Behavior-Driven Development for Data-Focused Teams

**Agile Enablement for DW & BI Teams**

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@AgileLynn
Lynn Winterboer

Colorado Native
Guest Ranch Childhood

Colorado College: Southwest Studies
University of Denver: International MBA

Agile Analytics Trainer & Coach
• Focused on agile and data projects since the mid-90’s
• CBIP – Mastery Level, Certified Scrum Professional, SAFe-PMPO, CSM, CSPO, PMP
Agenda

• How does testable acceptance criteria benefit the WHOLE team?
• What is the purpose of acceptance criteria?
• What does the “Three Amigos” conversation look like?
• What is BDD?
• Data-Focused BDD Example
• Data-Focused BDD Activity
• BDD Evolution
• Conclusion
How does testable acceptance criteria benefit the WHOLE team?
The 3 C’s of a Story

1. Card

   As a *distribution manager* I *need the ability to understand average monthly revenue per gallon on each route* so that *I can decide whether to change routes to be more profitable.*

2. Conversation

   **Key to success in delivering value!**

3. Confirmation
Testing is Central to Agile

Agile BI development is driven by tests

A team’s definition of done define standards to test

Acceptance criteria define business-facing tests

Passing tests are the measure of “done”

Regression tests are the measure of “still done”
Purpose of Acceptance Criteria
Purpose of Acceptance Criteria

Definition of Done = Build the Thing Right
Acceptance Criteria = Build the Right Thing

- Clarify customer (PO) expectations
- Set a clear “goal line” for the team for *each* story
- Input to estimation
- Define the boundaries for a story
- A good story is a testable one
- Often expressed in terms of tests to which the team develops
Acceptance and Done

DONE: APPLIES TO ALL STORIES

Unit tests pass and are documented
All regression tests pass
Each story has been reviewed by a peer to confirm the development and performance standards have been met.

  ETL Standards v1.3 (2/5/17)
  SSRS Standards v2.5 (11/15/16)

Documentation updated:
  Support Guides for Tiers 1, 2 & 3
  User Training – Onboarding and Updates
  Enterprise Data Dictionary

ACCEPTANCE: APPLIES TO INDIVIDUAL STORIES

Recognize the revenue from the sale of a product when:

  Software product has shipped.
  Hardware product has been received by the customer.
  Installed product has been installed at the customer site for 30 days.
  Services are complete.

Test against 16 specific orders provided by Carolyn to confirm combinations of products on a single order.
Test against Q3 last year data to confirm revenue recognition aligns with prior finance system results.
What Happens if a Story Isn’t Accepted?

Product owner has choices...

Make it the next priority for the next sprint:  
“This is still my top priority”

Slice it thinner – and prioritize the slices:  
“This piece of it is my top priority, and this other piece can come later”

Delay it until a later time:  
“Now that we know how much effort this will take, I’d like to focus on other stories that will bring value faster”

Abandon it:  
“This is just too expensive for the value – the ROI isn’t there”
Acceptance Criteria to BDD

Starring:

- Product Owner
- BI Developer
- Tester
- ETL Developer
Story: Revenue by Territory by Sales Rep

Product Owner:

As a Territory Sales Manager,

I want to see the number of orders and revenue by sales rep,

so that I can identify who are our best reps, and who are struggling.
Initial Acceptance Criteria

Provide a separate chart for each territory that shows monthly number of orders (in a line) and $ value (in bars) by rep, sorted from biggest $ value to smallest.
Delivery Team Question 1: Display

**BI Developer:** Can you give me an example of what you expect this to look like?

**Product Owner:**

![Graph](image-url)
Delivery Team Question 2: Time

ETL Developer: What time frame do you want?

Product Owner: I need May information ASAP
Delivery Team Question 3: History

ETL Developer: We can certainly focus on May 2017 first. How far back do you want us to report overall? Current year, or last year too?

Product Owner: Let’s start with the current year – I think I’ll only be interested in prior years when I eventually ask you for year-over-year comparisons.
Story revised

Title: *Monthly Revenue by Territory by Sales Rep*

**Story:** As a Territory Sales Manager,

I want to see the number of orders and revenue by sales rep,

so that I can identify who are our best reps, and who are struggling.
Acceptance Criteria Revised

Provide a separate chart for each territory that shows monthly number of orders (in a line) and $ value (in bars) by rep, sorted from biggest $ value to smallest.

Report by month, for the current year.
Delivery Team Question 4: Territory

Tester: We notice the title includes “by Territory” yet the story doesn’t?

Product Owner: Good point! I want it by territory – will update the story to reflect that.

BI Developer: Should we start with a report where you can select the month and the territory?

Product Owner: Sounds good!
Story revised

Title: Monthly Revenue by Territory by Sales Rep

**Story:** As a Territory Sales Manager,

I want to see the number of orders and revenue by territory and sales rep, so that I can identify who are our best reps, and who are struggling.
Acceptance Criteria Revised

Provide a separate chart for each territory that shows monthly number of orders (in a line) and $ value (in bars) by rep, sorted from biggest $ value to smallest.

Report by month, for the current year.

Let the user select which month and which territory to show.
Delivery Team Question 5: Territory and Rep Name

BI Developer: Do you want to see the Territory and Sales Rep Names, or just the IDs?

Product Owner: Names, please!
Delivery Team Question 6: Acceptance

Tester: How will you know we’ve done this right? What will you look for to confirm?

Product Owner: I’m going to compare to the totals I get from exporting order system data and summing by sales rep. For example, I know Michael Blythe had 10 orders for $178,459 in May 2017
Acceptance Criteria Revised

Provide a separate chart for each territory that shows monthly number of orders (in a line) and $ value (in bars) by rep, sorted from biggest $ value to smallest.

Report by month, for the current year.

Let the user select which month and which territory to show.

Show the names for territories and sales reps, instead of their IDs

For example, we know Michael Blythe had 10 shipped orders for $178,459 in May 2017.
Delivery happens!

<table>
<thead>
<tr>
<th>TerritoryName</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southwest</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SalespersonName</th>
<th>OrderCount</th>
<th>TotalDue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linda Mitchell</td>
<td>15</td>
<td>300470</td>
</tr>
<tr>
<td>Michael Blythe</td>
<td>10</td>
<td>201308</td>
</tr>
<tr>
<td>Shu Ito</td>
<td>9</td>
<td>166840</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>34</strong></td>
<td><strong>668618</strong></td>
</tr>
</tbody>
</table>

**TotalDue and OrderCount by SalespersonName**

- Linda Mitchell: **TotalDue = 300470**, **OrderCount = 15**
- Michael Blythe: **TotalDue = 201308**, **OrderCount = 10**
- Shu Ito: **TotalDue = 166840**, **OrderCount = 9**

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Test Discussion

ETL Developer: When we pull the data as you requested, we notice that we got $201,308 for Michael Blythe in May 2017, while you were expecting $178,459. That concerns us.

Product Owner: Hmmmm.... Could we look at the results for an individual order to see if that lines up? Michael’s sales order number 71810 in May should show $802.

ETL Developer: Sure – here you go.

(modifies the SQL to pull just that order – at which point PO notices a few things...)
SELECT CAST(SUM(TotalDue) AS int) AS TotalDue
FROM EDW.dbo.F_SalesOrderHeader
WHERE YEAR(OrderDate) = 2017
AND MONTH(OrderDate) = 5
AND SalesPersonID = 275
AND TerritoryID = 4
Product Owner: Ah! I see the problem – you are pulling TotalDue for the value of the orders, which includes tax and freight charges. The data I’m pulling excludes those numbers. The field I am looking at is **SubTotal**.

And, I notice you are using Order Date for the month. I wish I’d thought to mention that we consider an order “revenue” when it ships... so you should use the **Ship Date** instead.

And, be sure to only include **successfully shipped** orders – sometimes an order comes back undeliverable and we don’t count that as revenue.
Test Discussion

```sql
SELECT CAST(SUM(SubTotal) AS int) AS SubTotal
FROM EDW.dbo.F_SalesOrderHeader
WHERE YEAR(ShipDate) = 2017
AND MONTH(ShipDate) = 5
AND SalesPersonID = 275
AND TerritoryID = 4
AND status = 5
```
Story’s Acceptance Criteria

Provide a separate chart for each territory that shows monthly number of orders (in a line) and $ value (in bars) by rep, sorted from biggest $ value to smallest.

Report by month, for the current year.

Let the user select which month and which territory to show.

Show the names for territory and sales reps, instead of their IDs.

Show order value before tax and freight (SubTotal).

Since revenue is incurred upon shipment, only include successfully shipped orders (status = 5) and use the ship month for the date.

For example, we know Michael Blythe had 10 shipped orders for $178,459 in May 2017.
Delivery happens again!

<table>
<thead>
<tr>
<th>TerritoryName</th>
<th>Month</th>
<th>SalespersonName</th>
<th>OrderCount</th>
<th>SubTotal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southwest</td>
<td>5</td>
<td>Michael Blythe</td>
<td>10</td>
<td>178459</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shu Ito</td>
<td>15</td>
<td>335458</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jillian Carson</td>
<td>6</td>
<td>125564</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>52</td>
<td>1068964</td>
</tr>
</tbody>
</table>
Test the updated Story

Tester: We re-built the report using the revised criteria, and the values match up for Michael’s revenue in May.

Move to BDD

ETL Developer: Having an expected data set to test for was really helpful. Do you think you could provide other examples like this for more tests?

Product Owner: Sure!
Behavior-Driven Development (BDD)

Also known as

Specification by Example
Behavior Driven Development

User stories are often written:
As a [role] I need [feature] so that [benefit].

Corresponding acceptance criteria:

[Scenario Name]
GIVEN [initial context],
WHEN [event occurs],
THEN [ensure some outcomes].
Behavior Driven Development

• A technique for story testing
• Outside-in testing through the BI application user interface
• Uses concrete examples to describe BI application behavior
• Automating those examples provides quick feedback
• Regression testing is achieved right from the beginning
Story: Monthly Revenue by Territory by Sales Rep

As a Territory Sales Manager, I want to see the number of orders and revenue by territory and sales rep, so that I can identify who are our best reps, and who are struggling.

Acceptance Criteria:

- Chart formatted with revenue in bars and orders in a line, like this:
- Report by month, for the current year.
- Let the user select which month and which territory to show.
- Show the names for territory and sales reps, instead of their IDs.
- Show order value before tax and freight (SubTotal).
- Since revenue is incurred upon shipment, only include successfully shipped orders (status = 5) and use the ship month for the date.
- Michael Blythe had 10 shipped orders for $178,459 in May 2017.
Scenario: Single Sales Person Revenue Total

**GIVEN** Michael Blythe is a sales rep in the Southwest,

**AND** the total of those orders was $178,459.

**WHEN** we report on May 2017 Revenue by Rep for the Southwest,

**THEN** the report shows Michael Blythe with __________ in revenue for the month
Scenario: Single Sales Person Revenue Total

**GIVEN** Michael Blythe is a sales rep in the Southwest,

**AND** the total of those orders was $178,459.

**WHEN** we report on May 2017 Revenue by Rep for the Southwest,

**THEN** the report shows Michael Blythe with $178,459 in revenue for the month.
Scenario: Sales Reps Sorted by Revenue Totals

Example:
Southwest Rep Linda Mitchell has shipped $429,483 in May 2017.

**GIVEN** Michael Blythe is a sales rep in the Southwest,

**AND** he has shipped $178,459 in May 2017,

**AND** Linda Mitchell is also a sales rep in the Southwest,

**AND** _______

**WHEN** we report on May 2017 Revenue by Rep for the Southwest,

**THEN** the report shows _______
Scenario: Sales Reps Sorted by Revenue Totals

Example:
Southwest Rep Linda Mitchell has shipped $429,483 in May 2017.

**GIVEN** Michael Blythe is a sales rep in the Southwest,

**AND** he has shipped $178,459 in May 2017,

**AND** Linda Mitchell is a also sales rep in the Southwest,

**AND** she has shipped $429,483 in May 2017.

**WHEN** we report on May 2017 Revenue by Rep for the Southwest,

**THEN** the report shows Linda Mitchell with $429,483 in revenue to the left of Michael Blythe with $178,459 in revenue for the month.
Scenario: Only Successfully Shipped Orders

Example: In May, Jillian shipped $136,394 then had one of those orders for $10,830 returned as undeliverable (shipping status of 6)

GIVEN Jillian Carson is a sales rep in the Southwest,

AND she has shipped $136,394 in May 2017,

BUT ________

WHEN ________

THEN ________
Scenario: Only Successfully Shipped Orders

Example: In May, Jillian shipped $136,394 then had one of those orders for $10,830 returned as undeliverable (shipping status of 6)

GIVEN Jillian Carson is a sales rep in the Southwest,
AND she has shipped $136,394 in May 2017,
BUT one of those orders for $10,830 was returned as undeliverable,
WHEN we report on May 2017 Revenue by Rep for the Southwest,
THEN the report shows Jillian Carson with $125,564 in revenue for the month.
BDD Activity
Story: Sales Reps Selling <80% in Home Territory

As a Sales Territory Manager,
I want to know my sales reps are selling at least 80% of their revenue in their home territory,
So that I can ensure the base salaries I pay my Sales Reps are primarily bringing in revenue to my territory.

Acceptance Criteria:
MTD report of % revenue in home territory, by sales rep.
Report refreshed daily at 1 AM for the prior day.
Automatic email to both the sales rep and the territory manager when a rep’s MTD home territory sales revenue falls below 80%.
Data: José Saraiva Monthly Revenue through 3/8/17

Jose is officially part of the Canadian territory.
Assume the following were his March sales through 3/8/17:

<table>
<thead>
<tr>
<th>SalesOrderID</th>
<th>OrderDate</th>
<th>ShipDate</th>
<th>ShipStatus</th>
<th>SubTotal</th>
<th>SalesRep</th>
<th>Territory</th>
</tr>
</thead>
<tbody>
<tr>
<td>43661</td>
<td>2/28/17</td>
<td>3/7/17</td>
<td>Shipped</td>
<td>$32,726</td>
<td>José Saraiva</td>
<td>Canada</td>
</tr>
<tr>
<td>43662</td>
<td>2/28/17</td>
<td>3/7/17</td>
<td>Shipped</td>
<td>$28,833</td>
<td>José Saraiva</td>
<td>Canada</td>
</tr>
<tr>
<td>43668</td>
<td>2/28/17</td>
<td>3/7/17</td>
<td>Shipped</td>
<td>$35,944</td>
<td>José Saraiva</td>
<td>Canada</td>
</tr>
<tr>
<td>43672</td>
<td>2/28/17</td>
<td>3/7/17</td>
<td>Shipped</td>
<td>$6,124</td>
<td>José Saraiva</td>
<td>Canada</td>
</tr>
<tr>
<td>43674</td>
<td>2/28/17</td>
<td>3/7/17</td>
<td>Shipped</td>
<td>$2,624</td>
<td>José Saraiva</td>
<td>Canada</td>
</tr>
</tbody>
</table>

**Total sold in Canada:** $106,251  93%

<table>
<thead>
<tr>
<th>SalesOrderID</th>
<th>OrderDate</th>
<th>ShipDate</th>
<th>ShipStatus</th>
<th>SubTotal</th>
<th>SalesRep</th>
<th>Territory</th>
</tr>
</thead>
<tbody>
<tr>
<td>67293</td>
<td>3/1/17</td>
<td>3/8/17</td>
<td>Shipped</td>
<td>$4,348</td>
<td>José Saraiva</td>
<td>EU UK</td>
</tr>
<tr>
<td>67308</td>
<td>3/1/17</td>
<td>3/8/17</td>
<td>Shipped</td>
<td>$3,961</td>
<td>José Saraiva</td>
<td>EU UK</td>
</tr>
</tbody>
</table>

**Total sold in UK:** $8,309  7%

**Total sold:** $114,560  100%
Scenario: Rep’s MTD home territory revenue > 80%

GIVEN __________ ,
AND __________ ,
AND __________ ,
WHEN __________ ,
THEN __________
AND __________ .
Scenario: Rep’s MTD home territory revenue > 80%

GIVEN José Saraiva is a Sales Rep working for the Canadian Territory,

AND he sells $106,251 in Canada through 3/8,

AND he sells $8,309 in the EU UK through 3/8,

WHEN we calculate his percentage of revenue sold MTD as of 3/8/17 in his home territory of Canada,

THEN the result is 93%

AND the system DOES NOT notify either José and his Territory Manager.
Jose is officially part of the Canadian territory.

Assume an additional UK order ships on 3/9/17:

<table>
<thead>
<tr>
<th>SalesOrderID</th>
<th>OrderDate</th>
<th>ShipDate</th>
<th>ShipStatus</th>
<th>SubTotal</th>
<th>SalesRep</th>
<th>Territory</th>
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</thead>
<tbody>
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<tr>
<td>43674</td>
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<td>3/1/17</td>
<td>3/8/17</td>
<td>Shipped</td>
<td>$4,348</td>
<td>José Saraiva</td>
<td>EU UK</td>
</tr>
<tr>
<td>67308</td>
<td>3/1/17</td>
<td>3/8/17</td>
<td>Shipped</td>
<td>$3,961</td>
<td>José Saraiva</td>
<td>EU UK</td>
</tr>
<tr>
<td><strong>67261</strong></td>
<td><strong>3/2/17</strong></td>
<td><strong>3/9/17</strong></td>
<td><strong>Shipped</strong></td>
<td><strong>$29,064</strong></td>
<td><strong>José Saraiva</strong></td>
<td><strong>EU UK</strong></td>
</tr>
</tbody>
</table>

Total sold in Canada: $106,251 74%

Total sold in UK: $37,373 26%

Total sold: $143,624 100%
Scenario: Rep’s MTD home territory revenue < 80%

GIVEN __________ ,

AND __________ ,

AND __________ ,

WHEN __________ ,

THEN __________

AND __________ .
Scenario: Rep’s MTD home territory revenue < 80%

**GIVEN** José Saraiva is a Sales Rep working for the Canadian Territory,

**AND** he sells $106,251 in Canada through 3/9,

**AND** he sells $37,373 in the EU UK through 3/9,

**WHEN** we calculate his percentage of revenue sold in March as of 3/9/17 in his home territory of Canada,

**THEN** the result is 74%

**AND** the system notifies both José and his Territory Manager.
BDD Evolution
BDD Evolution

• Test-Driven Development (TDD)

• Story Test-Driven Development (STDD)
  • *A.k.a. Acceptance Test-Driven Development (ATDD)*

• Behavior-Driven Development (BDD)
  • *A.k.a. Specification by Example*
Test Driven Development

- Development Methodology vs. a Testing Methodology
  - **Red** – Write a little test & confirm it fails
  - **Green** – Write the code necessary to make the test pass
  - **Refactor** – Eliminate any scaffolding created just to make the test pass

- TDD Rhythm – Test Tiny/Build Tiny
  1. Quickly add a little test
  2. Run all the test and see the new one fail
  3. Make a little change
  4. Run all tests and see them succeed
  5. Refactor to remove scaffolding

  ![TDD Rhythm Diagram]

- Write a Test
- Make it Run
- Make it Right
TDD Example

Create a new field in the Customer table, CRM_ID

1. Write a test that looks for the field Customer.CRM_ID
2. Run the test; confirm it fails
3. Create the new field CRM_ID in the Customer table
4. Run the test; confirm it passes.
TDD Summary

• Test Tiny/Build Tiny

• “Specify a detailed, executable design for your solution on a JIT basis.” (Scott Ambler)

• Intentionally make high quality, small, incremental progress

• Re-use the tests in regression testing
Story Testing

• Specific examples of user stories, which define acceptance criteria
• Articulated by customers
• Expressed in the customer’s domain language
• Becomes the specification
• Can be automated using test automation tools
Story Test Driven Development

No development begins until at least one story test is written

1. Write a story test that fails
2. Make it pass using TDD
3. Run ALL tests and watch the new one pass
4. Refactor to make the implementation better
5. Repeat until all story tests are passing

Customers and product owners can continue to add story tests after development has begun.
Behavior Driven Development

User stories are often written:
As a [role] I need [feature] so that [benefit].

Corresponding acceptance criteria:

[Scenario Name]
GIVEN [initial context],
WHEN [event occurs],
THEN [ensure some outcomes].
Wrap up
Review Agenda

• How does testable acceptance criteria benefit the WHOLE team?
• What is the purpose of acceptance criteria?
• What does the “Three Amigos” conversation look like?
• What is BDD?
• Data-Focused BDD Example
• Data-Focused BDD Activity
• BDD Evolution
• Conclusion
Session Evaluations
Thank You!

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