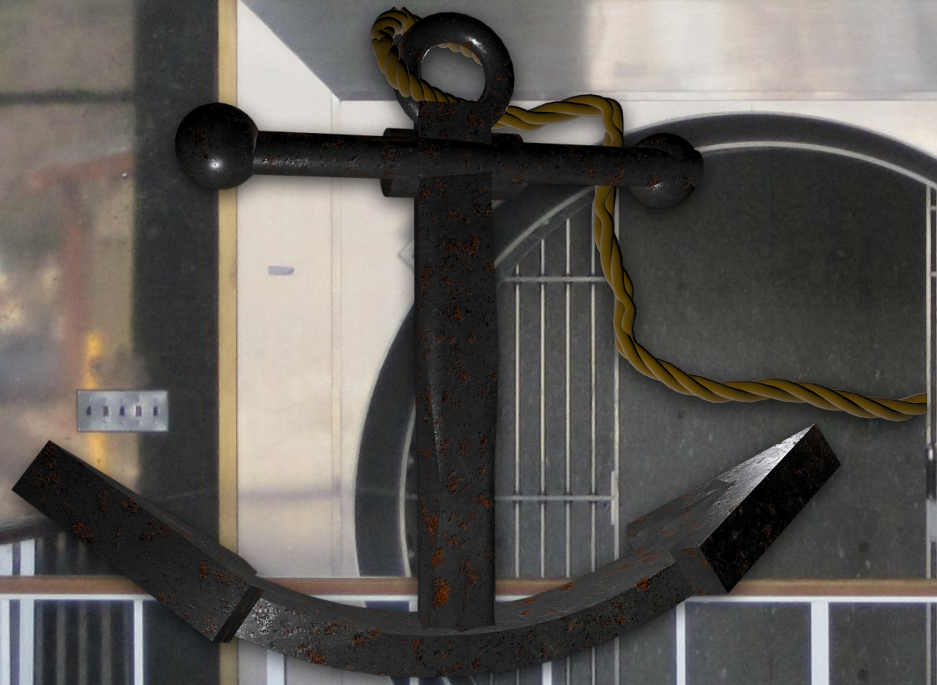
Anchor for Vaulters

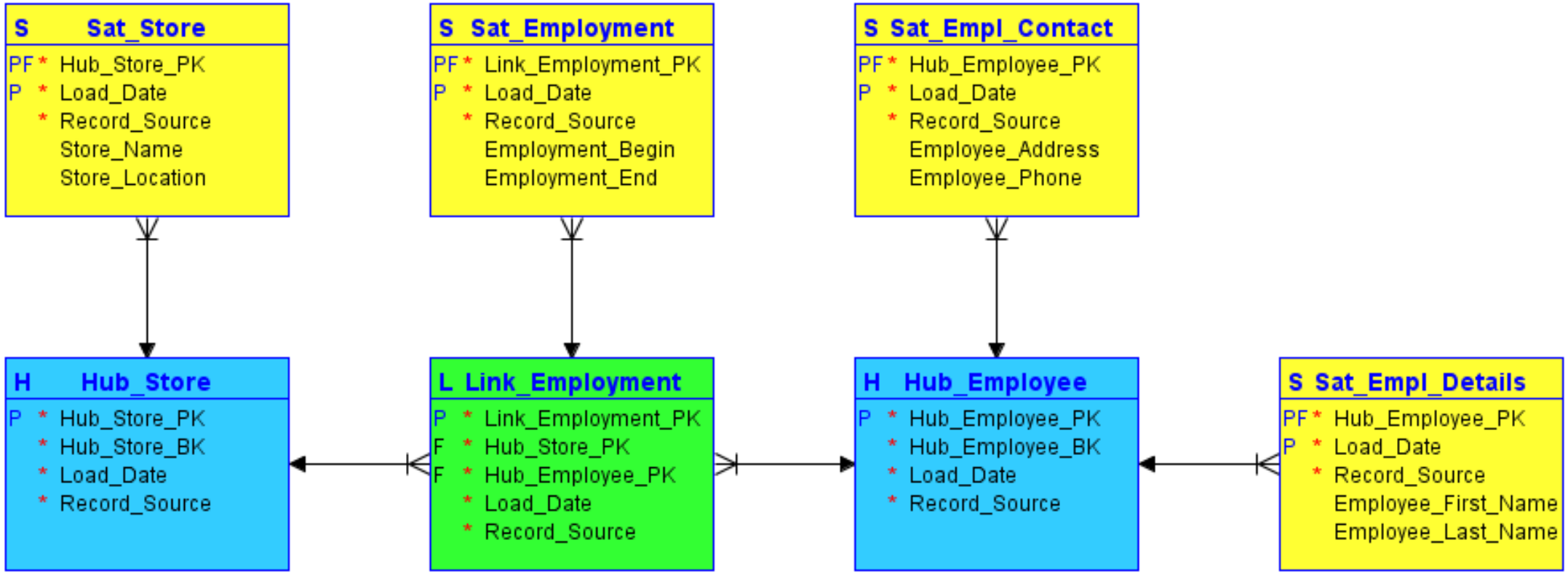
Lars Rönnbäck



ANCHOR™

Originally for the DVEE Summit in Stockholm, October 2019

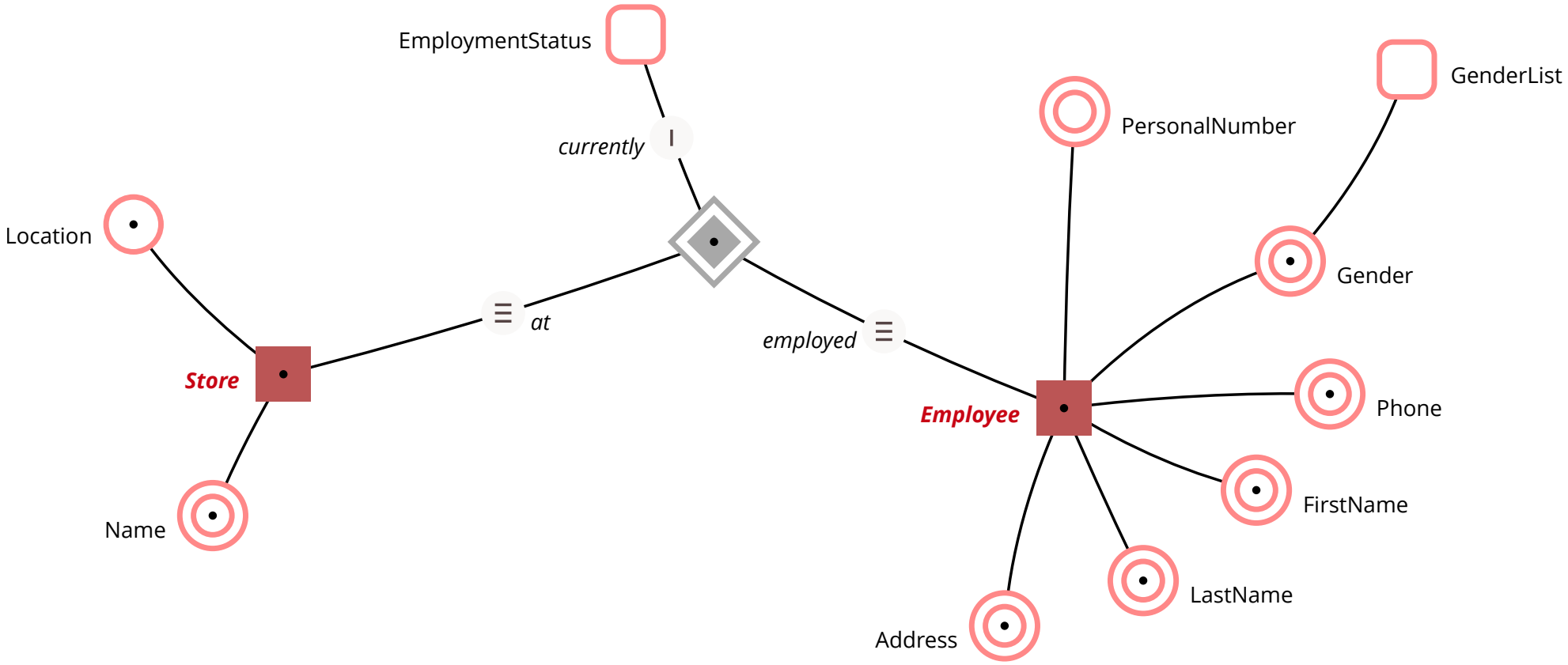
up to change



https://en.wikipedia.org/wiki/Data_vault_modeling

WIKIPEDIA
The Free Encyclopedia

http://www.anchormodeling.com/modeler/latest

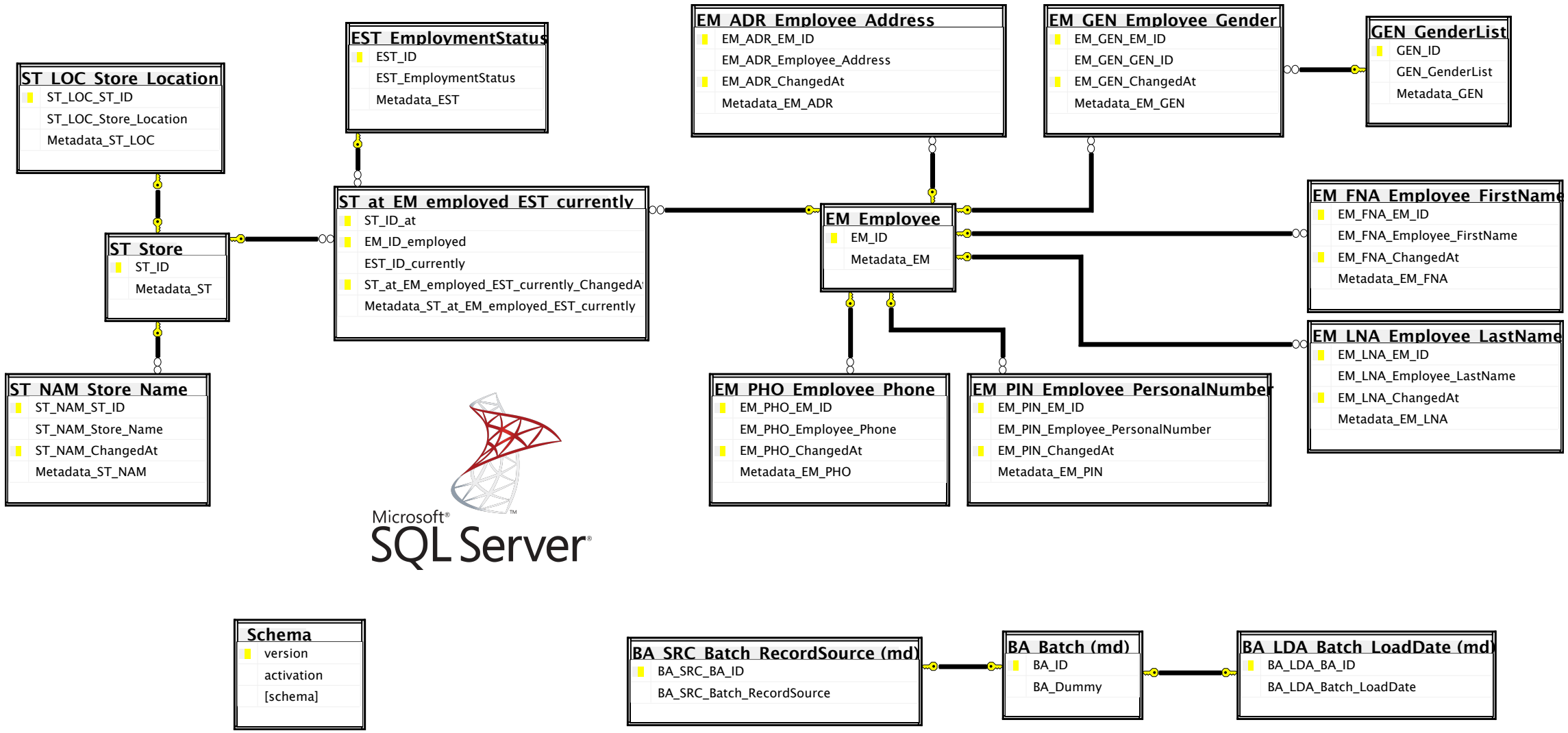


ANCHOR™

```
<anchor mnemonic="ST" descriptor="Store" identity="int">
  <metadata capsule="dbo" generator="true"/>
  <attribute mnemonic="NAM" descriptor="Name" timeRange="datetime" dataRange="varchar(42)">
    <metadata capsule="dbo" restatable="true" idempotent="false" deletable="false"/>
    <layout x="740.01" y="690.34" fixed="false"/>
  </attribute>
  <attribute mnemonic="LOC" descriptor="Location" dataRange="varchar(42)">
    <metadata capsule="dbo" deletable="false"/>
    <layout x="802.88" y="629.99" fixed="false"/>
  </attribute>
  <layout x="739.25" y="598.86" fixed="false"/>
</anchor>
<tie timeRange="datetime">
  <anchorRole role="at" type="ST" identifier="true"/>
  <anchorRole role="employed" type="EM" identifier="true"/>
  <knotRole role="currently" type="EST" identifier="false"/>
  <metadata capsule="dbo" restatable="true" idempotent="false" deletable="false"/>
  <layout x="719.48" y="494.32" fixed="false"/>
</tie>
<anchor mnemonic="EM" descriptor="Employee" identity="int">
  <metadata capsule="dbo" generator="true"/>
  <attribute mnemonic="ADR" descriptor="Address" timeRange="datetime" dataRange="varchar(555)">
    <metadata capsule="dbo" restatable="true" idempotent="false" deletable="false"/>
    <layout x="627.10" y="324.69" fixed="false"/>
  </attribute>
  <attribute mnemonic="PHO" descriptor="Phone" timeRange="datetime" dataRange="varchar(15)">
    <metadata capsule="dbo" restatable="true" idempotent="false" deletable="false"/>
    <layout x="755.11" y="405.57" fixed="false"/>
  </attribute>
  <attribute mnemonic="PIN" descriptor="PersonalNumber" timeRange="datetime" dataRange="char(12)">
    <metadata capsule="dbo" restatable="true" idempotent="false" deletable="false"/>
    <layout x="796.41" y="353.74" fixed="false"/>
  </attribute>
  <attribute mnemonic="LNA" descriptor="LastName" timeRange="datetime" dataRange="varchar(555)">
    <metadata capsule="dbo" restatable="true" idempotent="false" deletable="false"/>
    <layout x="739.38" y="301.86" fixed="false"/>
  </attribute>
  <attribute mnemonic="FNA" descriptor="FirstName" timeRange="datetime" dataRange="varchar(555)">
    <metadata capsule="dbo" restatable="true" idempotent="false" deletable="false"/>
    <layout x="637.90" y="404.40" fixed="false"/>
  </attribute>
  <attribute mnemonic="GEN" descriptor="Gender" timeRange="datetime" knotRange="GEN">
    <metadata capsule="dbo" restatable="true" idempotent="false" deletable="false"/>
    <layout x="688.44" y="199.60" fixed="false"/>
  </attribute>
  <layout x="703.63" y="364.04" fixed="false"/>
</anchor>
<knot mnemonic="EST" descriptor="EmploymentStatus" identity="tinyint" dataRange="varchar(42)">
  <metadata capsule="dbo" generator="false"/>
  <layout x="655.46" y="514.06" fixed="false"/>
</knot>
<knot mnemonic="GEN" descriptor="GenderList" identity="tinyint" dataRange="varchar(42)">
  <metadata capsule="dbo" generator="false"/>
  <layout x="683.81" y="106.85" fixed="false"/>
</knot>
```

sisula

```
-- Anchor table ----------------------------------------
-- ST_Store table (with 2 attributes)
--------------------------------------------------------
IF Object_ID('dbo.ST_Store', 'U') IS NULL
CREATE TABLE [dbo].[ST_Store] (
    ST_ID int IDENTITY(1,1) not null,
    Metadata_ST int not null,
    constraint pkST_Store primary key (
        ST_ID asc
    )
);
GO
-- Historized attribute table -------------------------
-- ST_NAM_Store_Name table (on ST_Store)
--------------------------------------------------------
IF Object_ID('dbo.ST_NAM_Store_Name', 'U') IS NULL
CREATE TABLE [dbo].[ST_NAM_Store_Name] (
    ST_NAM_ST_ID int not null,
    ST_NAM_Store_Name varchar(42) not null,
    ST_NAM_ChangedAt datetime not null,
    Metadata_ST_NAM int not null,
    constraint fkST_NAM_Store_Name foreign key (
        ST_NAM_ST_ID
    ) references [dbo].[ST_Store](ST_ID),
    constraint pkST_NAM_Store_Name primary key (
        ST_NAM_ST_ID asc,
        ST_NAM_ChangedAt desc
    )
);
GO
-- Static attribute table -----------------------------
-- ST_LOC_Store_Location table (on ST_Store)
--------------------------------------------------------
IF Object_ID('dbo.ST_LOC_Store_Location', 'U') IS NULL
CREATE TABLE [dbo].[ST_LOC_Store_Location] (
    ST_LOC_ST_ID int not null,
    ST_LOC_Store_Location varchar(42) not null,
    Metadata_ST_LOC int not null,
    constraint fkST_LOC_Store_Location foreign key (
        ST_LOC_ST_ID
```


ST_LOC_Store_Location
ST_LOC_ST_ID
ST_LOC_Store_Location
Metadata_ST_LOC
EST_EmploymentStatus
EST_ID
EST_EmploymentStatus
Metadata_EST
EM_ADR_Employee_Address
EM_ADR_EM_ID
EM_ADR_Employee_Address
EM_ADR_ChangedAt
Metadata_EM_ADR
EM_GEN_Employee_Gender
EM_GEN_EM_ID
EM_GEN_GEN_ID
EM_GEN_ChangedAt
Metadata_EM_GEN
GEN_GenderList
GEN_ID
GEN_GenderList
Metadata_GEN
ST_Store
ST_ID
Metadata_ST
ST_at_EM_employed_EST_currently
ST_ID_at
EM_ID_employed
EST_ID_currently
ST_at_EM_employed_EST_currently_ChangedA
Metadata_ST_at_EM_employed_EST_currently
EM_Employee
EM_ID
Metadata_EM
EM_FNA_Employee_FirstName
EM_FNA_EM_ID
EM_FNA_Employee_FirstName
EM_FNA_ChangedAt
Metadata_EM_FNA
EM_LNA_Employee_LastName
EM_LNA_EM_ID
EM_LNA_Employee_LastName
EM_LNA_ChangedAt
Metadata_EM_LNA
ST_NAM_Store_Name
ST_NAM_ST_ID
ST_NAM_Store_Name
ST_NAM_ChangedAt
Metadata_ST_NAM
EM_PHO_Employee_Phone
EM_PHO_EM_ID
EM_PHO_Employee_Phone
EM_PHO_ChangedAt
Metadata_EM_PHO
EM_PIN_Employee_PersonalNumber
EM_PIN_EM_ID
EM_PIN_Employee_PersonalNumber
EM_PIN_ChangedAt
Metadata_EM_PIN
Microsoft
SQL Server
Schema
version
activation
[schema]
BA_SRC_Batch_RecordSource (md)
BA_SRC_BA_ID
BA_SRC_Batch_RecordSource
BA_Batch (md)
BA_ID
BA_Dummy
BA_LDA_Batch_LoadDate (md)
BA_LDA_BA_ID
BA_LDA_Batch_LoadDate

Data Vault

Business Key

- **One key is the master key**
  (less flexibility)
- **The master key is stable**
  (makes assumptions about the future)
- **The master key is available in the hub**
  (faster loading performance)
- **No real explanation of how to manage other ways to identify the same thing**
  (confusing)
- **Hashing is (maybe) encouraged**
  (the surrogate key encodes the domain)

Anchor

Natural keys

- **Every candidate key is treated equally**
  (more flexibility)
- **Candidate keys may change over time**
  (assumes nothing about the future)
- **Keys are spread out in the model**
  (slower loading performance)
- **Every possible way to identify something is equally valid**
  (clear, but may complicate ETL)
- **Hashing is impossible**
  (the surrogate key cannot carry meaning)

Data Vault

Changes at Loading

- **Captured from the perspective of the database**
  (no requirements on the sources)

- **Temporally inconsistent data can be stored**
  (relies on ETL if this is undesirable)
- **Inconsistencies must be resolved at read time**
  (faster write, slower query performance)
- **The time when something changed in the domain is not part of the primary key**
  (more complicated point in time logic)

Anchor

Changes from the Domain

- **Captured from the perspective of the domain being modeled**
  (sources should be change-aware, fall-back to database perspective)
- **Temporally inconsistent data cannot be stored**
  (database will enforce consistency)
- **Inconsistencies must be resolved at write time**
  (slower write, faster query performance)
- **The time when something changed in the domain is part of the primary key**
  (less complicated point in time logic)

Data Vault

Grouping

- **Attributes are grouped by rate of change or by what they represent**
  (no clear cut rule)
- **To see what changed, the values from the previous row are needed**
  (slower change detection)
- **A typical query needs a few joins**
  (can be faster, can be slower, depending on the selectivity in the query)
- **Null values may exist**
  (not optimal for sparse data)

Anchor

6NF

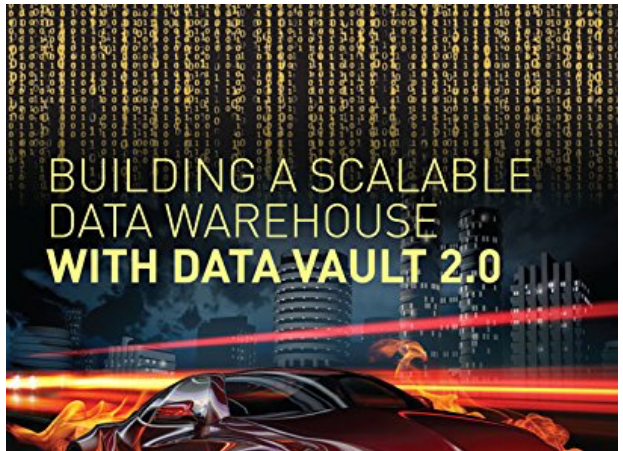
- **Every attribute becomes its own table**
  (no room for creativity)

- **Changes are tracked independently of each other**
  (faster change detection)
- **A typical query needs a lot of joins**
  (can be faster, can be slower, depending on the selectivity in the query)
- **Nulls become the absence of rows**
  (optimal for sparse data)

Data Vault

Implementation variety

- **No naming convention**
  (harder to swap between DWs)
- **Some degrees of freedom when it comes to implementation details**
  (different DWs may use different flavors)
- **Largest known Data Vault implementation is for the U.S. Government at 15 petabytes.**
  (not much more is public)



Anchor

Implementation consistency

- **Naming convention**
  (easier to swap between DWs)
- **Almost no degrees of freedom when it comes to implementation details**
  (different DWs have the same flavor)
- **Largest known Anchor implementation is for avito.ru at 279 terabytes on HPE Vertica.**
  (scientific papers available with a case study)

Big Data Normalization
for Massively Parallel Processing Databases

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Data Vault

Auditability

- **Links are always many-to-many**
  (may rely on ETL to enforce cardinality)
- **Column values can range over the span of the data type**
  (may rely on ETL to enforce constraints)
- **Values may disappear (become NULL)**
  (less up-front complexity)

- **Inconsistencies can be analyzed and managed before the next layer**
  (source corrections can be done asynchronously)
- **Raw data always available**
  (reloading doesn't need to touch the source)

Anchor

Correctness

- **Ties always have their cardinality specified**
  (the database will enforce cardinality)
- **Column values may be constrained to certain intervals**
  (the database will enforce constraints)
- **Values are assumed exhaustive (become explicitly "unknown")**
  (more up-front complexity)
- **Inconsistencies must be managed, but negates the need for layered architectures**
  (source corrections may need to be expedient)
- **Raw data rarely available in full**
  (reloading needs to touch the source again)

Data Vault

Flavorful

- **Infinitely extendable**
  (great ideas can be utilized immediately)
- **Extensions, such as bitemporality, may be added in any fashion**
  (less coherency)
- **Models can be created in almost all modeling tools, with some code generated**
  (no lock-down, but most tools are commercial)
- **Not overly dependent on query optimization features**
  (works well in most databases)
- **Dangling references**
  (any load order, disables some query optimization)

Anchor

Stringent

- **Controlled extensions**
  (if it doesn't adhere, it's something else)
- **Extensions are added to the methodology after careful research**
  (coherent, but features may take time to appear)
- **Models are normally created using the Online Anchor Modeler, lots of code generated**
  (dependent on a single tool, but it is free)
- **Very particular about query optimization features being present**
  (works well only in very recent databases)
- **PK – FK on every table**
  (particular load order, enables all query optimization)

Data Vault and Anchor

Built for managing change
Decouple mutable and immutable information
Differentiate between entities and relationships
Have features that reduce complexity
Care for the core concepts in the domain
Insert Only
Try to live up to modern requirements
Consider schema evolution
Have modeling tools that generate code
Have tools for metadata driven automation
Both can *twine*!
Still not as widely adopted as Dimensional…
Variations of ENSEMBLE MODELING