

Achieving 5 Nines Business Process Reliability With Barcodes

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Introduction



- All workflows rely on critical data to trigger and direct the workflow
 - Examples: customer ID, page No, contract No, agent ID, name, address, date.
 - These fields drive the indexing, routing or database updates in other applications
- Why barcodes are the solution
 - Barcodes are optimized for recognition by computers
 - They contain the most information in the least amount of space
- Best practices to achieve reliability
 - Inlite's nearly 20 years of experience can contribute to your success
 - Follow along to learn how to create ultra reliable processes
- Misconceptions about barcodes
 - There are many
 - Don't fall into the trap

Barcode Based Business Cycle







- What barcode to use?
 - So many choices Code 39, Code 128, PDF417, Data Matrix, UPC, 2of5,
- Where to put it?
 - Top, bottom, sides, any open area, special zone ?
- How big to make it?
 - Is it too small?
 - It looks too big?
 - Seems to fit go with it
- Why can't I read it?
- What is the impact of doing it wrong?



- Accurate recognition of critical data drives reliable imaging workflows
- Why? Examples include:
 - Waybill tracking numbers
 - Faxed insurance applications need account numbers
 - Legal documents use unique ID on each page to make sure all pages are present.
 - Patient identification on medical forms
 - Cover pages with unique batch or transaction code
 - Smart forms contain multiple entry fields
- You definitely don't want to read them wrong!!!
 - That's worse than not reading them at all
 - But that's what can happen with OCR



- Related to the number of failures to correctly read critical data from an image
 - It is actually 100% minus the sum of those failures
- Typically expressed as a number of "9s". For example:
 - 1 failure out of 100 pages is 99% reliability two 9s
 - 1 failure out of 1,000 pages is 99.9% reliability three 9s
 - 1 failure out of 100,000 pages is 99.999% reliability five 9s
- Customers who plunge into this process usually fail to achieve even 1 9
 - Their error rates are often in the 20% or worse rate
 - They think that this is "just the way it is"
- Wrong!!!
 - Inlite strives for 5 9's
 - Inlite customers usually achieve 3 9's or better
 - That means 99.9% reliability

Cost of Low Reliability



- We all know that high reliability has a price.
 - What about low reliability what does it cost?
- Consider the impact of recovery from errors
 - Interrupt workflow
 - Find them in the stack and correct misfiles
 - Rescan or Manual data entry
 - Reorganize archives to remove error items
- How much can it cost?
 - Let's assume average of 5 minutes per item, \$24/hr for the Tech
 - Annual Cost of reprocessing shown below

Success Rate	90%	99%	99.9%	99.999%	
Pages per day 1,000	\$44,000	\$4,000	\$440	\$4.4	
10,000	\$440,000	\$44,000	\$4,000	\$44	
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Why barcodes?



- What alternatives exist to enter critical data?
 - Human operator data entry
 - Fairly reliable (with double key entry) but expensive.
 - Offshore data entry presents security concerns.
 - Very slow
 - Optical character recognition (OCR)
 - Low reliability
 - Complex to setup and program
 - Slow
 - Barcodes
 - Reliable (can achieve 99.999%)
 - Inexpensive
 - Fast
- The only purpose of barcodes is to reliably acquire critical data to drive a business process

Major public domain symbologies



ID – Code 39, Code 128 and others



PDF417 - Logistics, ID cards, Driver Licenses





Common Applications

- Cover pages
 - Batch separators for scanning
 - Routing documents,
 - e.g. expense reports, invoices
- Document (and page) identifiers
 - Track each page of contract
- Document or Check security
 - Encrypted, private data fields
- Inventory
 - Reorder SKU's,
 - Refill prescriptions
- Smart Forms
 - Barcodes carry multiple data fields
 - Database on a sheet

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- Reliability relates directly to the Error Rate of the communication system
 - This is a general rule that applies to all communications
- Barcodes are simply one kind of communications technology to transfer data.
 - Uses paper and ink to carry information
 - Instead of electronic or radio signals
 - Think of them as packets on paper
- The design of RELIABLE barcode system is an engineering process
 - It is NOT a trial and error process
 - It is not mysterious and magical
 - It requires thinking about the whole system





Business Process Performance Requirements





- Specify maximum required data capacity
 - How many characters of data do you need to use
- Identify available space for the barcode symbol
 - Look for esthtetically acceptable, open areas on the form
 - Stay away from signature areas, to reduce overwriting on the barcode
- Determine volume and reliability targets
 - How many documents will be printed
 - How many will be scanned? By whom? How?
 - What error rates can be tolerated?

Process Requirements





Printing Equipment and Processes

- Laser, Inkjet or Impact printers
- Resolution of the printer
- Ink spread measurements
- Type and quality of paper stock
 - Background pattern
 - Decorative border
 - Carbon copies

Handling

- Writing or stamping on symbol, bleed-through
- Dirt, smears, smudges, scuffs
- Creases, tears
- Scanning Equipment
 - Scan settings (too dark/light, framing)
 - Resolution too low
 - Black & White, Grayscale, Color
 - Fax (1 or 2 cycles, standard or fine)



Design a barcode that satisfies performance requirements under the worst case process scenario

- Specify barcode symbology:
 - 1D (prefer Code 128 or code 93)
 - Error detection is built in
 - Prefer 2D barcodes: PDF417, DataMatrix
 - Error correction provides resilience against damage
 - Efficient use of space
- Specify barcode geometry:
 - Size of barcode elements: bars, space or modules
 - Shape, Row and Column count
- Specify barcode placement on a page
 - Ensure proper distance from other elements (quiet zone)
 - Account for printing tolerances
- Inlite's Visual Barcode Designer enables the user to automatically design a barcode correctly to meet these criteria

Components selection





Select barcode generation tools to:

- Generate barcodes within design specs
- Compensate for print and paper tolerances
 - Stock and symbol interaction
 - Print resolution
- Does the tool provide sufficient control of the design?

Select barcode recognition software to:

- Read the barcodes produced within design specs
- Compensate for expected deviations in high-volume production environment:
 - Printer runs low on ink.
 - Barcode too light or too dark
 - Barcode is distorted
 - Stamp imprint on a top of barcode.
 - Barcode is damaged.
 - Barcode printed out of tolerance.
 - Quiet zone violations

Design Evaluation



- Measure resilience of the design to assess its survivability under adverse conditions.
- Stress test methodology
 - Produce barcode images using worst case scenarios (Printing, handling, scanning)
 - 100-300 images suffice
 - Evaluate ability to read these barcodes.
 - Identify failure modes
 - Iteratively improve design
- Resilience margin analysis for 2D barcodes
 - Measure resilience margin
 - Correctable error budget
 - difference between maximum number errors that can be corrected and actual number of corrected errors
 - Optimize design to increase resilience margin
- Inlite Research provides consulting services to perform these functions

Barcode Resilience Margin



- Example of several barcode designs with the same capacity, similar geometry, similar area.
- All of these barcodes allow for maximum of 15 correctable errors.
- All of these barcodes are successfully read by the same reading engine.





Current Reality

How barcodes are used in Imaging



- Most software developers have expertise in other areas, such as IT
 - Lack familiarity with barcode issues
 - When problem reading barcodes is encountered, they fail to identify causes and develop remedies
- Vendors deliver partial one sided solutions
 - Barcode generators and labeling solutions
 - Image Capture devices (scanners, fax)
 - Barcode recognition products
 - Printing vendors
- Variability of real-life process requirements
 - No one-fits-all solution exits

How do you capture images?







- Users generally select components based on
 - Price
 - Ease of use in their application
 - Stumble on advertisement, etc.
- Do some testing
 - Print few pages with barcodes OR
 - find some barcodes (on vendor demo sites)
 - Simulate damage, e.g. distort with Photoshop
 - Run few tests on a dozen or so documents
- Put system together and pray that it works in production



System works.



- It often does
- Due to inherent reliability of barcodes and
- Low level system requirements
- Do you know where the failure limits lie?



- System does not work
 - Contact components supplier some may answer, most don't know better
 - Good supplier might provide useful advice
 - Are you fixing the "broke" part of the system?
 - Or tinkering?



- All of these barcodes "look good"
- Eye cannot detect distortions that affect readability of barcode, e.g.
 - Barcodes loaded from internet pages.
 - Look like barcode, scaled down to fit Web page.
- Magnified images shows poor printing or scanning quality (in this case)
- Incorrect barcode generator almost impossible to identify visually



Barcode Scanner vs Image Recognition

- Barcode Scanner vs Imaging Scanner
 - Barcode scanner has optics and specialized analysis hardware specifically designed for a single task - reading barcodes
 - Imaging scanners are general purpose devices
 - not designed or configured for reading barcodes
- Scanning process
 - Barcode scanner keeps scanning till it succeeds
 - With imaging there is just "the" one image
 - No retries read once and make it work
- Success depends on the capability of recognition software to read substandard images
- This is why it is important to use ClearImage Engines the leading recognition engines in the industry







- Inlite offers engines for developers
 - Tight integration into the user application
 - ClearImage engines for Image Processing and Barcode Recognition
 - Barcodes For Documents Runtine engine for barcode creation
 - Support any windows based development environment and language
 - Source code examples
- Inlite Applications automate the business cycle without programming
 - Many configuration possibilities
 - Powerful built in functions
 - Simple integration
 - No change to existing applications

Using Engines to Tightly integrate Businss Cycle





Inlite Applications Automate Business Cycle



