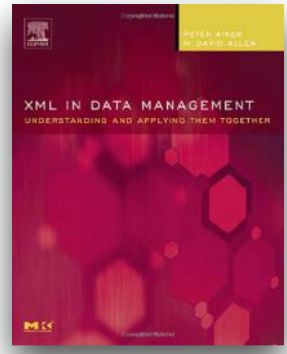
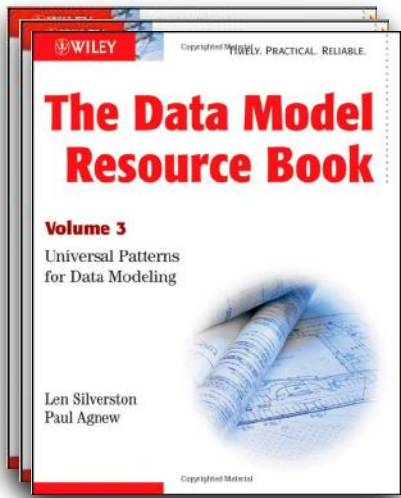


Metadata Specifies Design Patterns

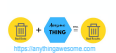
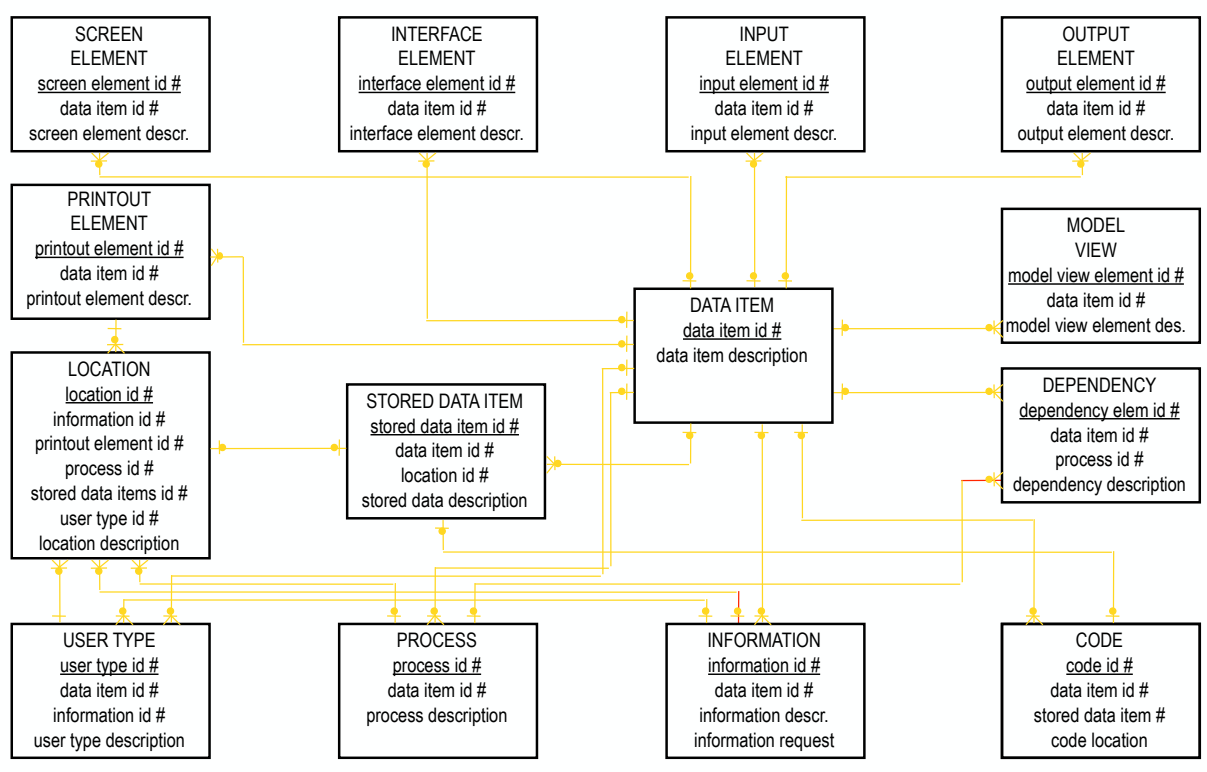
- Why are the restrooms in the same place on each floor?
- What about the electrical wiring?
- HVAC? Floorplans? ...
- Architecture design patterns (spoke and hub, hub of hubs, warehouse, cloud, MDM, changing tires, portal)



Purchasable Metadata Models



A Generalized Model for Maintaining Metadata



Application Build Model

Defines the tools, parameters and environment required to build an automated Business Application.

Applications Structure Model

Defines the overall scope of an automated Business Application, the components of the application and how they fit together.

Business Goals Model

Defines the mission of the enterprise, its long-range goals, and the business policies and assumptions that affect its operations.

Business Rules Model

Records rules that govern the operation of the business and the Business Events that trigger execution of Business Processes.

Data Structures Model

Defines the data structures and their elements used in an automated Business Application.

DB2 Model

Refines the definition of a Relational Database design to a DB2-specific design.

Derivations/Constraints Model

Records the rules for deriving legal values for instances of Entity-Relationship Model components, and for controlling the use or existence of E-R instance.

Enterprise Structure Model

Defines the scope of the enterprise to be modeled. Assigns a name to the model that serves to qualify each component of the model.

Entity-Relationship Model

Defines the Business Entities, their properties (attributes) and the relationships they have with other Business Entities.

Extension Support Model

Provides for tactical Information Model extensions to support special tool needs.

Flow Model

Specifies which of the Entity Relationship Model component instances are passed between Process Model components.

Global Text Model

Supports recording of extended descriptive text for many of the Information Model components.

IMS Structures Model

Defines the component structures and elements (attributes) and the application program views of an IMS Database.

Info Usage Model

Specifies which of the Entity-Relationship Model component instances are used by other Information Model components.

Library Model

Records the existence of non-repository files and the role they play in defining and building an automated Business Application.

Organization/Location Model

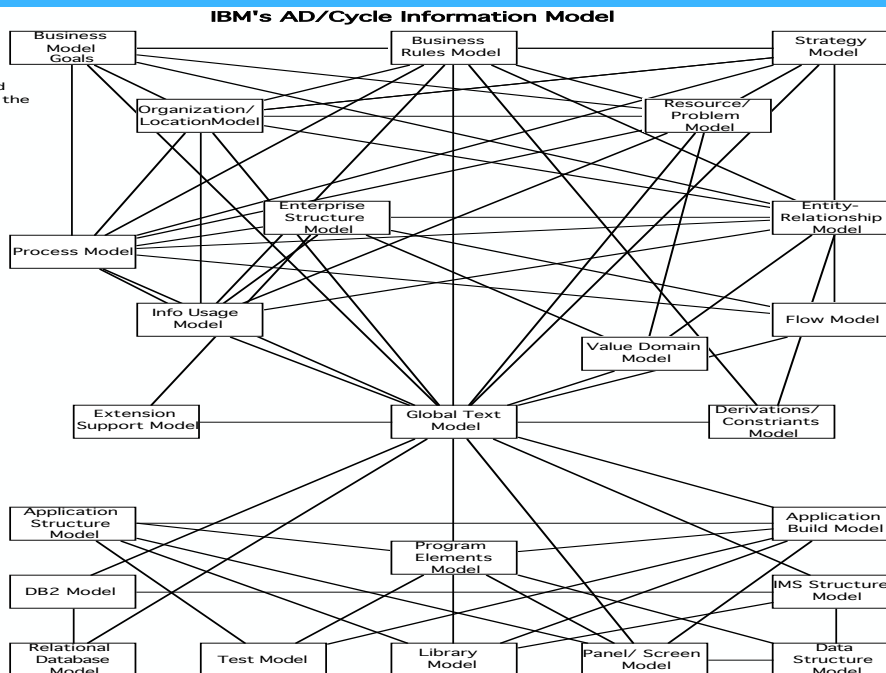
Records the organization structure and location definitions for use in describing the enterprise.

Panel/Screen Model

Identifies the Panels and Screens and the fields they contain as elements used in an automated Business Application.

Process Model

Defines Business Processes, their sub processes and components.



Library Model

Records the existence of non-repository files and the role they play in defining and building an automated Business Application.

Records the organization structure and location definitions for use in describing the enterprise.

Panel/Screen Model

Identifies the Panels and Screens and the fields they contain as elements used in an automated Business Application.

Defines Business Processes, their sub processes and components.

Program Elements Model

Identifies the various pieces and elements of application program source that serve as input to the application build process.

Identifies the problems and needs of the enterprise, the projects designed to address those needs, and the resources required.

Describes the components of a Relational Database design in terms common to all SAA relational DBMSs.

Strategy Model

Records business strategies to resolve problems, address goals, and take advantage of business opportunities. It also records the actions and steps to be taken.

Identifies the various file (test procedures, test cases, etc.) affiliated with an automated business Application for use in testing that application.

Defines the data characteristics and allowed values for information items.



Montgomery, S. L. (1991). AD/Cycle: IBM's Framework for Application Development and CASE. Van Nostrand Reinhold https://books.google.com/books/about/AD_Cycle.html?id=UR-zAAAAIAAJ

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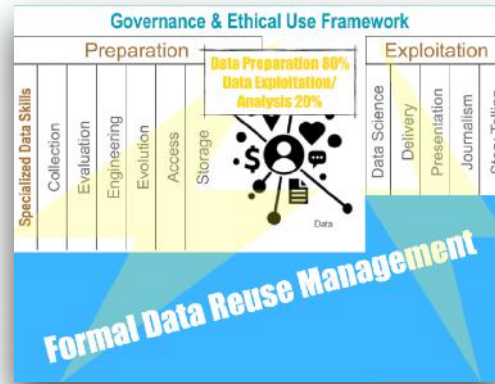
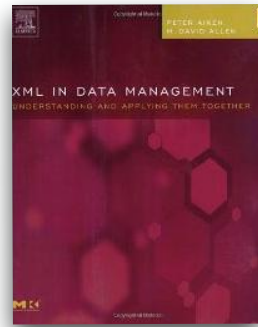
Metadata for Semistructured Data

- Metadata describes both structured and semi-structured data
 - You cannot convert unstructured data into structured data
- Better description
 - Non-tabular data → tabular data
- Semi-structured data
 - Any data that is not in a database or data file, including documents or other media data
- Metadata for semi-structured data exists in many formats, responding to a variety of different requirements
- Examples of metadata repositories describing unstructured data:
 - Content management applications
 - University websites
 - Company intranet sites
 - Data archives
 - Electronic journals collections
 - Community resource lists
- Common method for classifying Metadata in unstructured sources is to describe them as **descriptive** metadata, **structural** metadata, or **administrative** metadata
- Examples of **descriptive** metadata:
 - Catalog information
 - Thesauri keyword terms
- Examples of **structural** metadata
 - Dublin Core
 - Field structures
 - Format (audio/visual, booklet)
 - Thesauri keyword labels
 - XML schemas
- Examples of **administrative** metadata
 - Source(s)
 - Integration/update schedule
 - Access rights
 - Page relationships (e.g. site navigational design)



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Metadata Patterns Yield ...



Valuable comparisons and 'starting foundations':

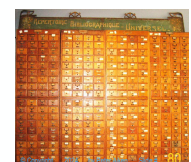
- Do we have to create a pharmacy billing system from scratch? **No!**
- Will the proposed software 'fit'? **Yes!**
- Do industry best practices exist? **Yes**
- Has anyone published a model implementing GPDR? **Not yet!**



Program overview

- Defining metadata in the context of data management
 - Defining data management
 - What do we mean by using data as metadata and why is this important? (Hint: leverage)
 - Specific teachable example using iTunes/Music™
- S1: Metadata is a gerund—do not treat it as a noun
 - Metadata is a use of data, not a type of data
- S2: Enforce metadata to be the language of data governance
 - Make metadata the language of data governance
- S3: Treat glossaries/repositories as capabilities not technology
 - Cyclic approaches do not start with technologies
- S4: Build from metadata building blocks
 - Many many many resources available to jump-start metadata efforts
- Benefits, application & sources
 - Understand that metadata defines organizational interoperability
- Take Aways, References and Q&A

The Importance of Metadata
Leveraging Strategies



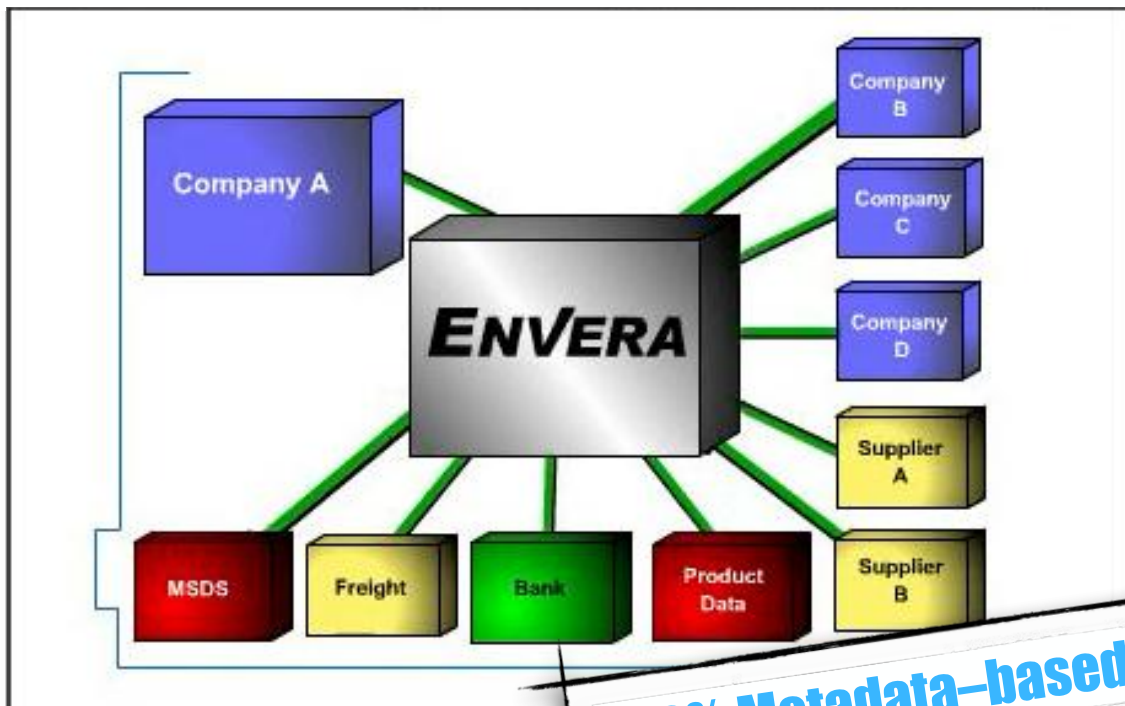


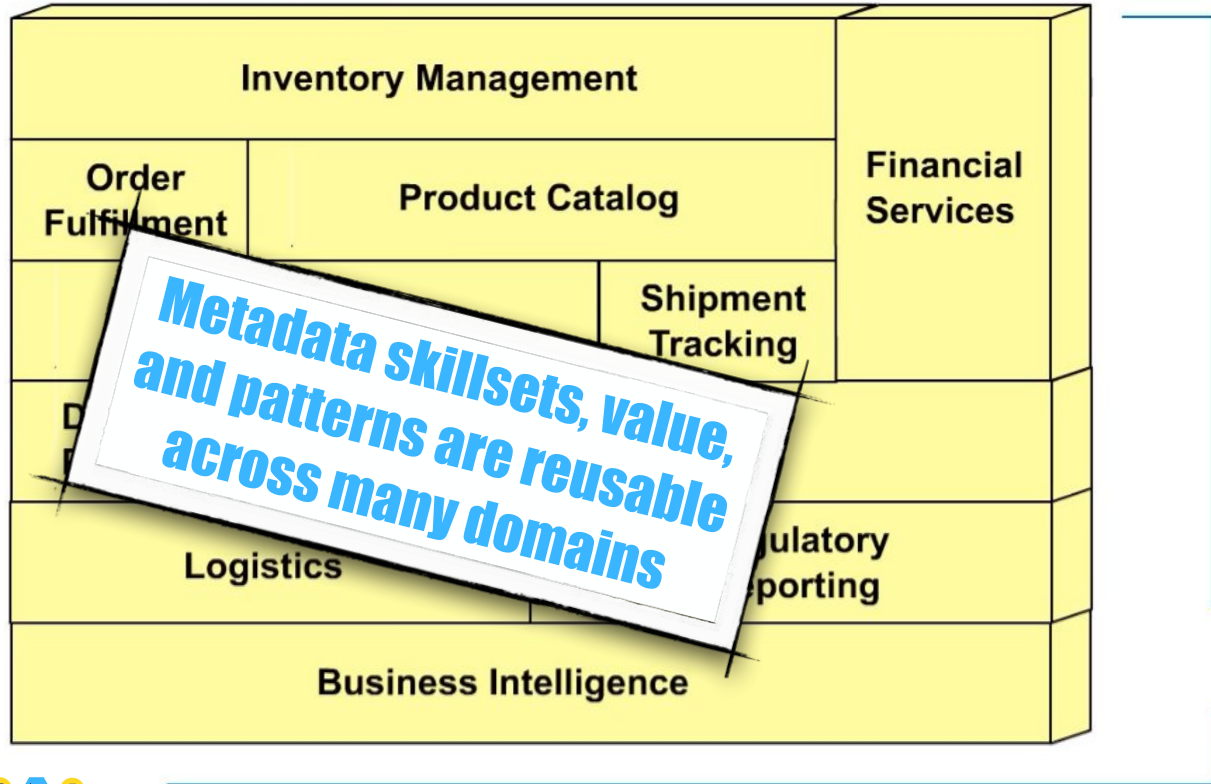
- **They** know you rang a phone sex service at 2:24 am and spoke for 18 minutes. But they don't know what you talked about.
- **They** know you called the suicide prevention hotline from the Golden Gate Bridge. But the topic of the call remains a secret.
- **They** know you spoke with an HIV testing service, then your doctor billed your health insurance company in the same hour. But they don't know what you discussed.
- **They** know you received a call from the local Planned Parenthood office while it was having a campaign against the abortion, and they called your senators and congressional representatives immediately after. But the content of those calls remains a secret from your intrusion.
- **They** know you called a gynecologist, spoke for a half hour, and then called the local Planned Parenthood's number later that day. But nobody knows what you spoke about.

"It's just metadata"



Envera Business Value Proposition





FEPA/OPEN Government Data Act



- Signed on 1/14/19
- Foundations for Evidence-Based Policymaking (FEBP) Act (H.R._4174,_S._2046)
- Title II, which includes the Open, Public, Electronic, and Necessary (OPEN) Government Data Act
 - All federal data is open by default
 - Non-political CDOs are required
 - Use of open data and open models required in policy evolution
 - Penalties are higher than HIPAA

Program overview

The Importance of Metadata 3 Leveraging Strategies

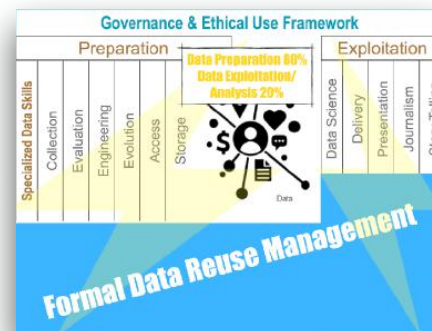


- Defining metadata in the context of data management
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Metadata Benefits ...

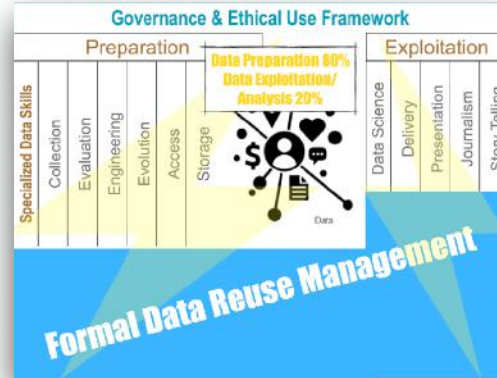
- Increase the value of **strategic information** (e.g. data warehousing, CRM, SCM, etc.) by providing context for the data, thus aiding analysts in making more effective decisions.
- Reduce **training costs** and lower the impact of staff turnover through thorough documentation of data context, history, and origin.
- Reduce data-oriented research time by **assisting business analysts** in finding the information they need in a timely manner.
- Improve communication by bridging the **gap** between business users and IT professionals, leveraging work done by other teams and increasing confidence in IT system data.
- Increased speed of system development's **time-to-market** by reducing system development life-cycle time.
- Reduce **risk** of project failure through better impact analysis at various levels during change management.
- Identify and reduce redundant data and processes, thereby **reducing** rework and use of redundant, out-of-data, or incorrect data.





Metadata Program Take Aways

- 'Data about data'
- Metadata unlocks the value of data, and therefore requires management attention [Gartner]
- Metadata is less about what and more about how
- Metadata must be the language of data governance in order to keep it focused
- Metadata definitions the essence of correctly specifying most organizational challenges
- Should we include this data item within the scope of our metadata practices?



References & Recommended Reading

11.4.1 General Reading

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Collier, Ken. Executive Report, Business Intelligence Advisory Service, *Finding the Value in Metadata Management* (Vol. 4, No. 1), 2004. Available only to Cutter Consortium Clients, <http://www.cutter.com/bia/fulltext/reports/2004/01/index.html>.

Hay, David C. Data Model Patterns: A Metadata Map. Morgan Kaufmann, 2006. ISBN 0-120-88798-3. 432 pages.

Hillmann, Diane I. and Elaine L. Westbrooks, editors. Metadata in Practice. American Library Association, 2004. ISBN 0-838-90882-9. 285 pages.

Inmon, William H., Bonnie O'Neil and Lowell Fryman. Business Metadata: Capturing Enterprise Knowledge. 2008. Morgan Kaufmann ISBN 978-0-12-373726-7. 314 pages.

Marco, David, Building and Managing the Meta Data Repository: A Full Life-Cycle Guide. John Wiley & Sons, 2000. ISBN 0-471-35523-2. 416 pages.

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Poole, John, Dan Change, Douglas Tolbert and David Mellor. Common Warehouse Metamodel: An Introduction to the Standard for Data Warehouse Integration. John Wiley & Sons, 2001. ISBN 0-471-20052-2. 208 pages.



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Poole, John, Dan Change, Douglas Tolbert and David Mellor. Common Warehouse Metamodel Developer's Guide. John Wiley & Sons, 2003. ISBN 0-471-20243-6. 704 pages.

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Tannenbaum, Adrienne. Implementing a Corporate Repository, John Wiley & Sons, 1994. ISBN 0-471-58537-8. 441 pages.

Tannenbaum, Adrienne. Metadata Solutions: Using Metamodels, Repositories, XML, And Enterprise Portals to Generate Information on Demand. Addison Wesley, 2001. ISBN 0-201-71976-2. 528 pages.

Wertz, Charles J. The Data Dictionary: Concepts and Uses, 2nd edition. John Wiley & Sons, 1993. ISBN 0-471-60308-2. 390 pages.



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11.4.2 Meta-data in Library Science

Baca, Murtha, editor. Introduction to Metadata: Pathways to Digital Information. Getty Information Institute, 2000. ISBN 0-892-36533-1. 48 pages.

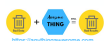
Hillmann, Diane I., and Elaine L. Westbrooks. Metadata in Practice. American Library Association, 2004. ISBN 0-838-90882-9. 285 pages.

Karpuk, Deborah. METADATA: From Resource Discovery to Knowledge Management. Libraries Unlimited, 2007. ISBN 1-591-58070-6. 275 pages.

Liu, Jia. Metadata and Its Applications in the Digital Library. Libraries Unlimited, 2007. ISBN 1-291-58306-6. 250 pages.

11.4.3 Geospatial Meta-data Standards

<http://www.fgdc.gov/metadata/geospatial-metadata-standards>.



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11.4.4 ISO Meta-data Standards

ISO Standards Handbook 10, Data Processing—Vocabulary, 1982.

ISO 704:1987, Principles and methods of terminology.

ISO 1087, Terminology—Vocabulary.

ISO 2382-4:1987, Information processing systems—Vocabulary part 4.

ISO/IEC 10241:1992, International Terminology Standards—Preparation and layout.

FCD 11179-2, Information technology—Specification and standardization of data elements - Part 2: Classification for data elements.

ISO/IEC 11179-3:1994, Information technology—Specification and standardization of data elements - Part 3: Basic attributes of data elements.

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ISO/IEC 11179-5:1995, Information technology—Specification and standardization of data elements - Part 5: Naming and identification principles for data elements.

ISO/IEC 11179-6:1997, Information technology—Specification and standardization of data elements - Part 6: Registration of data elements.



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Upcoming Events

Time: 19:00 UTC (2:00 PM NYC) | Presented by: Peter Aiken, PhD

Data Quality Management

12 September 2024



Strategy is Where Data Architecture and Data Governance Collide

8 October 2024



Data Warehousing Capabilities - Deploying to Support the Business

12 November 2024

Brought to you by:



[Clicking any webinar title will link directly to the registration page]

Critical Design Review?

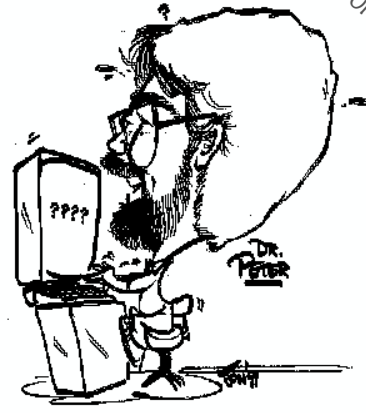
Mentoring?

Executive Data Literacy Training?

Collaboration?



Peter.Aiken@AnythingAwesome.com +1.804.382.5957



Independent Verification & Validation

Reverse Engineering Expertise?

Hiring Assistance?

Thank You!

Use your data more strategically?

Tool/automation evaluation?



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