



PASS SUMMIT 2013

October 15-18, 2013
Charlotte, NC

Fast Performing SSAS Hierarchies

Tips & Tricks

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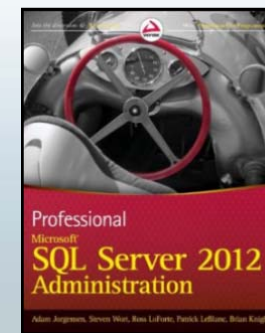
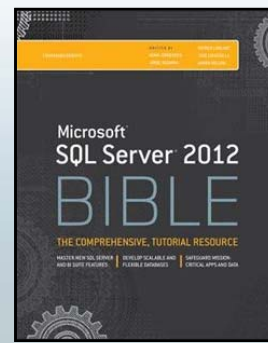
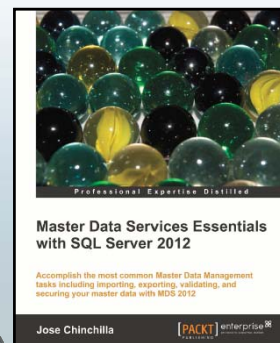
@sqljoe

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<http://www.linkedin.com/in/josechinchilla>

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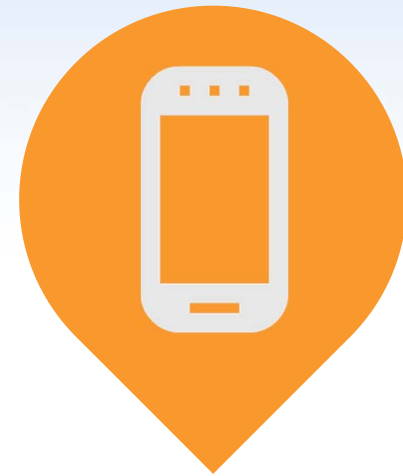
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Agenda: Part 1

- **Types & classification of hierarchies**
 - Natural & unnatural hierarchies
 - Attribute hierarchies vs. User hierarchies
 - Parent-child hierarchies
 - Balanced, unbalanced & ragged hierarchies
- **Demo**
 - Designing & optimizing hierarchies
 - Dim Products
 - Dim Reseller
 - Dim Geography
 - Dim Employee
 - Dim Date
 - Dim Account
- **Break**

Agenda: Part 2

- **Troubleshooting performance**
 - DMVs
 - Performance Monitor
- **Aggregations & Partitions**
 - Portioning strategy
 - Default aggregations
 - Usage based optimizations
- **Drill-down or Drill-through?**
- **Demo**
 - Adding Aggregations and Partitions
 - Adding Drill-through actions

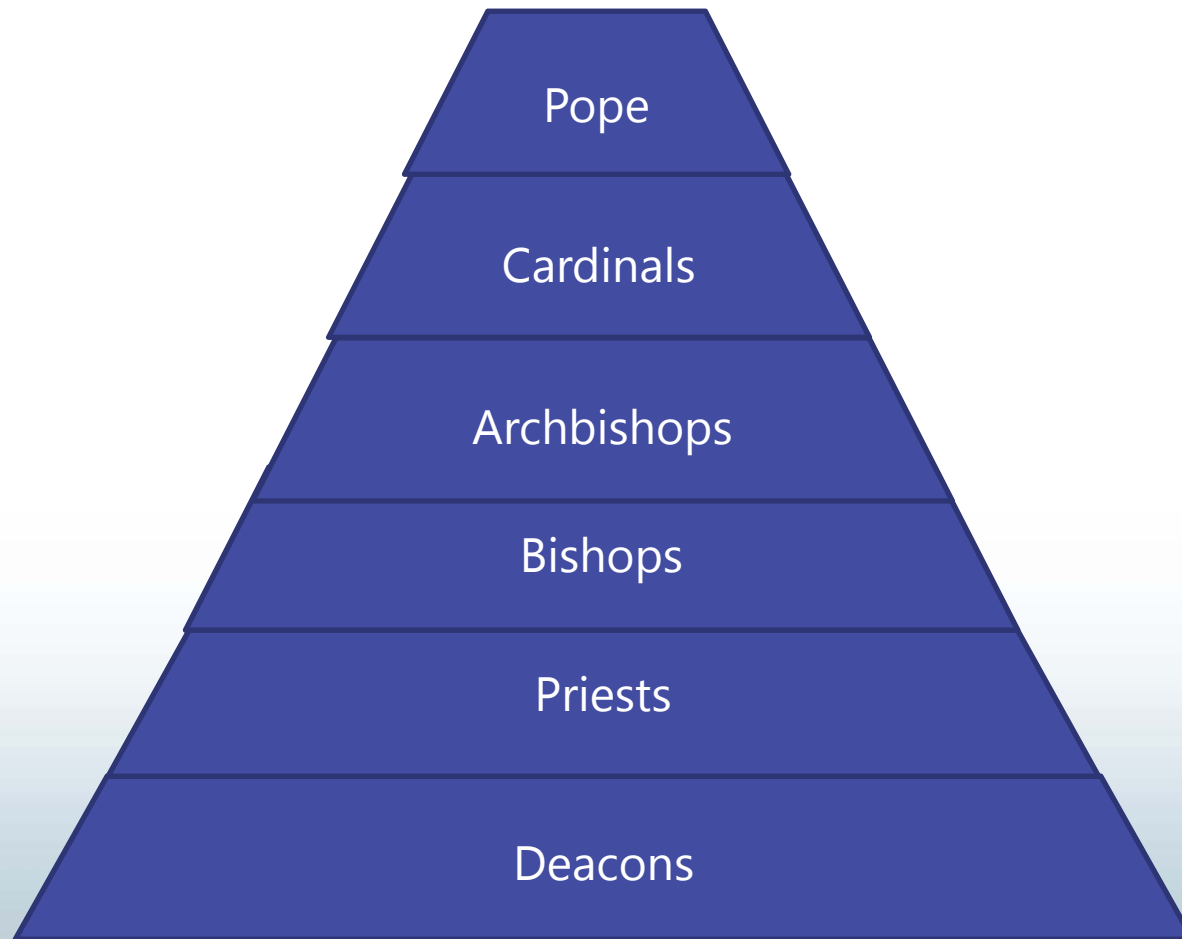
Hierarchies

Types & Classification

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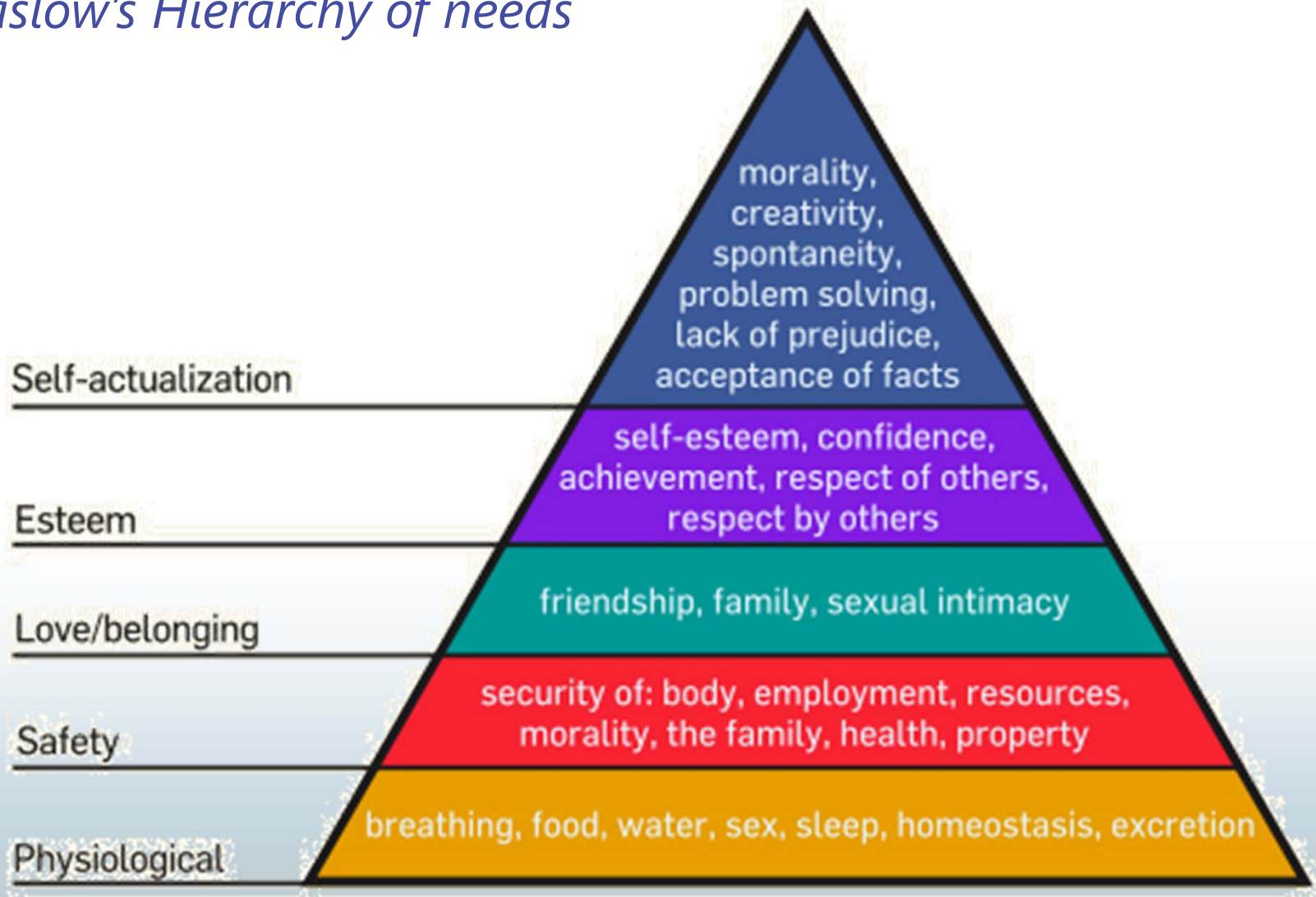


Hierarchies everywhere

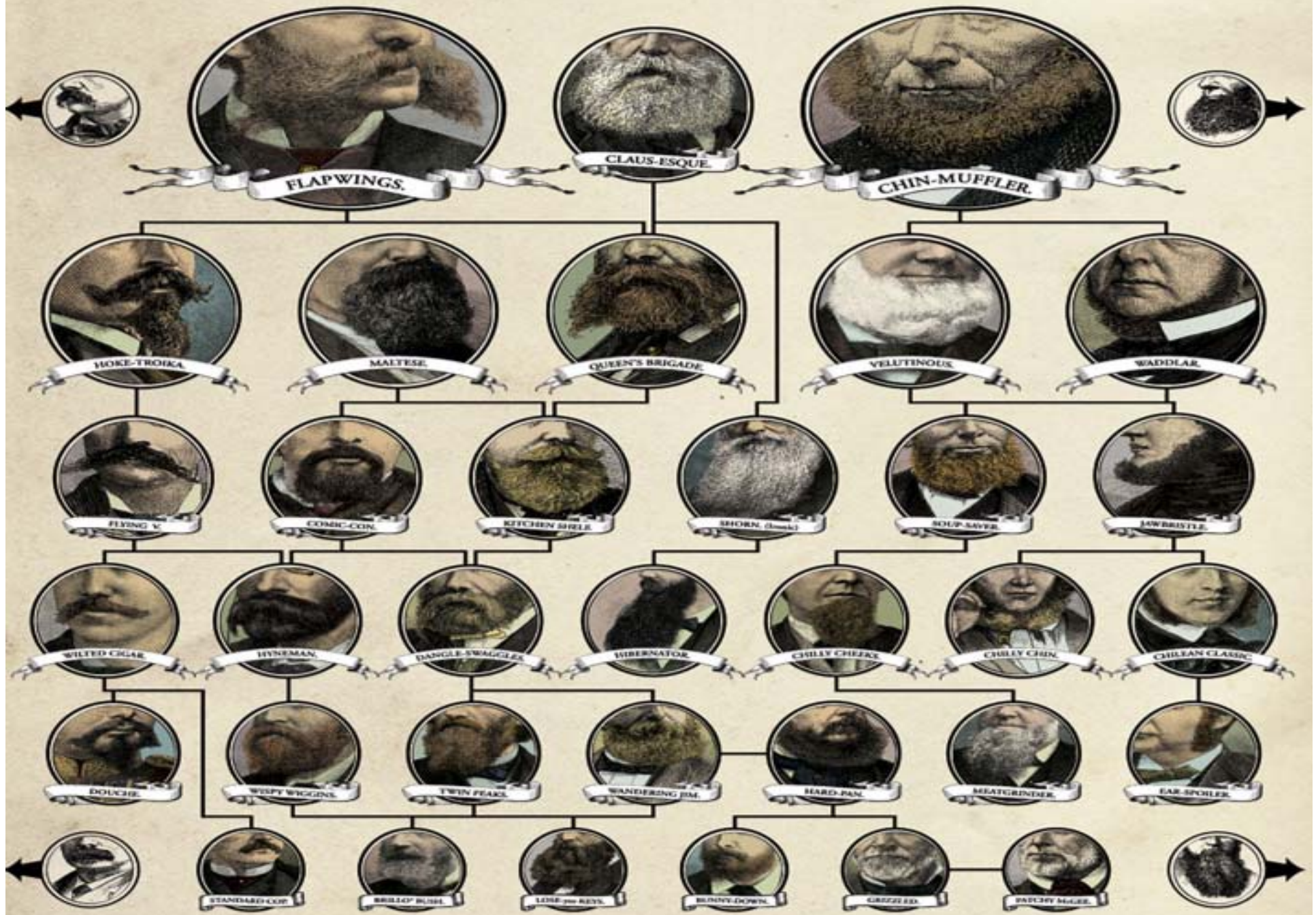


Hierarchies everywhere

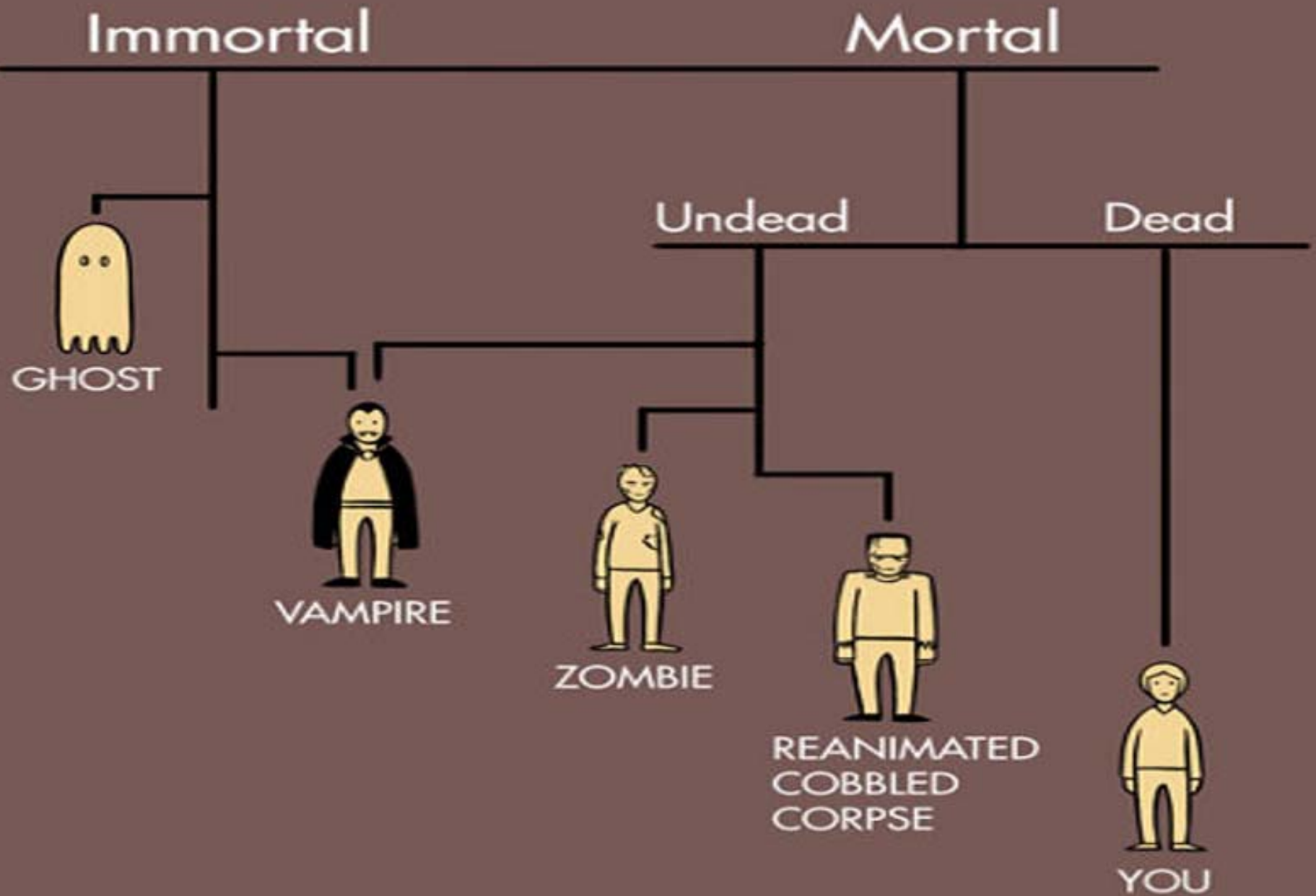
Maslow's Hierarchy of needs



HIERARCHY OF BEARDS.



HIERARCHY OF THE DEAD

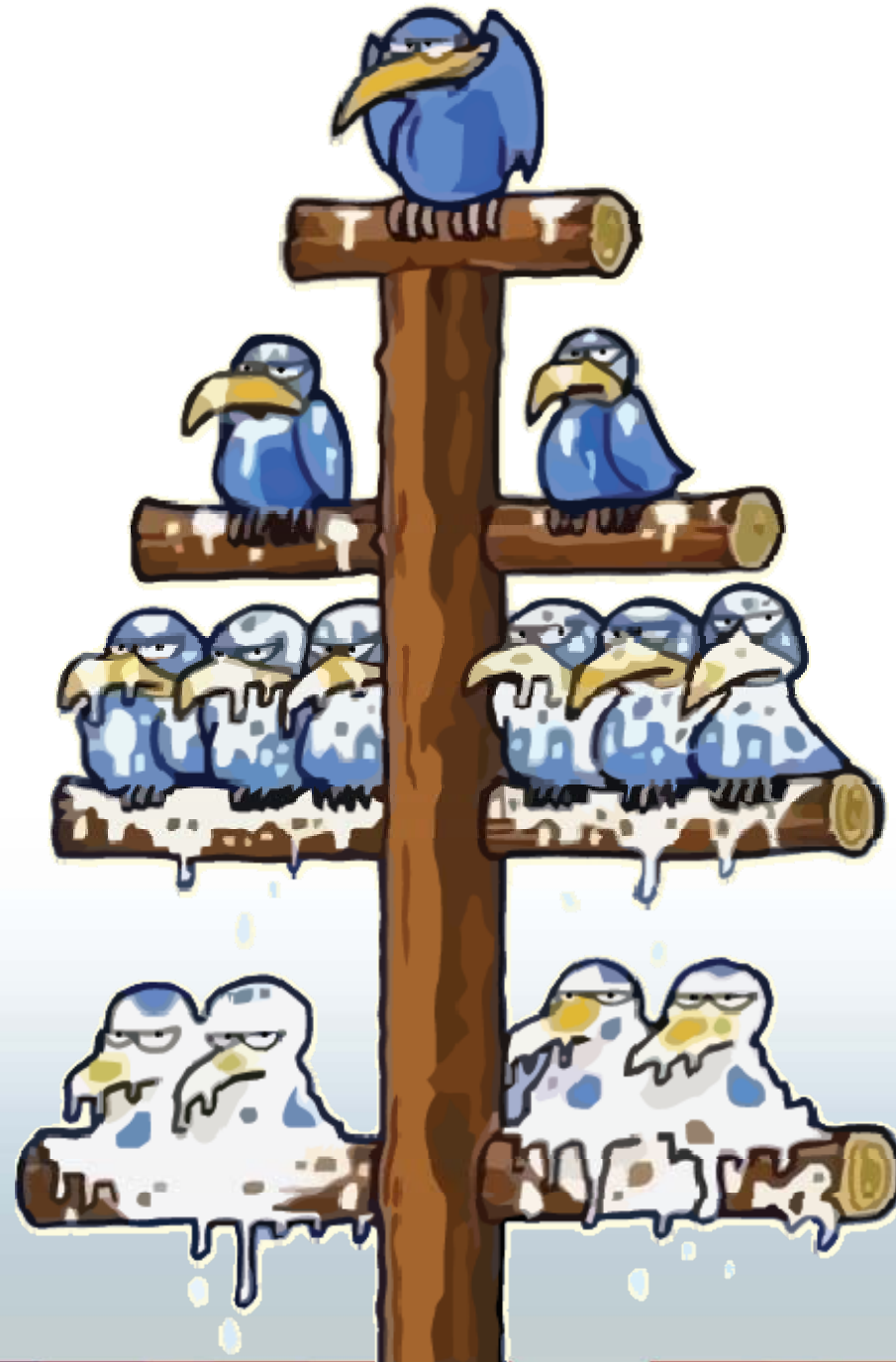


Executives

Analysts

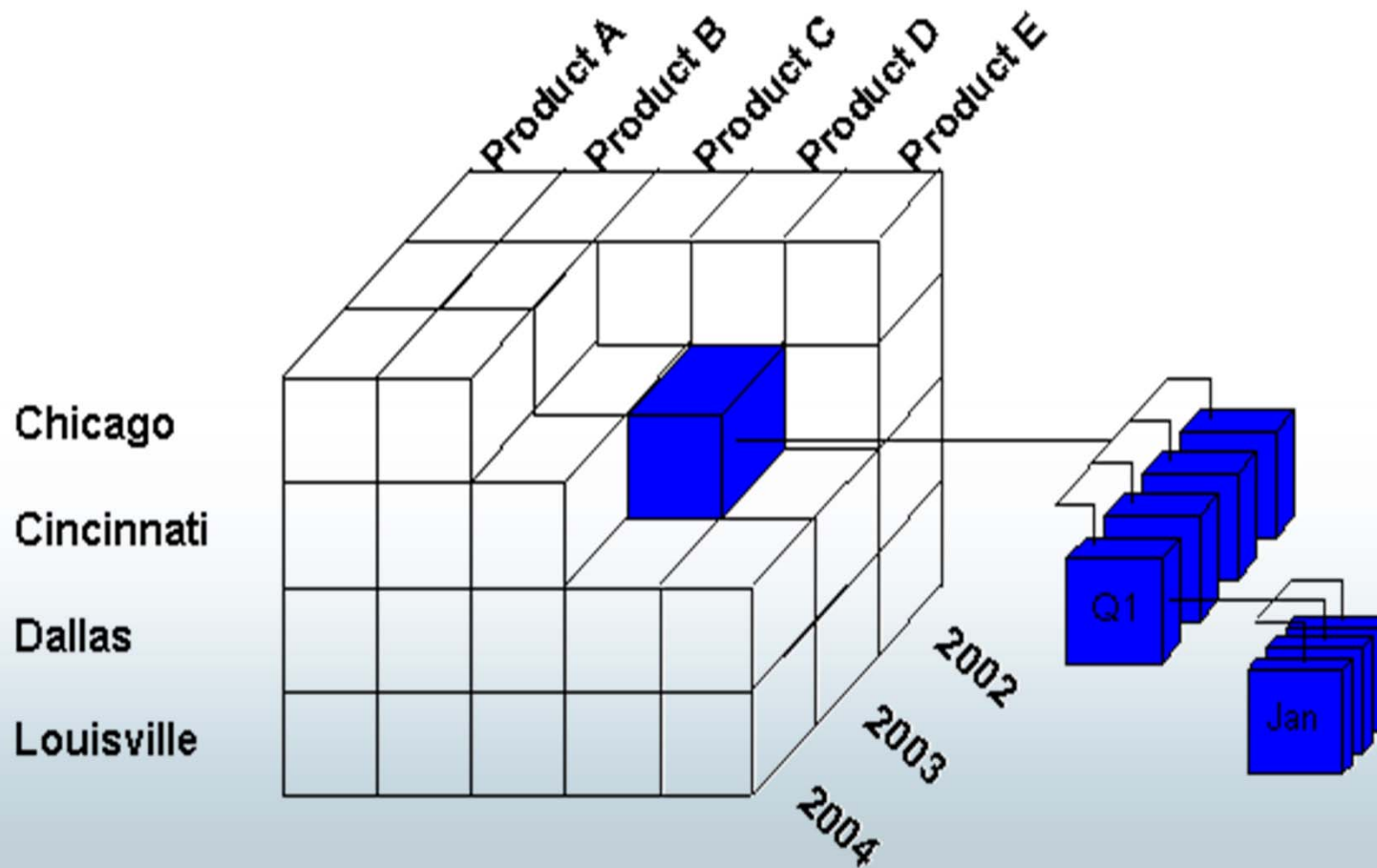
Developers

DBAs



Blame Flow

Analysis Services Hierarchies



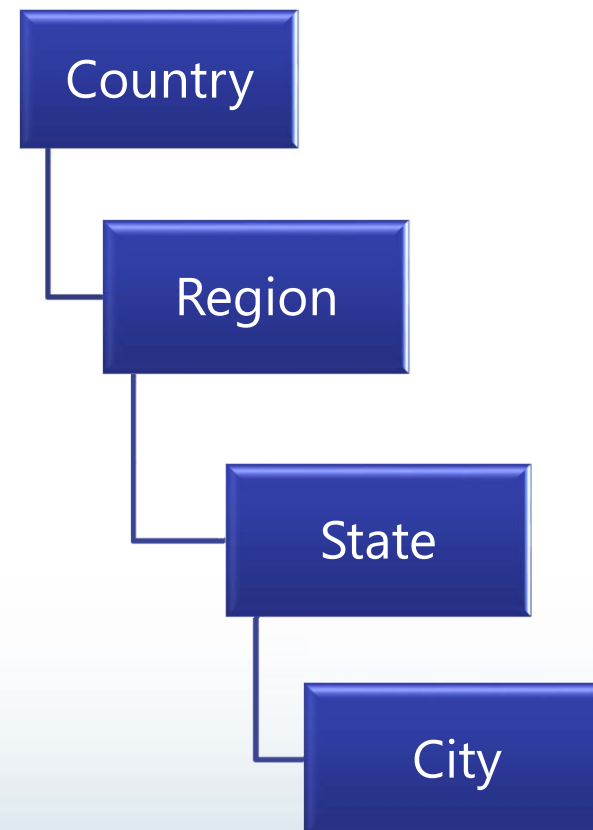
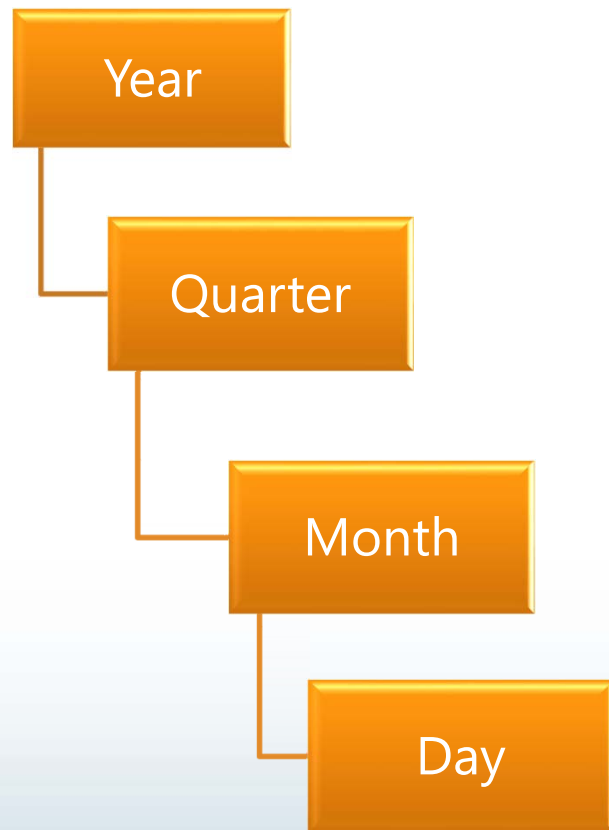


Natural & Unnatural Hierarchies

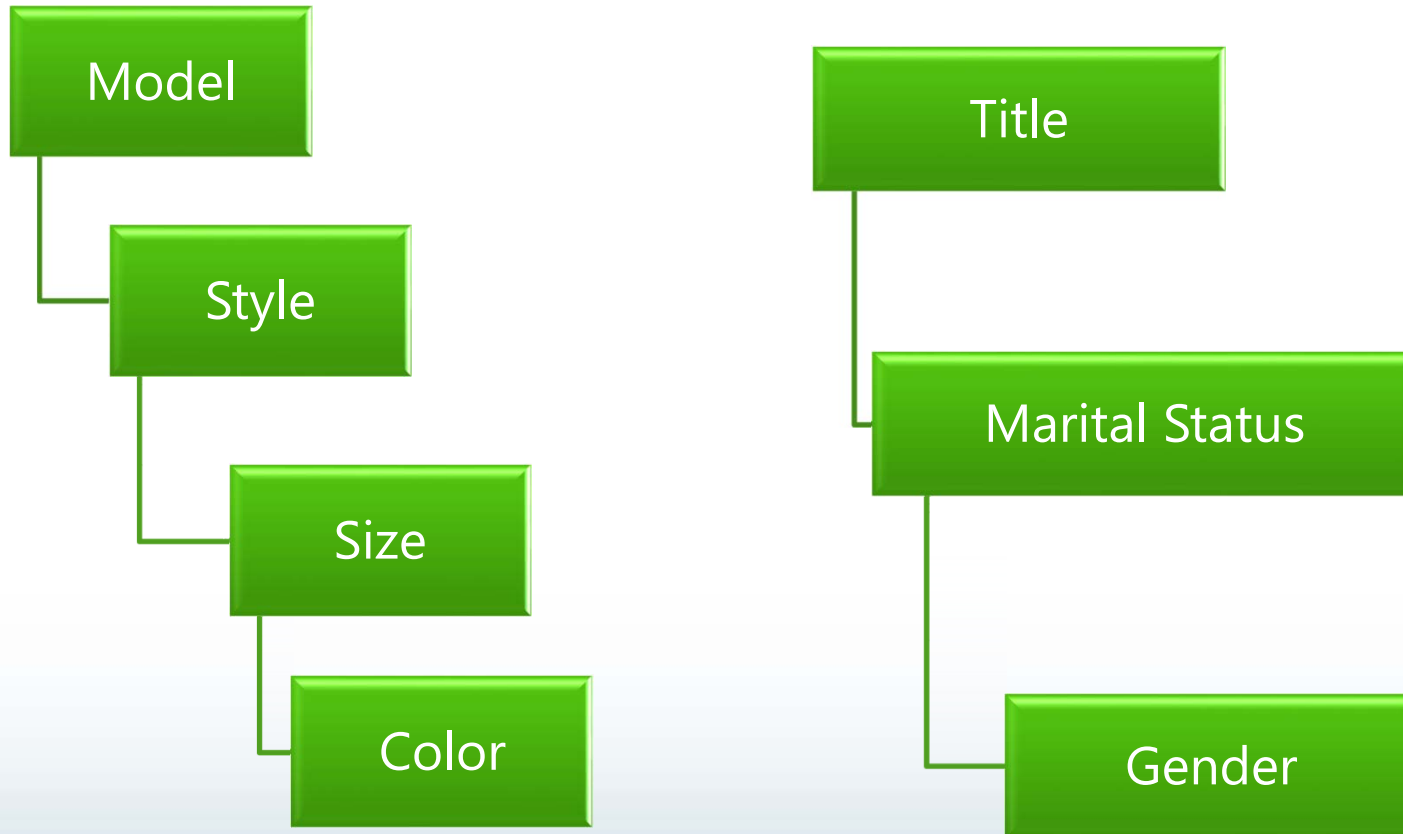
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Natural Hierarchies



Unnatural Hierarchies



Natural & Unnatural Hierarchies

Natural

1. Hierarchy tree is materialized on disk in hierarchy stores
2. Attributes automatically considered to be aggregation candidates.
3. Better performance

Unnatural

1. Not materialized on disk
2. Not considered as aggregation candidates.
3. Perform poorly

Tip #1

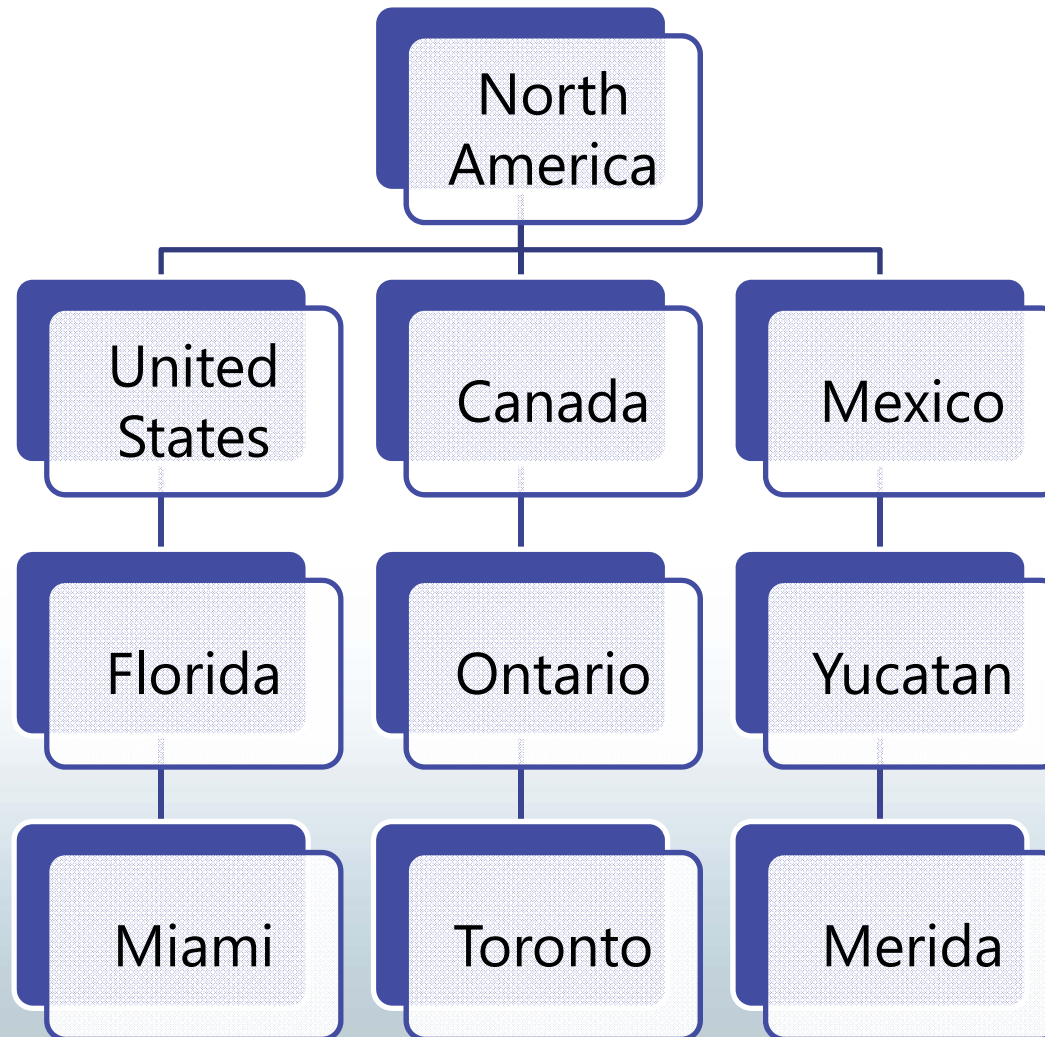
Avoid unnatural hierarchies.

Balanced & Unbalanced Hierarchies

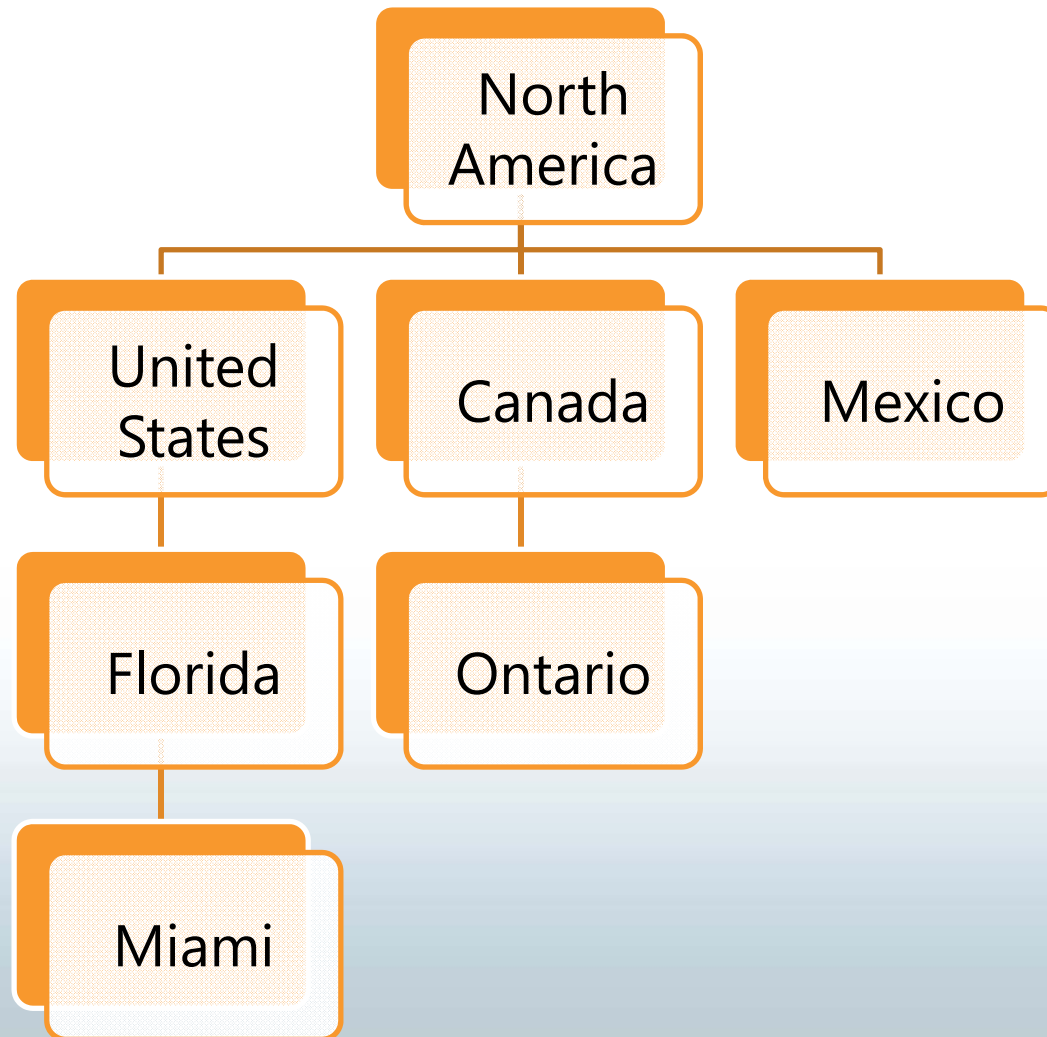
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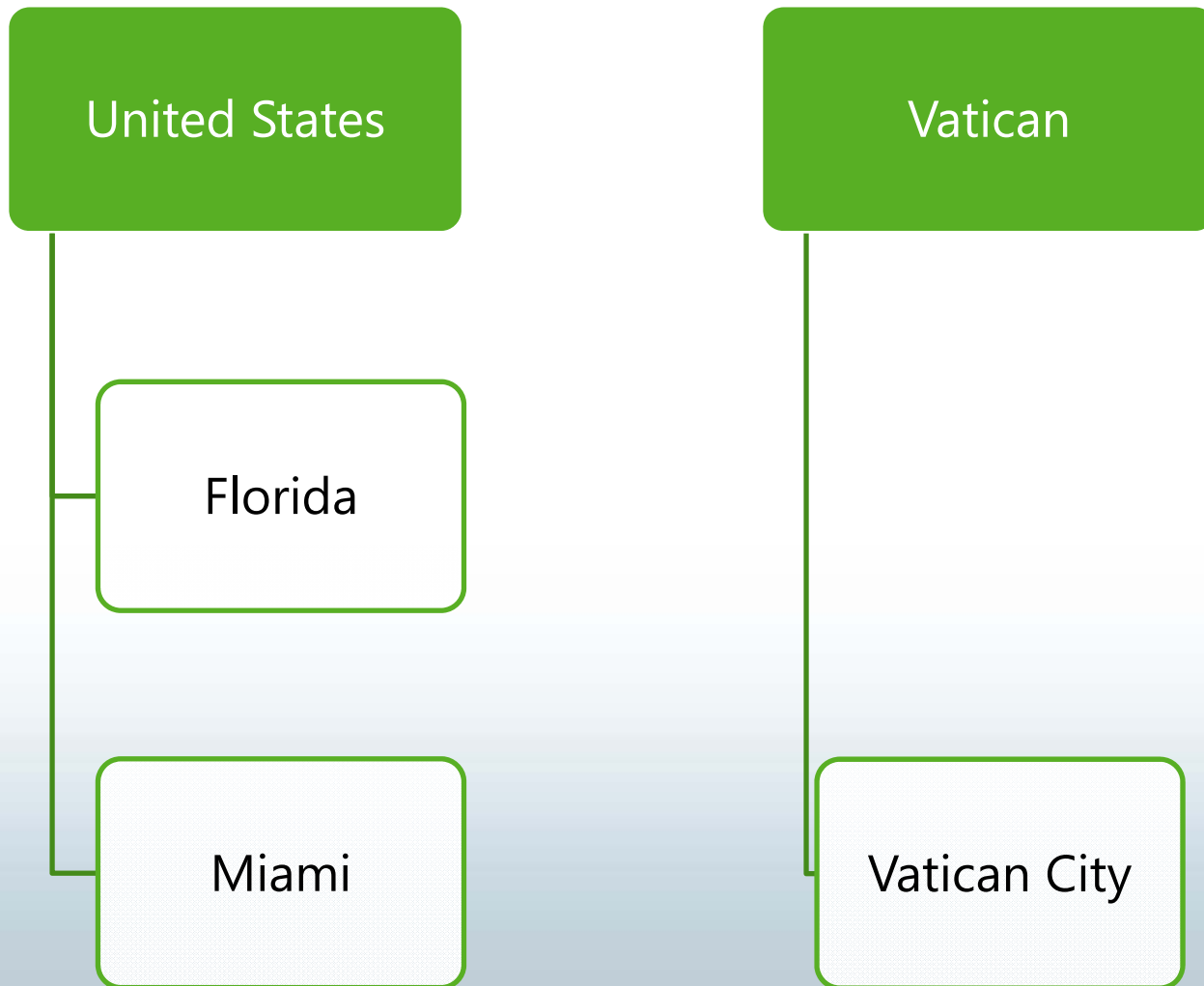
Balanced Hierarchy



Unbalanced Hierarchy



Ragged Hierarchy



Dimension Designer



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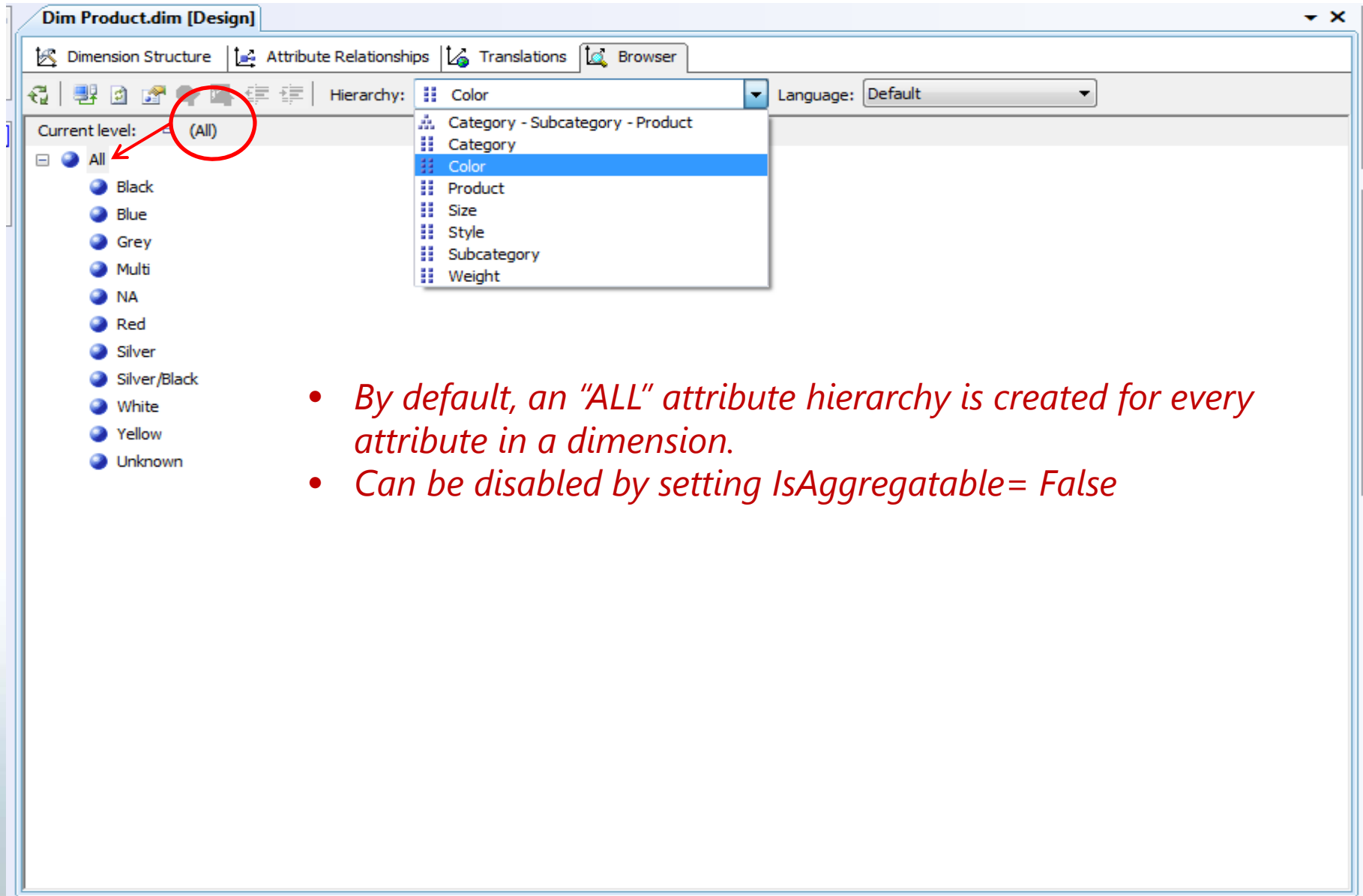


Attribute vs. User Hierarchies

The screenshot displays the 'Dim Product.dim [Design]' window in SQL Server Data Tools. It is divided into three main panes:

- Attributes:** A tree view showing the dimension structure. Under 'Dim Product', there are attributes: Category, Color, Product, Size, Style, Subcategory, and Weight. A red box highlights this pane with the text *aka Attribute Hierarchy*.
- Hierarchies:** A pane showing a hierarchy named 'Category - Subcategory - Product'. It lists 'Category', 'Subcategory', and 'Product' with expandable arrows. Below this, it says 'To create a new hierarchy, drag an attribute here.' A red box highlights this pane with the text *aka User Hierarchy*.
- Data Source View:** A diagram showing the relationships between dimension tables. 'DimProduct' is at the bottom, with arrows pointing to 'DimProductSubcategory' and 'DimProductCategory'. 'DimProductSubcategory' has an arrow pointing to 'DimProductCategory'. Each table lists its primary key and other attributes.

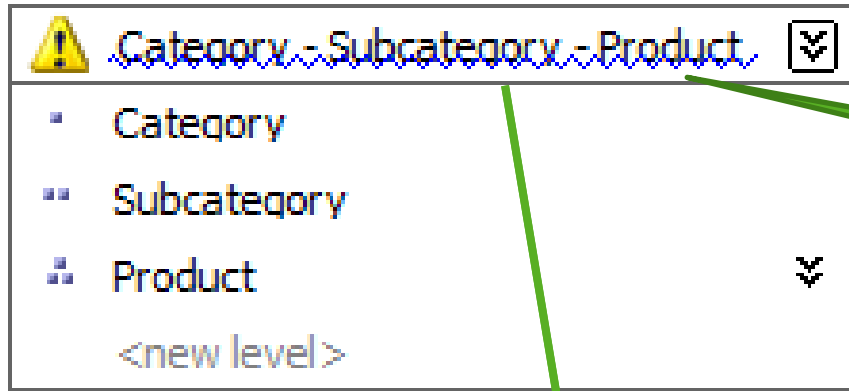
Default Attribute Hierarchy – “ALL”



The screenshot shows the 'Dim Product.dim [Design]' window. The 'Hierarchy' dropdown is set to 'Color'. A list of attribute levels is shown, with 'All' selected and circled in red. A list of color values is also visible.

- *By default, an “ALL” attribute hierarchy is created for every attribute in a dimension.*
- *Can be disabled by setting `IsAggregatable= False`*

User hierarchies



Blue Squiggly Lines

Attribute relationships do not exist between one or more levels of this hierarchy. This may result in decreased query performance.

- *Attribute relationships are essential for better query performance.*

User hierarchies: Attribute Relationships



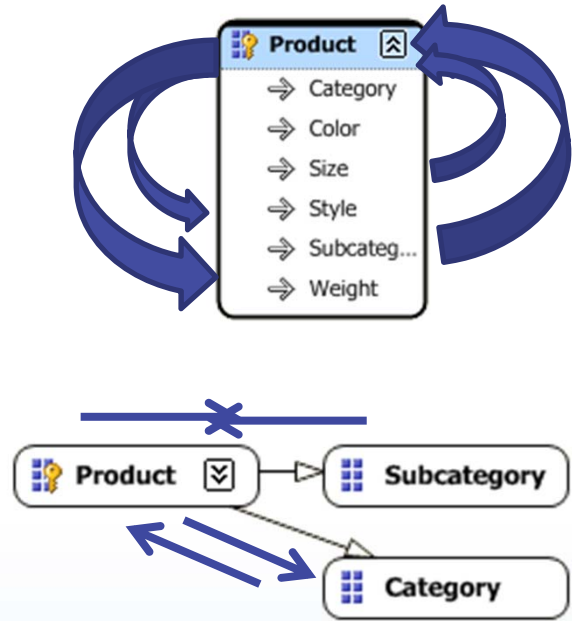
The screenshot shows the 'Attribute Relationships' tab in a software application. At the top, a navigation bar includes 'Dimension Structure', 'Attribute Relationships', 'Translations', and 'Browser'. Below this is a toolbar with various icons. The main workspace displays a hierarchy: 'Product' (with a checkmark icon) → 'Subcategory' → 'Category'. A large blue starburst graphic is overlaid on the workspace, containing the text: 'Source of 90% of Cube Performance Gains'. At the bottom, there are two panels: 'Attributes' on the left and 'Translations' on the right. The 'Attributes' panel lists: Category, Color, Product, Size, Style, Subcategory, and Weight. The 'Translations' panel shows a list of relationships: Product →, Product →, Product →, Product →, Product →, and Subcategory →.

Tip #2

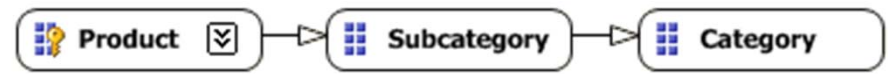
Always create attribute relationships in user hierarchies.

User hierarchies: Attribute Relationships

Inefficient



Efficient



More Detail

Less Detail

**Exercise:
Follow my daddy!**

Dimension & Attribute Properties

The screenshot displays the Microsoft Visual Studio interface for designing a dimension. The main workspace is divided into three panes: Attributes, Hierarchies, and Data Source View. The Properties window on the right is expanded to show the configuration for the 'Dim Date' dimension.

Attributes Pane: Shows a tree view for 'Dim Date' with sub-items: Calendar Year, Date Key, and Month.

Hierarchies Pane: Contains the instruction: "To create a new hierarchy, drag an attribute here."

Data Source View Pane: Shows a list of attributes for 'DimDate': DateKey, FullDateAlternateKey, DayNumberOfWeek, EnglishDayNameOfWeek, SpanishDayNameOfWeek, FrenchDayNameOfWeek, DayNumberOfMonth, DayNumberOfYear, WeekNumberOfYear, and EnglishMonthName.

Properties Window (Dim Date Dimension):

Property	Value
AttributeAllMemberName	
CurrentStorageMode	Molap
CurrentStringStoresCompatibility	1050
DependsOnDimension	
ErrorConfiguration	(custom)
Language	
MiningModelID	
ProcessingGroup	ByAttribute
ProcessingMode	Regular
ProcessingPriority	0
ProcessingRecommendation	None
ProcessingState	Unprocessed
Source	Adventure Works DW2012 (Data sour
StringStoresCompatibilityLevel	1050
UnknownMember	None
UnknownMemberName	
WriteEnabled	False
Basic	
Description	
ID	Dim Date
Name	Dim Date
Type	Regular
Misc	
Annotations	(Collection)



Product Hierarchy

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Product Hierarchy

- Snowflake
 - SubCategory
 - Category
- Attribute Relationships
 - Key based
- Multiple Drilldowns
 - ProductLine – Model
- Attribute Discretization
 - Weight
 - Size Range

Demo: Product Hierarchy



Reseller & Geography Hierarchy

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Reseller & Geography Hierarchy

- Snowflake
 - Geography
- Reseller Dimension
 - Geography - Reseller Drilldown
- Geography Dimension
 - Referenced
 - Materialize



Demo: Reseller & Geography Hierarchy

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Employee Hierarchy

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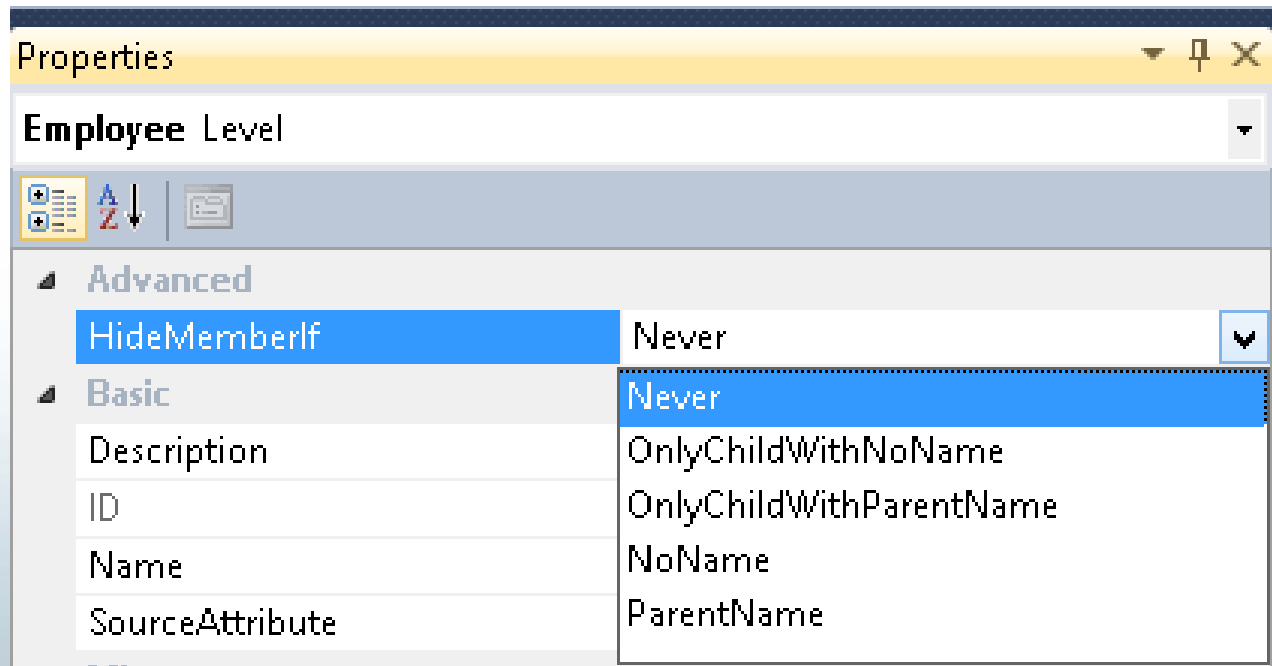


Employee Hierarchy

- Parent-Child
 - Self-join / Self-referencing
 - Read / write performance scalability issues
- Alternative Options:
 - Flat table / Naturalization (Adjacency list)
 - Hierarchy IDs (SQL Server 2008)
 - Many-to-Many
 - Snowflake

Employee Hierarchy

- Hierarchy Properties
 - HideMemberIf
 - Support for Ragged hierarchies



Employee Hierarchy

- Attribute Properties
- Hierarchy Properties
 - HideMemberIf

Employee Hierarchy

- Attribute Properties
 - MembersWithDataCaption: (free text)
* (Parent) will add label to Parents showing as children of themselves.
 - MemberswithData: NonLeafDataHidden
Hide Parents showing as children of themselves.
 - Naming Template: (free text)
Employee Level * or CEO, VP, Manager, Associate
Add custom label to each level

Employee Hierarchy

- Attribute Properties
 - RootMemberIf:
Determines how the **root** or **topmost members** of a **parent-child hierarchy** are identified

Parent-Child	
MembersWithData	NonLeafDataVisible
MembersWithDataCaption	
NamingTemplate	
RootMemberIf	ParentsBlankSelfOrMissing
UnaryOperatorColumn	ParentsBlankSelfOrMissing
Source	
CustomRollupColumn	ParentsSelf
CustomRollupPropertiesColumn	ParentsMissing

Employee Hierarchy

- Attribute Properties

- RootMemberIf

ParentsBlank: Only keys in the dimension that have a parent key of null, zero, or empty string are the top most level in your parent-child hierarchy

ParentsMissing: Only keys in the dimension where no key can be found are the top most level in your parent-child hierarchy

ParentsSelf: Only keys in the dimension where the key is equal to itself are the top most level in your parent-child hierarchy

By default it's set to "ParentsBlankSelforMissing"," which means essentially "any of the above"

Source: http://www.databasejournal.com/features/mssql/article.php/10894_3749671_2/Dimension-Attributes--Introduction-and-Overview-Part-IV.htm



Demo: Employee Hierarchy

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Date Hierarchy

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Date Hierarchy

- Multiple Calendars
 - Calendar Year Drilldown
 - Fiscal Year Drilldown
- Month Sorting
 - Key Columns: (Collection) Year, MonthNumberOfYear
 - Orderby: Key
- Dimension & Attribute Properties
 - Dimension Type: Time
 - Attribute Type: Month, Quarter, Year,

Date Hierarchy

- Attribute Relationships
 - Rigid vs. Flexible

Demo: Date Hierarchy

Dimension and Attribute Types

Dimension Types

Properties window for **Dim Date Dimension**. The **Type** dropdown is open, showing the following options:

- Regular
- Time
- Geography
- Organization
- BillOfMaterials
- Accounts
- Customers
- Products
- Scenario
- Quantitative
- Utility

Other visible properties include: WriteEnabled (False), Name (Dim Date), ID (Dim Date), and Description.

Attribute Types

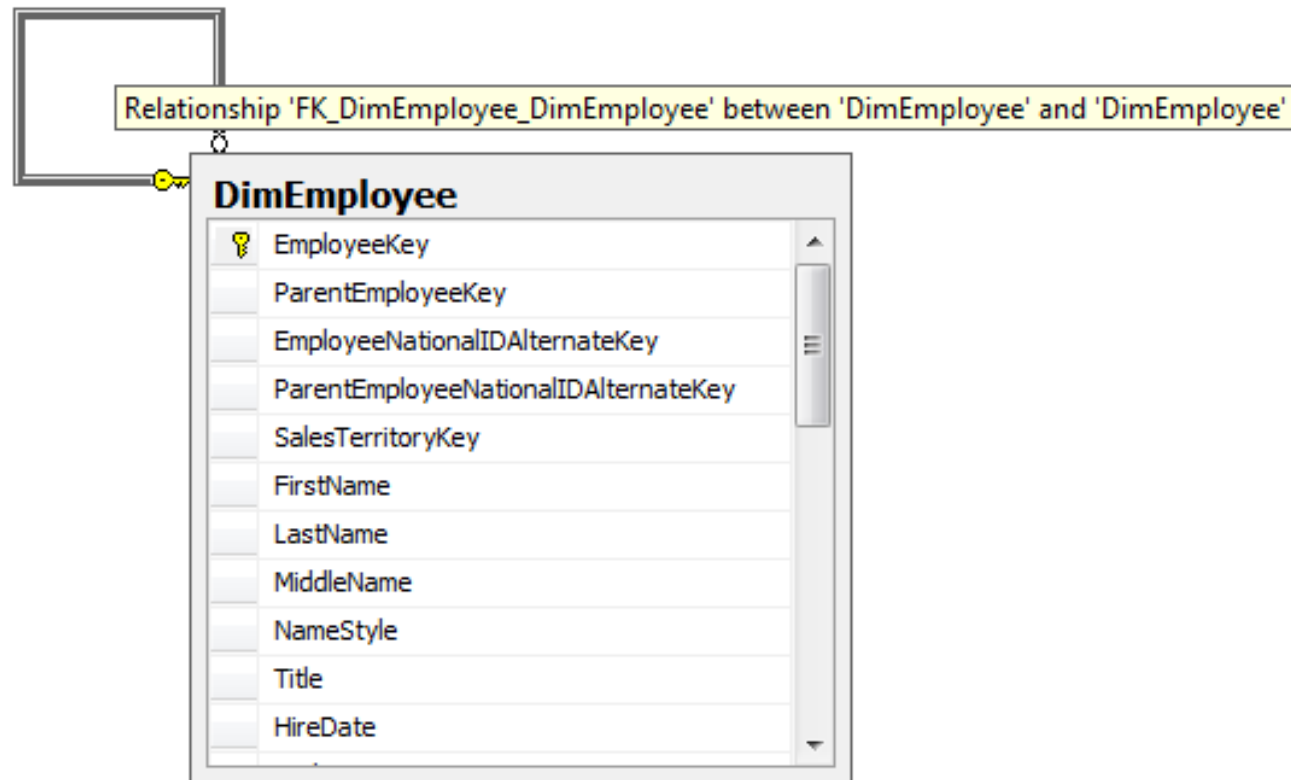
Properties window for **Date DimensionAttribute**. The **Type** dropdown is open, showing the following options:

- Date
- DayOfHalfYear
- DayOfMonth
- DayOfQuarter
- DayOfTenDays
- DayOfTrimester
- DayOfWeek
- DayOfYear
- Days

Other visible properties include: Name (Date), Usage (Date), and Misc (Calendar).

Parent-child hierarchies

Self-referencing relationship or self-join





Performance Optimizations

- Aggregations
- Partitions

Aggregations

- Aggregation Design
 - Set of Aggregation Definitions
- Aggregation
 - Pre-aggregation of measure group data at certain granularity of related dimensions
 - Intersections between Dimension table and Fact table based on FK and references

Can be understood somewhat as indexes.

Aggregations

- Aggregation usage

Default

Select to set the aggregation usage setting for the attribute to Default. By using this setting, the designer applies a default rule based on the type of attribute and dimension.

Full

Select to set the aggregation usage setting for the attribute to Full. By using this setting, every aggregation for the cube must include this attribute or a related attribute that is lower in the attribute chain. The Full aggregation usage setting should be avoided when an attribute contains many members. If specified for multiple attributes or attributes that have many members, this setting might prevent aggregations from being designed because of excessive size.

None

Select to set the aggregation usage setting for the attribute to None. By using this setting, no aggregation for the cube can include this attribute.

Unrestricted

Select to set the aggregation usage setting for the attribute to Unrestricted. By using this setting, no restrictions are put on the aggregation designer; however, the attribute must still be evaluated to determine whether it is a valuable aggregation candidate.

Set All to Default

Select to set the aggregation usage settings for all attributes to Default.

Partitions

- Container for a measure group or part of it.
- Commonly partitioned by date, month, or year

Can be understood somewhat table partitioning.

Demo: Adding Aggregations and Partitions



Considerations

- Query performance
- Storage
- Processing time

Data Types

Data Type	Query Perf	Storage	Processing
integer, bigint		↓	↓
String, GUIDs		↑	↑

Flexible vs. Rigid Attribute Relationships




Relationship Type	Processing Option	Query Perf	Storage	Processing
Flexible	Incremental			
Rigid	Incremental			

- Process Full will re-compute aggregations for both Flexible & Rigid

Attribute properties

Property	Query Perf	Storage	Processing
IsAggregatable = False <i>No default "All" attribute hierarchy</i>	↑	↓	↓
AttributeHierarchyOptimizedState = False <i>No Aggregations</i>	↓	↓	↓
AttributeHierarchyOrdered = False <i>No Sorting</i>	↑		↓
Estimated Count <> 0 <i>Member count stats</i>			↑
OrderBy = Key (integer) <i>Order column</i>			↑
DiscretizationMethod <> None	↓		↑

Aggregations

Query Perf	Storage	Processing
		

...too much of a good thing is not good.

Partitioning

Query Perf	Storage	Processing
		

...too much of a good thing is not good.

Summary

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Summary

- Hierarchy Types & Classifications
 - Natural
 - Unnatural
 - Balanced
 - Ragged
 - Parent-Child
- Analysis Services
 - Attribute hierarchies
 - User hierarchies
- Hierarchy Performance Drivers
 - Attribute Relationships
 - Attribute Properties

Summary

- Performance optimizations
 - Aggregations
 - Partitions
- Optimizations Impact
 - Query
 - Processing
 - Storage

Contact Info

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