Presentation Outline

- Introduction to ARTS Data Models
- What’s New –
  - ARTS Operational Data Model Version 7
  - ARTS Data Warehouse Version 3
- Questions & Discussion
ARTS Data Models

- **Relational Operational Data Model**
  - Persistent data store for transactional processing and operational reporting

- **Relational Data Warehouse Model**
  - Persistent data store for predefined and ad-hoc analysis and decision support reporting

- **XML Schema-based Data Model**
  - Message-based data structures for moving data between retail business processes
Conceptual Basis for Integrating ARTS Data Models

- Retail Business Principles & Concepts
- Retail Business Rules
- Retail Controlled Vocabulary & Taxonomy
- Common Retail Semantic Foundation
  - ARTS Operational Data Model
  - ARTS XML Schemas
  - ARTS Data Warehouse Model

RELATIONAL

HIERARCHICAL
Different Scenarios For Using ARTS Data Models

ARTS DW V3

Non-ARTS queries, views and functions

Non-ARTS Data Warehouse

Non ARTS ODS

Legacy to ETL services

Legacy Data

ART ODM V7 (ODS)

ARTS DW V3

ARTS ETL queries, views and functions

ART ODM V7 (ODS)

ARTS DW V3

ARTS ETL queries, views and functions

ART ODM V7 (ODS)

Legacy XML mapping services

Legacy Data

ARTS XML

ARTS XML Schemas provide a starting point for retailers to create canonical data model and related services

www.nrf.com/arts
Two Complementary Relational Models

Operational Data Model
- Supports retail business day to day operation
- Transactional data model
- 3rd Normal Form relational data model
- Covers basic retail business functions
- Provides transactional and master data source for data warehouse facts and dimensions

Data Warehouse Model
- Supports sales and inventory reporting and analytics
- Decision support data model
- Dimensional data model built from ARTS Operational Data Model

Deep Dive

www.nrf.com/arts
What is new in ARTS ODM V7?

- Supports consumer-customer journey (lifecycle)
- Data to support customer behavioral analysis
- Expands customer descriptive attributes
  - Demographic characteristics
  - Psychographic characteristics
  - Geographic characteristics
  - Interests and activities
- New reference data
  - Weather
  - Currency
  - Geolocation
  - Channels
- Builds behavioral customer attributes to support anonymous customer
- Revised treatment of party subtyping
Understanding The Consumer/Customer Journey

- **Consumer**
  - A person or organization this is or may be a purchaser of goods and services from the retailer.

- **A Customer** represents one of several consumer **states** that make up a consumer **life cycle**
Consumer Lifetime Story

Generic Retail Consumer-Customer Portfolio - Life Cycle Context Model

The red arrows represent CONVERSION EVENTS and mark the state transition of individuals and organizations as they progress from being part of an undifferentiated population to being CUSTOMERS.

The funnel graphically illustrates the notion of CONVERSION YIELD.
ARTS Sample Consumer-Customer States Within Each Relationship Stage
Understanding Customer Behavior
Fidelity of Customer Behavioral Information by Source

- **Direct observation (with context)**
  - Person to person *conversation* with customer *during* shopping experience

- **Transactional Information**
  - Tells you what customers do *at conclusion* of shopping experience
  - Reflects actual purchases/Returns/Cancellations/Adjustments
  - Log of outcomes

- **Interaction Journals**
  - Video analytics
  - Clickstream analysis
  - Call center logs

- **Direct Conversation and interaction**
  - Tells you what customers say to you (and what you say to them)
  - Reflects customer intent

- **Indirect Conversation**
  - Tells you what customers say ABOUT you
  - Reflects customer sentiment (based on hear-say)

- **Unobserved/recorded actions and conversations**
- **Silence**
Behavioral Analysis

Customer Doing: Segmentation Based on Behavior

Quantitative Analysis

- Market Basket Analysis
- Price Elasticity & Promotional Patterns
- Brand Affinity

Derive patterns & pattern criteria and assign name

Persona

Transaction Magnitude (line item, quantity, value)

Transaction Context (channel, location, time, weather)

And more...

Future ARTS DW Releases

Customer Order Behavior Observations

Customer Web Interaction Behavior Observations

Posts Topics, sentiment observations

What? (Products & Services)

How? (channels, tender type)

Where (business units)

When (week days, oldays,customer occasions)

Who (customer, worker, anonymous)

Why? (customer occasions, customer asset, RETAILER PROMOTIONAL INITIATIVES)

Product affinity

Price sensitivity

“fashionality”

Magnitude

Transaction milieu

www.nrf.com/arts
Consumer-Customer Lifecycle Measurement & Characterization

- **Demographic Segments**
  - Customer Demographic Characteristics
- **Geographic Segments**
  - Customer Geographic Characteristics
- **Psychographic Segments**
  - Customer Psychographic Characteristics
- **Behavioral Segments**
  - Transaction volume, sizing and value
  - Shopping frequency & recency
  - Occasion
  - Customer purchase Promotion/Price condition
  - Channels (where, when media for shopping)
  - Brands
  - Merchandise Category

**Independent Variables** that influence customer behavior:

- Customer Behavior

**Dependent Variables** that reflect the results of customer behavior:

- Relative Customer Value to the Retailer

Retailer initiatives to increase net profitability
Understanding Customer Behavior: Analytic Context

**Analytic**
- Applied Methods to Classify, cluster, Measure proximity And derive patterns
- Patterns of Behavior

**Optimization**
- Product
- Price
- Promotion
- Place
- Relationship

**Predictive Modeling**
- Applied Non-causal, causal and judgment Based forecasting methods
- Forecasted Activity

**Data Warehouse**
- Historical Reporting
- What? | Who?
- Where? | FACT | When?
- How? | Why?

**Probability of satisfying profitability objectives**

www.nrf.com/arts
Customer Independent Characteristics
Sample Independent Characteristics & Segmentation

<table>
<thead>
<tr>
<th>Life stage</th>
<th>Younger years</th>
<th>Middle years</th>
<th>Older years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household head/chief wage earner</td>
<td>Single (living with family)</td>
<td>Married without child (joint family)</td>
<td>Married without child (nuclear family)</td>
</tr>
<tr>
<td>Less educated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unskilled worker</td>
<td>G1</td>
<td>H1</td>
<td>G4</td>
</tr>
<tr>
<td>Primary educated skilled worker</td>
<td>F1</td>
<td>F2</td>
<td>G2</td>
</tr>
<tr>
<td>School-educated skilled worker</td>
<td>E1</td>
<td>E2</td>
<td>F3</td>
</tr>
<tr>
<td>School-educated businessman</td>
<td>E3</td>
<td>E4</td>
<td>F4</td>
</tr>
<tr>
<td>Highly educated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate/PG skilled worker</td>
<td>D1</td>
<td>D2</td>
<td>E5</td>
</tr>
<tr>
<td>Graduate/PG professional</td>
<td>C1</td>
<td>C2</td>
<td>E6</td>
</tr>
<tr>
<td>Graduate executive/manager</td>
<td>B1</td>
<td>B2</td>
<td>E7</td>
</tr>
<tr>
<td>Graduate/PG businessman</td>
<td>A1</td>
<td>A2</td>
<td>E8</td>
</tr>
<tr>
<td>Residuals</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SEC: Socio-economic category; PG: postgraduate

Deep Dive

www.nrf.com/arts
Reference Data Revisions

- Weather
- Currency
- Geolocation hierarchy
- Channels
ARTS Data Warehouse Model Version 3
The intermediate data aggregation and summarization discussion applies to the specification, design and implementation of the queries and resultant stored summary data (data cubes or simply cubes).

Portfolio of Performance Measures and KPIs that consume summarized and detailed data. The performance measures may, with appropriate care, combine inventory and customer-sales data cubes.
ARTS Sales Data Mart
Dimensions for inventory state (condition) and Revenue Cost Center brought over directly from ODM.
## Sample Measure 1: Customer Reporting Period Average Transaction Value Per Business Unit

<table>
<thead>
<tr>
<th>Sample Performance Measure Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure Name:</td>
</tr>
<tr>
<td>Customer Average Transaction Value Per Business Unit for a Reporting Period (sample measure 1)</td>
</tr>
<tr>
<td>Business Definition &amp; Description</td>
</tr>
<tr>
<td>Goal</td>
</tr>
<tr>
<td>Grow average customer sales per business unit</td>
</tr>
<tr>
<td>Question</td>
</tr>
<tr>
<td>What is the average value of customer purchase by business unit for a reporting period?</td>
</tr>
<tr>
<td>Description</td>
</tr>
<tr>
<td>Average value of each customer’s purchases by business unit (store) for a reporting period</td>
</tr>
<tr>
<td>Subject</td>
</tr>
<tr>
<td>Customer</td>
</tr>
<tr>
<td>Spreadsheet Ref.</td>
</tr>
<tr>
<td>Line 10</td>
</tr>
<tr>
<td>Observable Facts/Phenomena</td>
</tr>
<tr>
<td>Sales/Returns</td>
</tr>
<tr>
<td>Dimensions</td>
</tr>
<tr>
<td>Customer</td>
</tr>
<tr>
<td>Reporting Period</td>
</tr>
<tr>
<td>Business Unit</td>
</tr>
<tr>
<td>Transaction</td>
</tr>
<tr>
<td>Derivation/Formula</td>
</tr>
<tr>
<td>Sum NetSales grouping by Customer, Business unit and Period / Retail Transaction Count grouping by Customer, Business Unit and Reporting Period</td>
</tr>
<tr>
<td>Output/Result</td>
</tr>
<tr>
<td>Monetary Value</td>
</tr>
<tr>
<td>Link to Technical Specification</td>
</tr>
<tr>
<td><img src="#CustomerAvgTrxValPerBusUnitRptPer" alt="Expected SQL Query" /></td>
</tr>
</tbody>
</table>

Sample SQL query to derive the KPI
Contact Information:
Tom Sterling
Email: tster9306@verizon.net
Phone: (717) 608-8035
DEEP DIVE SECTIONS

Optional sequences of slides used to go into detail about topics introduced in the higher-level presentation

www.nrf.com/arts
Defining Customer

- A Customer is:
  - An individual or organization (i.e. a Party)
  - that assumes a role (PartyRoleAssignment) of a Consumer with respect to the retail enterprise
  - Who purchases a product or service (exhibited behavior – ConsumerConversionState)
Core Entities For Consumer State

- Customer acquisition
- Customer retention
- Customer reactivation

- Prospect
- Visitor
- Shopper
- New Customer
- Active Customer
- Inactive Customer
- Ex-customer

RelationshipStage
- RelationshipStageCode (FK)
- RelationshipStageDescription

ConversionState
- ConversionStateCode (FK)
- ConversionStateDescription
- RelativeLowToHighValue
- RelationshipStageCode (FK)

ConversionGoal
- ConversionGoalTypeCode (FK)
- SuccessConversionBehaviorTypeCode (FK)

ConversionBehaviorType
- ConversionBehaviorTypeCode (FK)
- ConversionActionName
- SubActionFunctionName
- Description

ConversionInitiative
- PromotionalInitiativeID (FK)
- ConversionGoalTypeCode (FK)
- PromotionalOfferID (FK)

WebConversionGoal
- WebConversionGoalID
- GoalUniformResourceID
- VisitDuration
- DocumentsPerVisit
- SuccessWebEventTypeCode (FK)
- ConversionStateCode (FK)
- WebTrackerID (FK)
- ConversionGoalDescription

WebConversion
- WebConversionGoalID (FK)
- ConversionID

ConversionEvent
- ConversionEventID (FK)
- ConversionBehaviorTypeCode (FK)
- PreconditionConversionStateCode (FK)
- PostConditionConversionStateCode (FK)
- ConversionEventDataTimeStamp
- LocationID (FK)
- MediaID (FK)
- Retail.TransactionID (FK)
- CustomerOrderID (FK)
- ConsumerID (FK)
- PromotionalInitiativeID (FK)

ConversionInitiative
- ConversionGoalID

ConversionGoal
- ConversionGoalTypeCode (FK)

Consumer
- ConsumerID

WebConversion
- WebConversionGoalID

WebConversionGoal
- WebConversionGoalID

Conversion
- ConversionID

Customer acquisition
- Visitor
- Shopper
- New Customer
- Active Customer
- Inactive Customer
- Ex-customer
Retailer’s definition of customer lifecycle stages of development and specific named conversion states within each stage

Consumer’s lifecycle story memorialized

Consumer states differentiate Visitors from Customers

Snapshot of the point where a consumer’s state changed

Retailer defined conversion goals, conversion behavior type (observable elicited behavior) and conversion initiatives (retailer actions) taken to elicit desired conversion behavior.
Formalizing Customer Journey

ARTS Consumer State Machine

- Individual in population
- Prospect
- Visitor
- Shopper
- New Customer
- Repeat Customer
- Inactive Customer

Population → [Uniquely identified] Create consumer instance → [Uniquely identified] Create consumer instance

- [activity:GE,Silver and LT Gold]
- [activity:GE,Silver and LT Platinum]
- [activity:GE,Gold and LT Platinum]
- [activity:GE,Platinum]
- activity < 0 Net Profit

- Iron
- Copper
- Silver
- Gold
- Platinum

- Ex-Customer

no activity [no activity for > N months]
completes 1st purchase
completes repeat purchase [2nd or subsequent purchase]
no activity [no activity for > N months]
completes repeat purchase [2nd or subsequent purchase]
no activity [no activity for > N months]
completes repeat purchase [2nd or subsequent purchase]
no activity [no activity for > N months]
completes repeat purchase [2nd or subsequent purchase]
no activity [no activity for > N months]
completes repeat purchase [2nd or subsequent purchase]
no activity [no activity for > N months]
completes repeat purchase [2nd or subsequent purchase]
Operational Data Model Organized Around Themes

- **Transaction Themes** for retail activity
  - Retail transactions
  - Control transaction
  - Tender control transactions
  - Customer orders
  - Food service and hospitality
  - Forecourt transactions
  - Inventory receipt and movement documents
  - Operational and financial reporting

*Themes* are named collections of ARTS Subject Areas. ARTS Subject Areas are, in turn, named collections of entities.
Operational Data Model Organized Around Themes

- **Lifecycle Themes** to capture states and transitions over time
  - Consumer-customer journey (explicit)
  - Customer order lifecycle (explicit)
  - Merchandise journey through the retailer (implicit)
  - Product lifecycle management (future)
  - Vendor lifecycle management (future)

*ARTS is explicitly modeling important retail business lifecycles using a state-transition set of entities.*
Operational Data Model Organized Around Themes

- **Master Data Themes** that describes business context
  - **Proper Nouns** (named people, places, things, concepts)
    - Party (generalized model for answering the question who?)
    - Consumer/customer
    - Items and Services Sold
    - Fresh Item Management
    - Assets and Equipment
    - Place (or location)
    - Supplier/vendor
    - Worker and Human Resources
  - **Business Rules**
    - Selling Rules
    - Tax Rules
    - Price Derivation Rules
    - Promotion Rules
Operational Data Model Organized Around Themes

- **Master Data Themes** that describes business context
  - Reference & Lookup
    - Calendar and Time
    - Currency
    - Enterprise Hierarchies and Structures
    - Language
    - Weather Reference
**ARTS Operational Data Model Scope**

**Business Infrastructure and Support**

**Voice of the Customer**

**Consumer Independent Characteristics**
- Demographic
- Geographic
- Psychographic
- Activities & Interest
- Health & Dietary

**Consumer Behavior Dependent Characteristics**
- Consumer-customer interaction
- Consumer-customer social network
- Consumer-customer Transaction History
- Consumer-customer Conversion State

**Product Strategy**
- Item (product or service)
- Merchandise Hierarchy
- Retail Calendar

**Pricing & Promotion Strategy**
- Deal
- Promotion
- Price Derivation
- Loyalty Program
- Cost

**Place Strategy**

**Business Infrastructure and Support**
- Party
- Calendar
- Worker
- Control Transaction
- Tender Control
- Organization
- Reference Tables
- Worker Scheduling
- Store Operations

**Retail Accounting & Reporting**

**Tax (VAT and Sales Tax)**

**Core Value Adding Process and Transaction Oriented Subject Areas**

- Supplier
- Inventory Control Documents
- Inventory
- Customer Order
- Retail Transaction
- Customer
- Fresh Item Management

**Transactions reflect customer behavior and are key part of learning model built into data model.**

**Black arrows reflect sales flow**

**Red arrows reflect returns flow**

**Green blocks represent macro-level subject areas that are new with the release of ARTS Operational Data Model V7 or are planned for in future releases.**

**Financial Accounting (ERP)**

**Uses retail accounting information but is outside of ARTS ODM domain**

**WHAT does the retailer sell?**

**WHAT value proposition does the retailer offer to its customers?**

**WHERE, WHEN and HOW does the retailer sell to and service customers?**

**CUSTOMER needs, wants and preferences**

**Loyalty Program**

**Planogram**

**w w w . n r f . c o m / a r t s**

**back**
Demographic Data

Controlled vocabulary for demographics

ARTS method of tying a Party to a KeyCustomer

Composite demographic segment which is a named combination of individual demographic characteristics
Controlled vocabulary for psychographic characteristics

Composite psychographic characteristics, which is a named combination of individual psychographic attribute values.
Health, diet and activity characteristics that, subject to privacy rules might be used to characterize customers independently of their behavior.
Organization Demographic & Related Data

Controlled vocabulary for organization demographics

Composite demographic segment for organization

Contact information (same as for person or any other party type)
Currency Reference

ISO4217-CurrencyType
- ISOCurrencyCode: ISO_4217_CurrencyCode_char(3)
- ISOExchangeNumber: ISO_4217_CurrencyCodeNumber(3) (AK1.1)
- ISOExchangeName: Name
- ISOExchangeCountryCode: Code2 (FK)
- RetailerAssignedCurrencyTypeCode: Code
- Symbol: Name

ExchangeRate
- SequenceNumber: LineNumber
- From: ISO_4217_CurrencyCode_char(3) (FK)
- To: ISO_4217_CurrencyCode_char(3) (FK)
- ExchangeRateEffectiveDate: EffectiveDate
- ExchangeRateExpirationDate: ExpirationDate
- ToBuyAmount: ExchangeRate
- ToSellAmount: ExchangeRate
- ServiceFeeAmount: Money
- MinimumCurrencyAmount: Money

ISO3166-1Country
- ISOExchangeCountryCode: Code2
- ITUCountryCode: PhoneNumberCountryCode (FK)
- CountryName: Name
- ISO3166ThreeCharacterCountryCode: Code4

Denomination
- DenominationID: Identity
- ISOExchangeCurrencyCode: ISO_4217_CurrencyCode_char(3) (FK)
- Description: Name
- MonetaryValueAmount: MoneyShortRetail
Observation, Data Reduction Classification of Customer Behavior

Retail Transaction Customer Behavior Observations

- Customer
- Reporting Period
- Retail Transaction
  - Sale/Return Line Item: Quantity & Monetary Value Facts
    - Regular Retail Value (unit & ext)
    - Discount Value (unit & ext)
    - Actual Retail Value (unit & ext)
    - Item Cost (unit & ext)
    - Item retail pricing unit count
    - Item retail selling unit count
    - Line Item Action (Sale, Return, NoSale)
  - Retail Price Modifier
    - Applicability Range
    - Previous Price (basis for modification)
    - Price Modification Value
    - New Price
    - Customer Loyalty Program-Account Points Redeemed
  - Price Modification Line Item (Transaction-level discount)
    - Customer Loyalty Program Account Points Redeemed
  - Tender Line Item
    - Tender Value
    - Tender Action (Cash, CR/DB, credit, etc.)
    - Tender Type (cash, CR/DB, coupon, etc.)
    - Customer Loyalty Program Account Points Earned
  - Retailer Promotion & Promotional Initiative
  - Weather Conditions
  - Channel
  - Business Unit

Reduce Retail Transaction Facts for Behavioral Segmentation

- Frequency = Count of named actions per period
- Volume = Count of named entities per period OR lifetime
- Magnitude = Value (usually monetary) of aggregation or unit attributes for a period or lifetime
- Rate = Ratio of two values indicate change
- Duration = Elapsed time

NOTE: Clustering analysis as a method for discovering customer segments will be addressed on Phase 4.

NOTE: Except for segments relating to customer loyalty program-accounts and customer occasions, these categorizations of behavior apply to anonymous as well as key customers.

Also, customer assignment to a segment will change each time an analysis is run. For period to period comparisons, a history of customer behavior snapshots should be kept. This also applies to developing time series analysis that can be used as part of a forecasting model.

Note that for any snapshot customers can only be assigned to one type of segment. For example, a customer, within a given snapshot, cannot be classified as both a platinum and silver level customer type. They may change from one snapshot to another.
CUSTOMER Behavior Observation & Measurement

- Browsing
- Selecting
- Customer Ordering
- Pre-Authorize/Prepayment
- Picking & Packing
- Shipping
- Settlement