



# INDIANA DEPARTMENT OF REVENUE

## The End of 2D Bar Code?

Achieving High Recognition Rates on Machine Printed  
Tax Forms

Monday, August 15, 16

# Presenters

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Returns Processing Center Manager

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Deputy IT Director

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Product Manager



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# Agenda

- DOR's Imaging Project
- What Were We Thinking?
- What Did We Do?
- How Did It Work?
- Questions & Answers



# DOR's Imaging Project

DOR made an agency-wide commitment to imaging

- To reduce processing costs for paper tax returns

TY	2007	2008	2009	2010	2011	2012	2013	2014	2015
\$ Cost/ Return	\$3.33	\$2.04	\$1.34	\$1.13	\$0.89	\$0.73	\$0.72	\$0.70	\$0.75

- To speed up processing

PY	2007	2008	2009	2010	2011	2012	2013	2014	2015
End Date	6/30	6/30	6/1	6/5	5/26	5/24	5/19	5/10	5/15



# DOR's Imaging Project

## System Acquisition Process

- Issued RFP in February 2007 for Document Imaging and Retrieval Services
- Contract completed September 2008
- Limited production in January 2009
- Completed new form implementations by January 2011



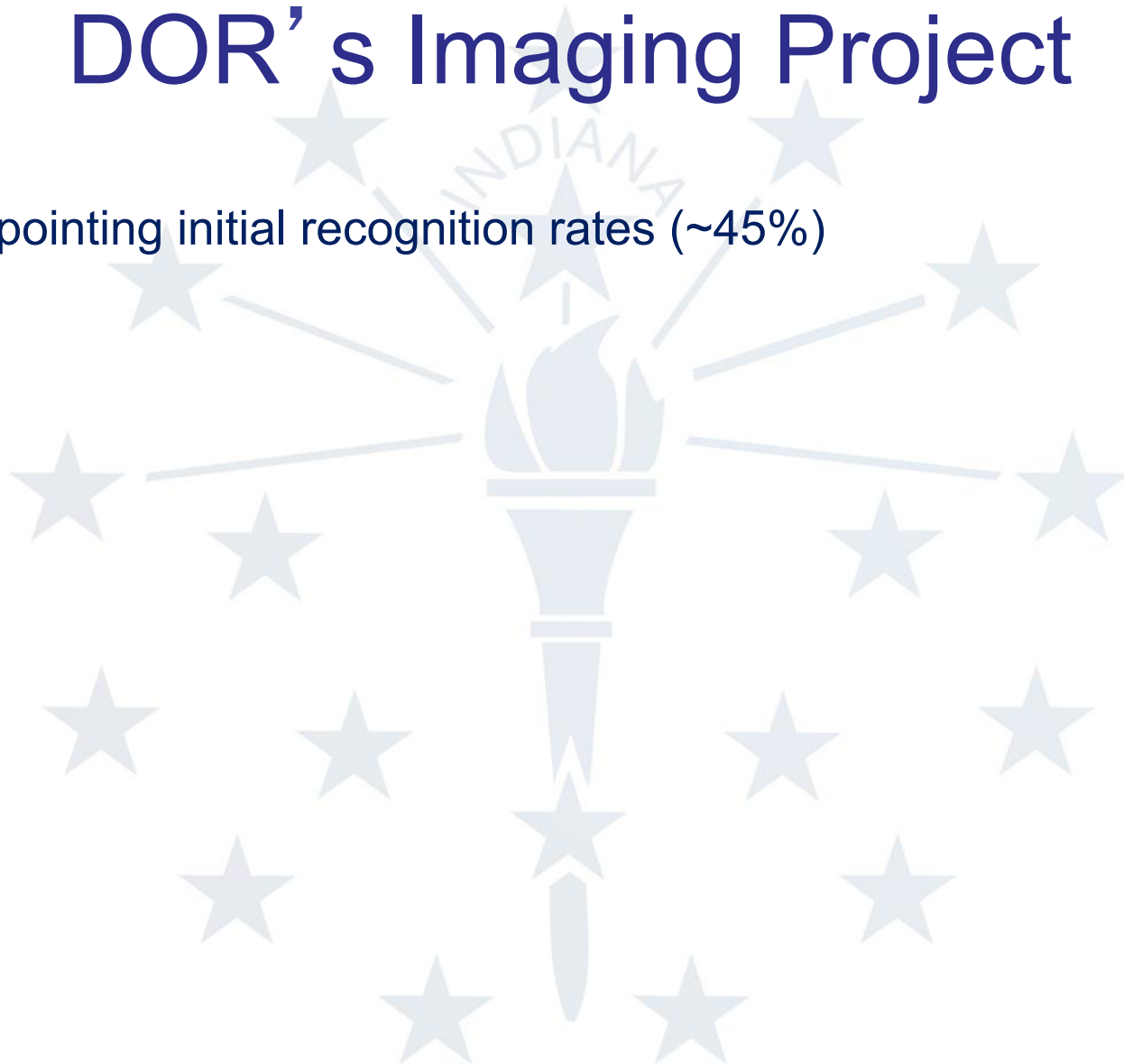
# DOR's Imaging Process

- Multiple tax types are scanned together
- Tax returns and schedules are identified from the images
- Templates are created for each tax form for data capture
- W2/1099 data is captured and used to match to taxpayer information
- Straightforward data completion is provided by home keyers
- Items that fail validation are presented to a knowledge worker
- Completed data is formatted and handed off to RPS backend system
- Images and index data are uploaded to the image repository
- **2D returns skip the recognition and data perfection steps**
  - **2D barcode is decoded on scanner**
  - **2D data passed to imaging system**
- All output is extracted to the backend system



# DOR's Imaging Project

- Disappointing initial recognition rates (~45%)



# What Were We Thinking?

- It's redundant, complex, and expensive to develop 2D barcode processing
- 2D barcode schedules are produced as part of machine-generated returns
- We could vastly improve recognition rates for machine-generated forms

**Could we eliminate 2D barcode and just process machine-generated returns?**





# What Did We Do?

- Recognized recognition problem



# Recognition Problem

## Causes

- Imaging system wasn't working as expected
- Tax forms weren't designed to be imaged
- Replacement forms meant a unique set of templates for each vendor

## Results

- Wrong template selected more often than not
- Multiple template sets led to data mapping inconsistencies
- Form design confused the recognition engines



# What Did We Do?

- Recognized recognition problem
- Improved recognition



# Tuned the Imaging System

## Recognition Engines

- Analyzed machine vs. hand printed
- Modified the engine groups
- Adjusted engine confidence thresholds

## Forms Calibration

- Modified template matching threshold
- Created removable zones – not used in matching



# Redesigned Forms

TY 2008

TY 2014

**Form IT-65**  
State Form 118-03 (07/08/09)

Indiana Department of Revenue  
**Indiana Partnership Return**  
for Calendar Year Ending December 31, 2008  
or Other Tax Year Beginning  /  2008 and Ending  /  2008

Check box if amended:  A or  B Check box if name changed:  C

Name of Partnership: \_\_\_\_\_ Federal Identification Number: \_\_\_\_\_  
 Number and Street: \_\_\_\_\_ Indiana County or O.O.S.: \_\_\_\_\_ Principal Business Activity Code: \_\_\_\_\_  
 City: \_\_\_\_\_ State: \_\_\_\_\_ ZIP Code: \_\_\_\_\_ Telephone Number: \_\_\_\_\_

R. Date of organization: \_\_\_\_\_ Q. Check all boxes that apply to entity:  Initial Return  Final Return  In Bankruptcy  Composite Return  
 In 19th State of U.S.: \_\_\_\_\_ P. Enter total number of partners: \_\_\_\_\_ Enter number of nonresident partners: \_\_\_\_\_  
 State of commercial domicile: \_\_\_\_\_ Q. Do you have on file a valid extension of time to file your return under Indiana Form 7004 or an electronic extension of time?  Y  N  
 M. Year of initial Indiana return: \_\_\_\_\_ R. Are you a limited liability company electing partnership treatment on your federal return?  Y  N  
 N. Accounting method: Cash  Accrual  Other  S. Is this partnership a member of any other partnership(s)?  Y  N  
 1  Cash 2  Accrual 3  Other

**Aggregate Partnership Distributive Share Income (see worksheet)**

1. Total net income (loss) from U.S. Partnership return, Form 1065 Schedule K, lines 1 through 11 less line 12, and a portion of line 13 related to investment income (see instructions) \_\_\_\_\_ 1 \_\_\_\_\_  
 2. Add: a) All state income taxes deducted on the federal return \_\_\_\_\_ 2a \_\_\_\_\_  
 b) Net bonus depreciation allowed \_\_\_\_\_ 2b \_\_\_\_\_  
 c) Excess IRC Section 179 deduction \_\_\_\_\_ 2c \_\_\_\_\_  
 d) Use allowed for department use only \_\_\_\_\_ 2d \_\_\_\_\_  
 Deduct: e) Interest on U.S. government obligations \_\_\_\_\_ 2e \_\_\_\_\_  
 f) Indiana lottery prize income \_\_\_\_\_ 2f \_\_\_\_\_  
 2g. Total state modifications to distributive share of partnership income (lines 2a through 2e minus lines 2c and 2f) \_\_\_\_\_ 2g \_\_\_\_\_  
 3. Total partnership income, as adjusted (add lines 1 and 2g) \_\_\_\_\_ 3 \_\_\_\_\_  
 4. Other average percentage for Indiana apportioned adjusted gross income from IT-65 Schedule E line 10, if applicable \_\_\_\_\_ 4 \_\_\_\_\_

**Summary of Calculations**

1. Corrected tax due on purchases subject to use tax from Sales/Use Tax worksheet (from page 27) \_\_\_\_\_ 1 \_\_\_\_\_  
 2. Total composite tax from completed Schedule IT-65-COMP (D-1), Attach schedule \_\_\_\_\_ 2 \_\_\_\_\_  
 3. Total tax (add lines 1 and 2). Caution: If line 2 is zero, see line 12 for file priority \_\_\_\_\_ 3 \_\_\_\_\_  
 4. Total composite tax minus credits (attach schedule) and MH-18 statements for composite members \_\_\_\_\_ 4 \_\_\_\_\_  
 5. Other payments/credits belonging to the partnership (attach statements) \_\_\_\_\_ 5 \_\_\_\_\_  
 6. Subtotal (line 3 minus lines 4 and 5). If total is greater than zero, proceed to lines 11, 12, and 13 \_\_\_\_\_ 6 \_\_\_\_\_  
 7. Interest: Enter cash interest due; see instructions. (Contact the Department for current interest rate) \_\_\_\_\_ 7 \_\_\_\_\_  
 8. Penalty: If paying late, enter 10% of line 12. If line 7 is zero, enter \$3 per day past the due date; see instructions \_\_\_\_\_ 8 \_\_\_\_\_  
 9. Penalty: If failing to include all nonresident partners on composite return, enter \$300; see instructions \_\_\_\_\_ 9 \_\_\_\_\_  
 10. Total Amount Due (add lines 6 through 9); if less than zero, enter on line 15. Make payment in U.S. funds \_\_\_\_\_ 10 \_\_\_\_\_  
 11. Overpayment (line 8 plus line 3, minus lines 7, 11, 12, and 13) \_\_\_\_\_ 11 \_\_\_\_\_  
 12. Refund: Attach State line 15. We carry forward a zero. Enter as a positive figure \_\_\_\_\_ 12 \_\_\_\_\_  
 Do not write in line 23. Reserved for Department's use only \_\_\_\_\_ 23 \_\_\_\_\_

**Certification of Signatures and Authorization Section**  
 Under penalties of perjury, I declare that I have examined this return, including all attachments if schedules and attachments, and to the best of my knowledge and belief, it is true, correct, and complete.  
 I authorize the Department to discuss my return with my personal representative (see page 12):  Y  N

Partnership E-mail Address: \_\_\_\_\_  
 If Paid Preparer: Firm's Name (do not file self-employed) \_\_\_\_\_  
 O Check One:  Federal ID Number  TIN OR  Social Security Number  
 Signature of Preparer: \_\_\_\_\_ Telephone number: \_\_\_\_\_  
 Print or Type Name of Preparer: \_\_\_\_\_ Title: \_\_\_\_\_  
 Personal Representative's Name (Print or Type): \_\_\_\_\_ Address: \_\_\_\_\_  
 Telephone Number: \_\_\_\_\_ City: \_\_\_\_\_  
 Address: \_\_\_\_\_ State: \_\_\_\_\_ ZIP Code - 4 digit: \_\_\_\_\_  
 Street: \_\_\_\_\_ ZIP Code - 4 digit: \_\_\_\_\_  
 Signature: \_\_\_\_\_ Date: \_\_\_\_\_

► Please mail forms to: Indiana Department of Revenue, 100 N. Senate Ave., Indianapolis, IN 46204-2263

**Form IT-65**  
State Form 118-04  
(01/13, 8-14)

Indiana Department of Revenue  
**Indiana Partnership Return**  
for Calendar Year Ending December 31, 2014

2014

or Other Tax Year Beginning  /  2014 and Ending  /  2014

Check box if amended:  A or  B Check box if name changed:  C

Name of Partnership: \_\_\_\_\_ Federal Identification Number: \_\_\_\_\_  
 Number and Street: \_\_\_\_\_ Indiana County or O.O.S.: \_\_\_\_\_ Principal Business Activity Code: \_\_\_\_\_  
 City: \_\_\_\_\_ State: \_\_\_\_\_ ZIP Code: \_\_\_\_\_ Telephone Number: \_\_\_\_\_

R. Date of organization: \_\_\_\_\_ Q. Check all boxes that apply to entity:  Initial Return  Final Return  In Bankruptcy  Composite Return  
 In 19th State of U.S.: \_\_\_\_\_ P. Enter total number of partners: \_\_\_\_\_ Enter number of nonresident partners: \_\_\_\_\_  
 State of commercial domicile: \_\_\_\_\_ Q. Do you have on file a valid extension of time to file your return (federal Form 7004 or an electronic extension of time)?  Y  N  
 M. Year of initial Indiana return: \_\_\_\_\_ R. Are you a limited liability company electing partnership treatment on your federal return?  Y  N  
 N. Accounting method: Cash  Accrual  Other  S. This partnership is a member of another partnership(s).  Y  N. The entity reports income from disregarded entities.  Y  
 1  Cash 2  Accrual 3  Other

**Aggregate Partnership Distributive Share Income (see worksheet)**

1. Total net income (loss) from U.S. Partnership return, Form 1065 Schedule K, lines 1 through 11 less line 12, and a portion of line 13 related to investment income (see instructions), use minus sign for negative amounts \_\_\_\_\_ 1 \_\_\_\_\_  
 2. a. Enter name of addback or deduction (see instructions) \_\_\_\_\_ Code No. \_\_\_\_\_ 2a \_\_\_\_\_  
 b. Enter name of addback or deduction \_\_\_\_\_ Code No. \_\_\_\_\_ 2b \_\_\_\_\_  
 c. Enter name of addback or deduction \_\_\_\_\_ Code No. \_\_\_\_\_ 2c \_\_\_\_\_  
 d. Enter name of addback or deduction \_\_\_\_\_ Code No. \_\_\_\_\_ 2d \_\_\_\_\_  
 e. Enter name of addback or deduction \_\_\_\_\_ Code No. \_\_\_\_\_ 2e \_\_\_\_\_  
 f. Enter the total amount of addbacks and deductions from any additional sheets (use a minus sign for negative amount) \_\_\_\_\_ 2f \_\_\_\_\_  
 3. Total partnership income, as adjusted (add lines 1 through 2f) \_\_\_\_\_ 3 \_\_\_\_\_  
 4. Total percentage for Indiana apportioned adjusted gross income from IT-65 Schedule E line 9, if applicable \_\_\_\_\_ 4 \_\_\_\_\_  
**Summary of Calculations**  
 5. Sales/use tax due on purchases subject to use tax from Sales/Use Tax worksheet (from page 16): \_\_\_\_\_ 5 \_\_\_\_\_  
 6. Total composite tax from completed Schedule IT-65-COMP (118); Attach schedule \_\_\_\_\_ 6 \_\_\_\_\_

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# Changed Vendor Certification

- Vendors produce replica forms; not replacement forms
- Replicas must match data placement of exemplars
- Replica submissions must select the correct exemplar template
- Vendors don't print handwriting cues (no box)
- Vendors print courier font (non-proportional spacing)

## Results

- Single template set → Optimized template selection
- One set of data mappings
- Achieved VERY high recognition rates (> 90%)
  - Lots of white space around interest area
  - Minimized data points
- Reduction in popularity with NACTP



# What Did We Do?

- Recognized recognition problem
- Improved recognition
- Examined costs



# Costs Unique to 2D Bar Code

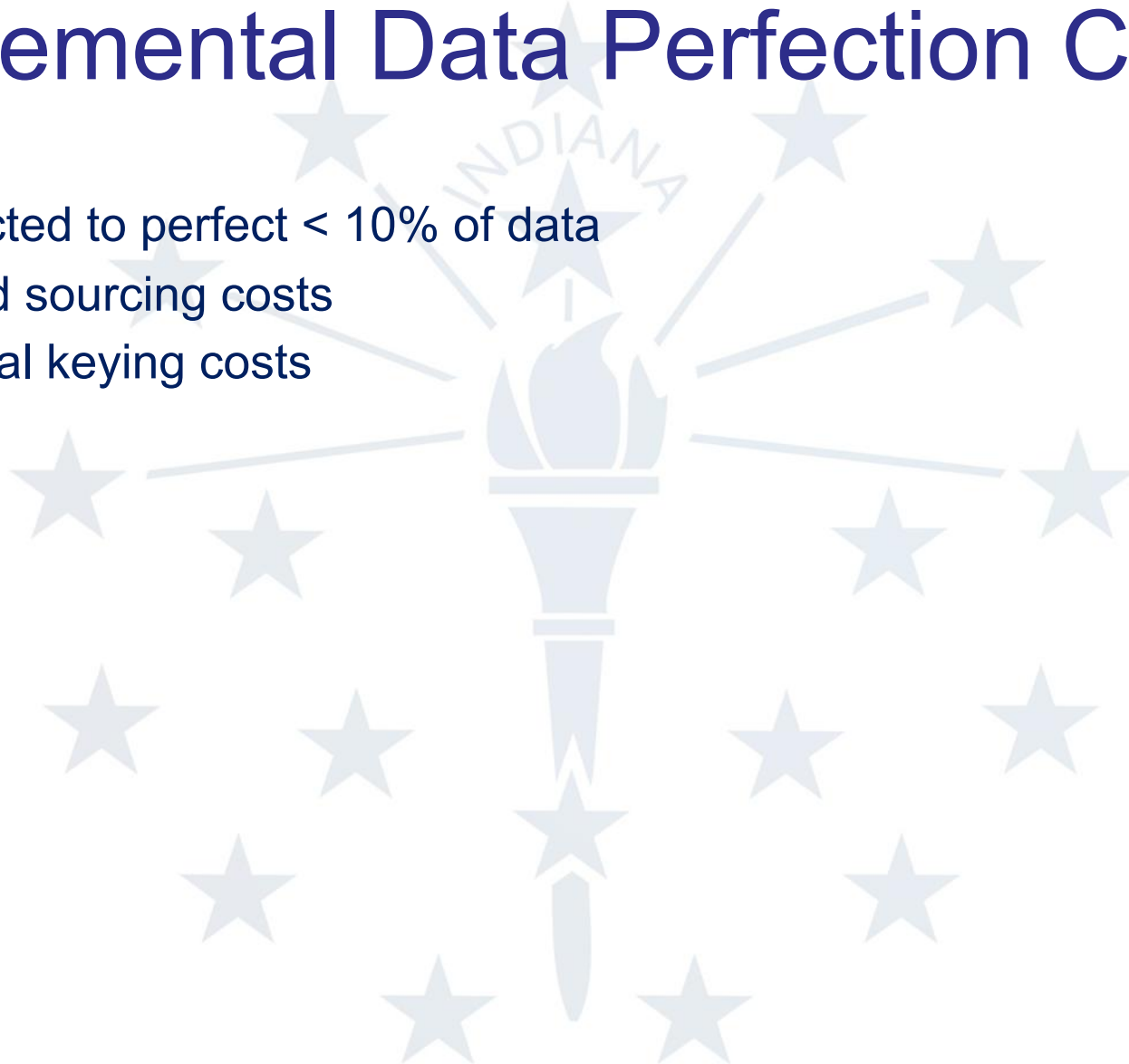
- Documentation for vendors
- Development
  - Scanner vendor
  - Imaging vendor
  - Internal systems support staff
- Testing
  - Internal systems support staff
  - Internal QA
  - Internal UAT
- Vendor certification





# Incremental Data Perfection Costs

- Expected to perfect < 10% of data
- Crowd sourcing costs
- Internal keying costs



# What Did We Do?

- Recognized recognition problem
- Improved recognition
- Examined costs
- Did the math



# The BIG Question

Can we absorb the cost of data perfection for the expected 10% of misrecognized data elements with the savings from not doing 2D barcode development, testing, and certification?



# Doing the Math

- Machine-generated return suspend rate was less than 2D barcode return suspend rate
- Paper filing volume was trending down
  - TY2012/ 2013/ 2014 = 25% → 20%
  - TY2015 = 15%
- 2D barcode filing volume was trending down
- Vendor support for 2D barcode was trending down by TY2013
  - 5 IND vendors
  - 2 COR vendors
  - Barcode vendors got extra tolerance on template picking



# Doing the Math

- Number of paper returns would NOT increase
- Most processing costs would remain stable
  - Mail opening
  - Document preparation
  - Scanning
- Data perfection costs would increase incrementally
  - Percentage of 2D barcode returns processed *versus* total paper returns
  - 10% requirement for intervention

**Incremental cost increase for data perfection was less than savings from not developing process for 2D barcode returns.**



# How Did It Work?

We stopped processing 2D barcode beginning TY2014

- Year end timeline issues in 2013
- BHAG presented to SOC

We saved money and time

- Reduced year end timeline 5-7 weeks
- Increased IT & operational capacity by 91 days
- Reduced year end complexity and change curve
- Savings of \$43,000/year

Eliminating IND EZ Form due to IND Form Redesign



# Questions & Answers

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