



working  
together!

PDF Days Europe 2022 | Berlin

# PDF in Variable Data Printing

Individualized PDF in customer communications

- What is variable data printing (VDP)?  
Why should I care (when preparing PDFs for VDP)?
- What does the internal PDF structure have to do with VDP?
- „Best Practice Guides for Variable Data Printing“  
recently published by the PDF Association

# Where is variable data printing used



- Direct Mail (“Omni Channel Marketing”, Customer Communications)
  - Example: Retarget shopping cart droppers
  - Highly individualized print products
- Transactional (e.g. invoices)
  - Transpromo
- Label and packaging
- Tickets
- ...



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# Where is variable data printing used

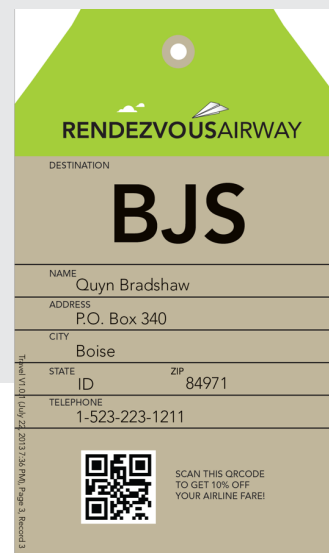


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# Where is variable data printing used



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- ...



# High speed ink jet



- Made possible by high speed inkjet machines at up to 2.5m/sec (9km/h, 5.6mph)
- ... which are expensive, but allow for high profitability – if data comes in from the DFE (digital front end) at print machine speed
- The DFE needs PDF files that can be processed at print machine speed ...



# How much optimization of VDP jobs matters



- Example: Printing speed 3 pages / second (180 pages / minute)  
Job for 360 copies
- Static job
  - While the engine prints 360 copies of the first page  
the DFE has 2 minutes to prepare the next page
- Variable data job
  - 360 (different) pages
  - The DFE has 0.333 seconds to prepare the next page



# Overview



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# Fast processing and PDF structure



- VDP jobs are usually created from designed templates with static and variable data
- Variable parts are often texts, barcodes (QR-codes) or images
- Key technology in the DFE for their fast processing is **caching**
  - As much content as possible needs to be cached
  - Identification of static and variable parts should be straightforward (in the internal PDF structure)

# Example – static vs variable content





The Far East is calling you! Known for being a developed country that hasn't lost it's flavor, there is a little something for everyone. Experience the fast-paced city life, beautiful landscapes and the rich history it has to offer. From the bustling city of Shanghai to the Forbidden City, there are many sites you can see, such as the Great Wall, the Terracotta army, the gorgeous terraced rice fields in Yunnan province, or the surreal fog covered peak in Huangshan, these views will surely take your breath away.



Here is a list of the most common activities to do in China as well as some hot spots that you could see!

Activities

- Audubon Stone
- 7th Ave District
- Chuan Park
- Jack Malet
- Hong Kong
- Chow Chow
- Grand Street
- Yunnan Gardens
- Night Market
- PC Mall
- Great Panda Pavilion
- Financial Center
- Xi'an Mosque

Attractions

- Great Wall of China
- Shenmu Army
- Forbidden City
- Tampanan Square
- Temple of Heaven
- Beijing Stadium
- Shanghai Zoo
- Lebanon Buddha
- Summer Palace
- Palace Museum
- Financial Center
- Xi'an Mosque

YOUR NEAREST AIRPORT IS

129 mi 103 mins away

TRAVEL FAR, TRAVEL OFTEN AND WITH PEOPLE YOU LIKE

HELLOQUYN

DAYS	COST	TRAVELERS
21	\$2363	4



Henry Miller, Jack Kerouac, and Hunter S. Thompson all considered Big Sur a creative hide-away from civilization. These writers immersed themselves in Big Sur's natural beauty and travelers from all over the world have done the same. The mountainous terrain mixed with the California coasts makes Big Sur a great location for hiking, wildlife viewing and beach sports. Make Big Sur your next outdoor adventure!



Here is a list of the most common activities to do in Big Sur as well as some hot spots that you could see!

Activities

- Surfing
- Hiking
- Lighthouse Tour
- Backpacking
- Horseback Tour
- Bird Watching
- Fishing
- Mineral Baths
- Bicycling
- Scuba Diving
- Whale Watching
- Camping

Attractions

- Pfeiffer State Park
- Bixby Bridge
- Point Lobos
- McWay Falls
- Point Sur
- Cone Peak
- Garrapata Park
- Landels-Hill Creek
- Point Sur Lighthouse
- Carmel River Beach
- Sykes Hot Springs
- Ventana Wilderness


YOUR NEAREST AIRPORT IS

202 mi 161 mins away

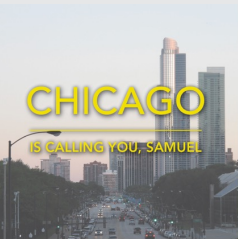
TRAVEL FAR, TRAVEL OFTEN AND WITH PEOPLE YOU LIKE

HELLOAIMEE

DAYS	COST	TRAVELERS
10	\$3626	5



Make the lovely Windy City your next travel destination! A huge center for culture, art, architecture, food, and design, there's too much to do and see in Chicago. Millennium Park is a wonderful jumping off point for all the other things to see in the city, as it is centrally located near many other famous attractions. The famous Cloud Gate sculpture is found in the center of the park. And bordering the park is Michigan Avenue on one side and Lake Michigan on the other. Let Chicago enrich your travels.



Here is a list of the most common activities to do in Chicago as well as some hot spots that you could see!

Activities

- High Blue Tour
- Chicago Pizza Tour
- Peoria
- Museum
- Driver Course
- Architecture Tour
- Golf
- Running Tour
- Peoria Chicago Race
- Bowling Tours
- Fish Tour

Attractions

- Art Institute
- Shedd Aquarium
- Cloud Gate
- Bake House
- Wills Tower
- Shedd Chicago
- Lake Michigan
- Millennium Park
- Museum of Science
- Grant Park
- Navy Pier
- United Center

YOUR NEAREST AIRPORT IS

200 mi 160 mins away


TRAVEL FAR, TRAVEL OFTEN AND WITH PEOPLE YOU LIKE

HELLOSAMUEL

DAYS	COST	TRAVELERS
14	\$215	5


Static content

Variable content



Activities

Attractions




YOUR NEAREST AIRPORT IS

TRAVEL FAR, TRAVEL OFTEN AND WITH PEOPLE YOU LIKE

HELLOAIMEE

DAYS	COST	TRAVELERS
10	\$3626	5

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Point Sur

Cone Peak

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Point Sur Lighthouse

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Sykes Hot Springs

Ventana Wilderness

YOUR NEAREST AIRPORT IS

202 mi

HELLOAIMEE

DAYS	COST	TRAVELERS
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# Caching uses PDF “XObjects”



- Image XObjects
- Form XObjects  
Any piece of a content stream can be put into a form XObject
- How exactly caching works is implementation dependent, but some rules always apply...



# Rules and limitations of form XObject caching (overview)



- Self-contained form XObjects
- Transparency and overprinting

# Self-contained form XObjects



- XObjects may depend on context
  - Dependent on graphics state parameters (line width, color etc) when invoked
  - They may have no resource dictionary, inherited from page (e.g. fonts, color spaces)
- Only self-contained form XObjects can be cached
- The DFE needs to find out whether a form XObject is self-contained or not
  - Whether any objects in the PDF depend on graphics state parameters from parent content that are not always the same

# PDF/VT metadata facilitates caching decisions



- Caching hints for form XObjects
  - GTS\_Encapsulated
    - Whether a form XObject is self-contained
  - GTS\_Scope
    - Scope in which the XObject is reused  
Eg. File or Record
- Record delimiters via DPart structure
- Unfortunately, this metadata is still rare

# Transparency and overprint



Overlapping or overlapped form XObjects may prevent caching

- if *covered* by another object (of any kind) that uses transparency or overprint
- if it uses transparency or overprint and is *on top* of another object
- if *within* another form XObject that includes transparency or overprint



# Summary



- Determination of what is static and variable is important and should be straightforward for the DFE
- Interactions between static and variable content should be avoided (overlapping at all, if not possible at least overprint or transparency)
- Ideally variable content should be placed after the static content
- PDF/VT metadata is desirable
- To be clear: No compromise on design!

A concise overview is available via a recent publication of the PDF Association...

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# Best Practice for Variable Data Printing



## Developer Edition

## Designer Edition

Download (free) from [pdfa.org](https://pdfa.org)

Developed by the

**Print Product Metadata LWG**

Main author: Martin Bailey  
(Global Graphics /  
Hybrid software)

Practical suggestions for  
designers and vendors

...



## Best Practice in creating PDF files for Variable Data Printing

Designer Edition



## Best Practice in creating PDF files for Variable Data Printing

Developer Edition



# Optimizing VDP layouts to enable caching



- As mentioned
  - Draw static content before variable elements
  - Minimize object overlaps - between static and variable content
- Do not hide any objects (draw something new above)



# Optimizing images for VDP to enable caching



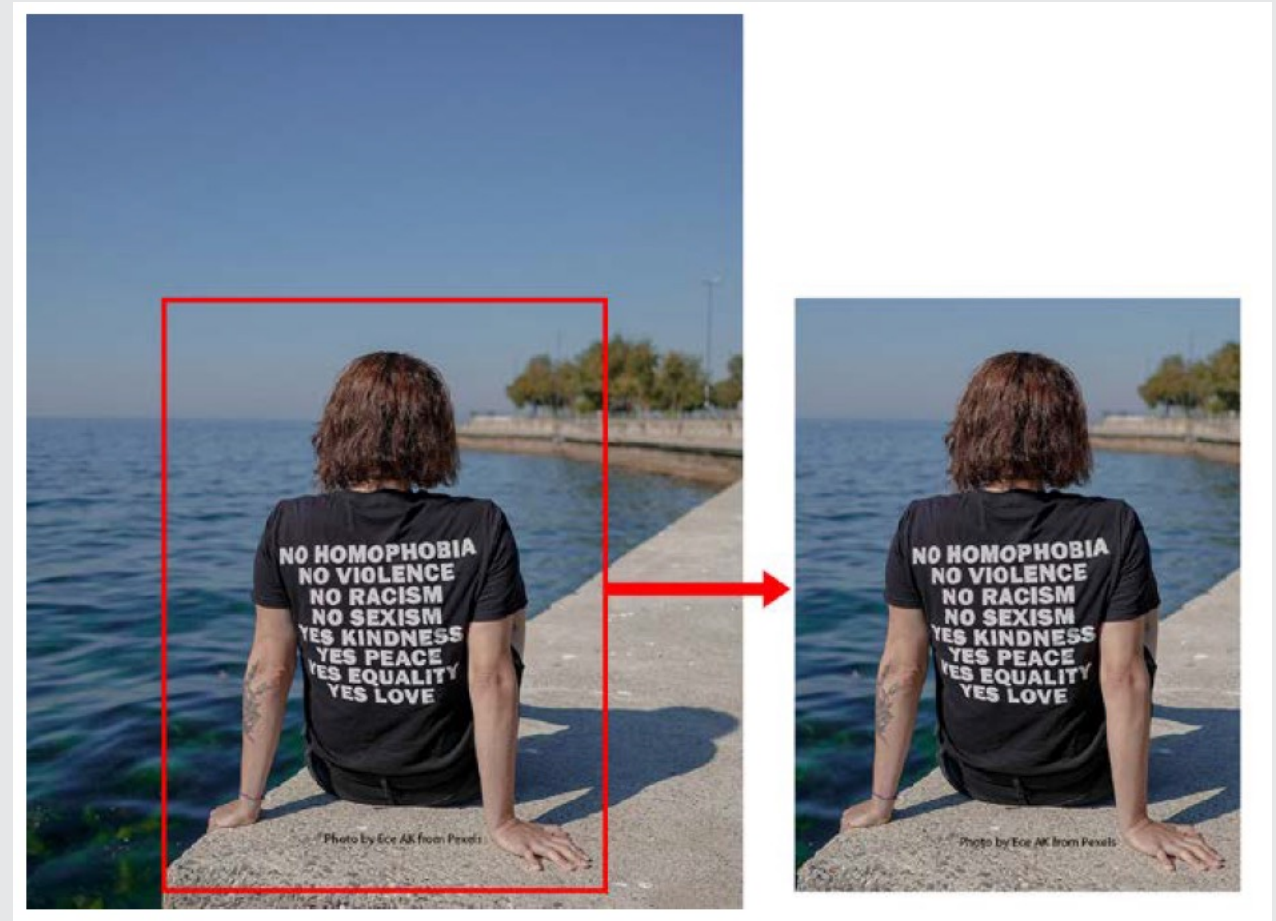
- Embed each image in the PDF just once
  - Avoid inline images for reused images
- Don't tile or stripe images
  - Outdated since DFEs today have enough memory
- Optimize personalized images
  - Images with individual parts should be created as two images:  
One for the static part and  
one for the variable part



# Additional suggestions for images



- Set photographic image resolutions not too high
- Discard cropped pixels from images (do not clip)



# Optimize vector graphics



- Text - Fonts can be cached if not in different subsets (on each page)
  - Use a single subset for the whole PDF or fully embed the font (if font license permits)
- Don't draw the same graphic multiple times
- Avoid unnecessary smooth shades

# Optimize transparency



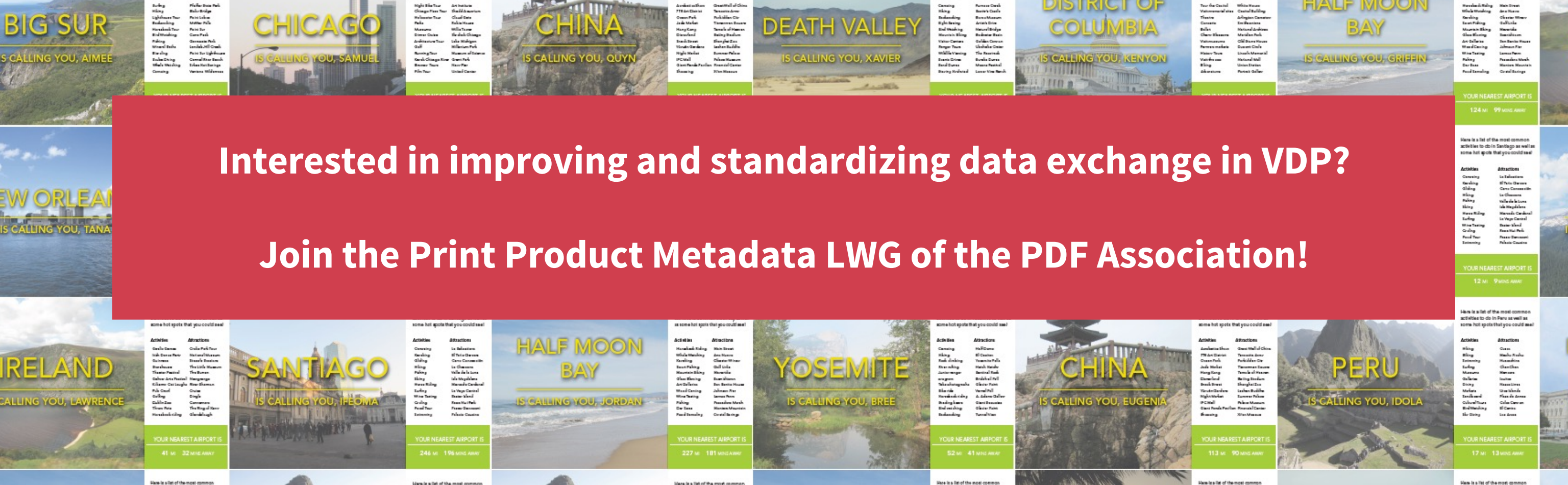
- **Summary:**
  - **Use transparency only for static content**
  - Let it not overlap with variable content
  - Draw (place) it before variable content is drawn
- **More detailed**
  - **Avoid transparency**
    - Alternatives: Overprinting, hard clips rather than masks, pre-composite images with soft masks
    - Don't flatten transparency (may create a huge number of objects)
  - **Avoid unnecessary color space conversions for transparency**
  - **Avoid soft masks**



# Take advantage of PDF standards



- PDF/VT
  - Use PDF/VT metadata
- DPart
  - Print Product Metadata  
(another work item of the same PPM LWG)
- Processing Steps
  - Identify additional information like die lines, folding marks etc



Interested in improving and standardizing data exchange in VDP?

Join the Print Product Metadata LWG of the PDF Association!



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