

Measurement of Very Large Scale Biometric Systems: India's UID Project



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UID Introduction



Goal of the UID

- Provide a Unique number to every resident of India
 - Earlier databases plagued by duplicates and errors
 - remove ghost identities
- To improve government service delivery
- Provide ubiquitous verifiable identity proof
 - Deliver govt. subsidies
 - banking
 - access control



UID Enrollment

UID Authentication & FI (NREGA)

Authetication Status

- Auth services live
- Formally launched in Feb 2012
- 8 PoCs were conducted – summary published
- 3 Pilots underway

Enrollment Status

- 1M/day enrollment per day
- 36,000 enrollment stations, 87K certified operators
- 11 models of certified devices
- 200 Million enrolled
- 150 trillion person matches/day

District 1 Taluks District 2 Taluks District 2 Taluks District N Taluks



Enrollment



NREGA
Job Site



Authentication

Financial Inclusion

UID Biometric Innovations

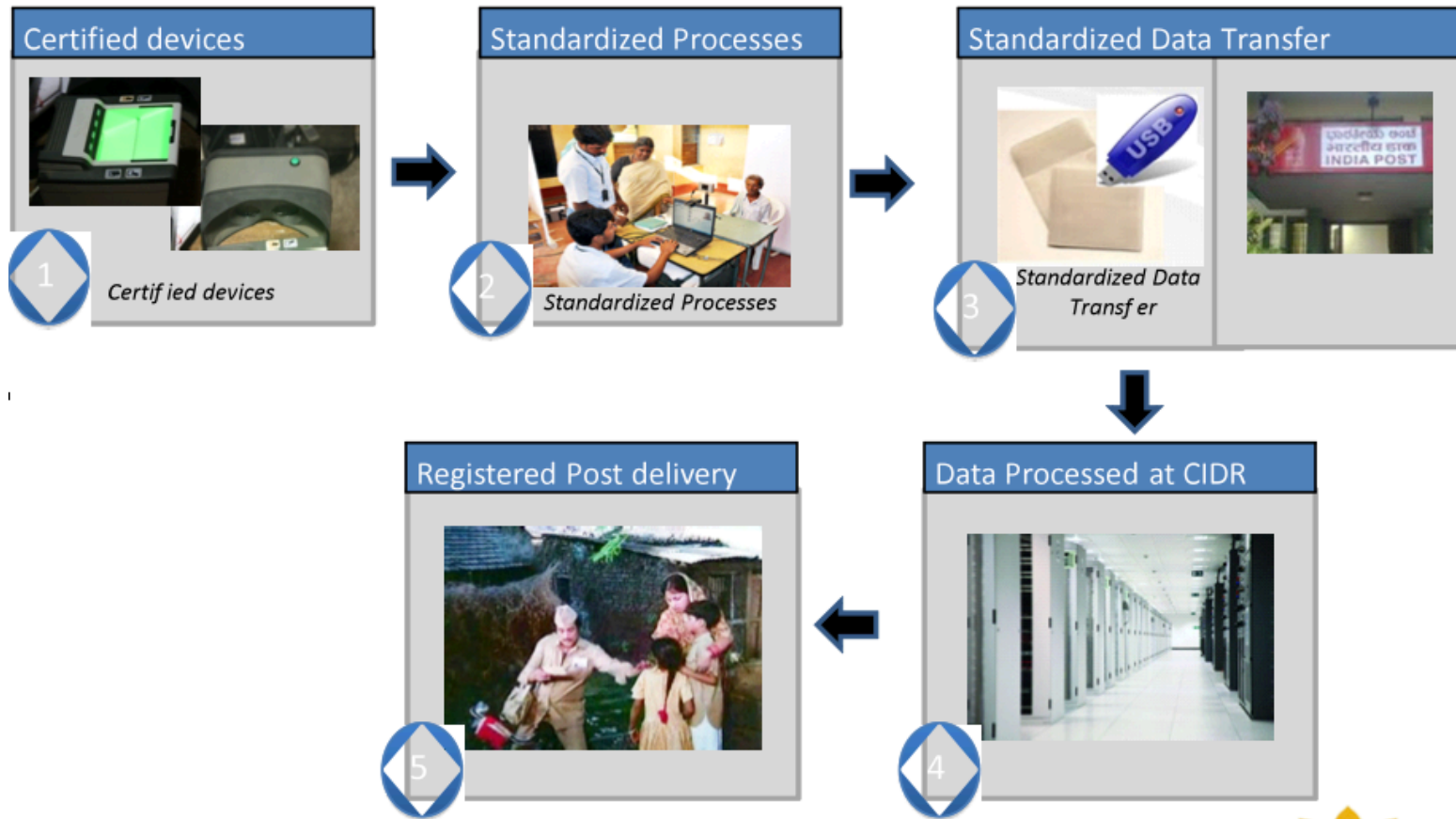
- Multi-ABIS system
- Dynamic Allocation to ABIS
- Biometric Accuracy
 - Absolute/Relative methods
- Accuracy as gallery grows



ENROLLMENT



Enrollment Process



Enrolment Accuracy Study

based on a sample size of 84million





IMAGE QUALITY



Image Quality - Definitions

- Methodology
 - Quality metrics embedded in enrollment packet
 - Face: ICAO-- (slightly relaxed)
 - FP: Poor quality when there is at least one finger with NFIQ >3 in each of three slaps (4, 4, 2)
 - Iris: Poor quality when “Irisness” score < 50 (proprietary)



Image Quality - Results

- Govt. Policy - everyone must be enrolled
 - ie FTE=0%
- Biometric FTE: **0.14%** (no FP & Iris captured)
- Poor Quality FP & Iris: **0.23%**
- Poor Quality
 - FP: **2.9%**,
 - Iris: **3.0%**



Under the Hood

- Face Quality: 85%
- Iris (L & R): 93.4% & 92.5%
- Fingerprint
 - Slap: 93.4% (L), 93.6%(R)
 - Thumbs: 91.6%
- Quality improves over time (learning curve)



Analysis & Interpretation

- Multiple modality improves FTE by 10 to 25x
- Quality is comparable to Western results
 - Diverse demographic
 - Effect of manual labor (FP)
- Good biometric obtainable from 5 yrs age
- Senior population difficult but still feasible
- Considering age specific algorithms – for Auth



IDENTIFICATION

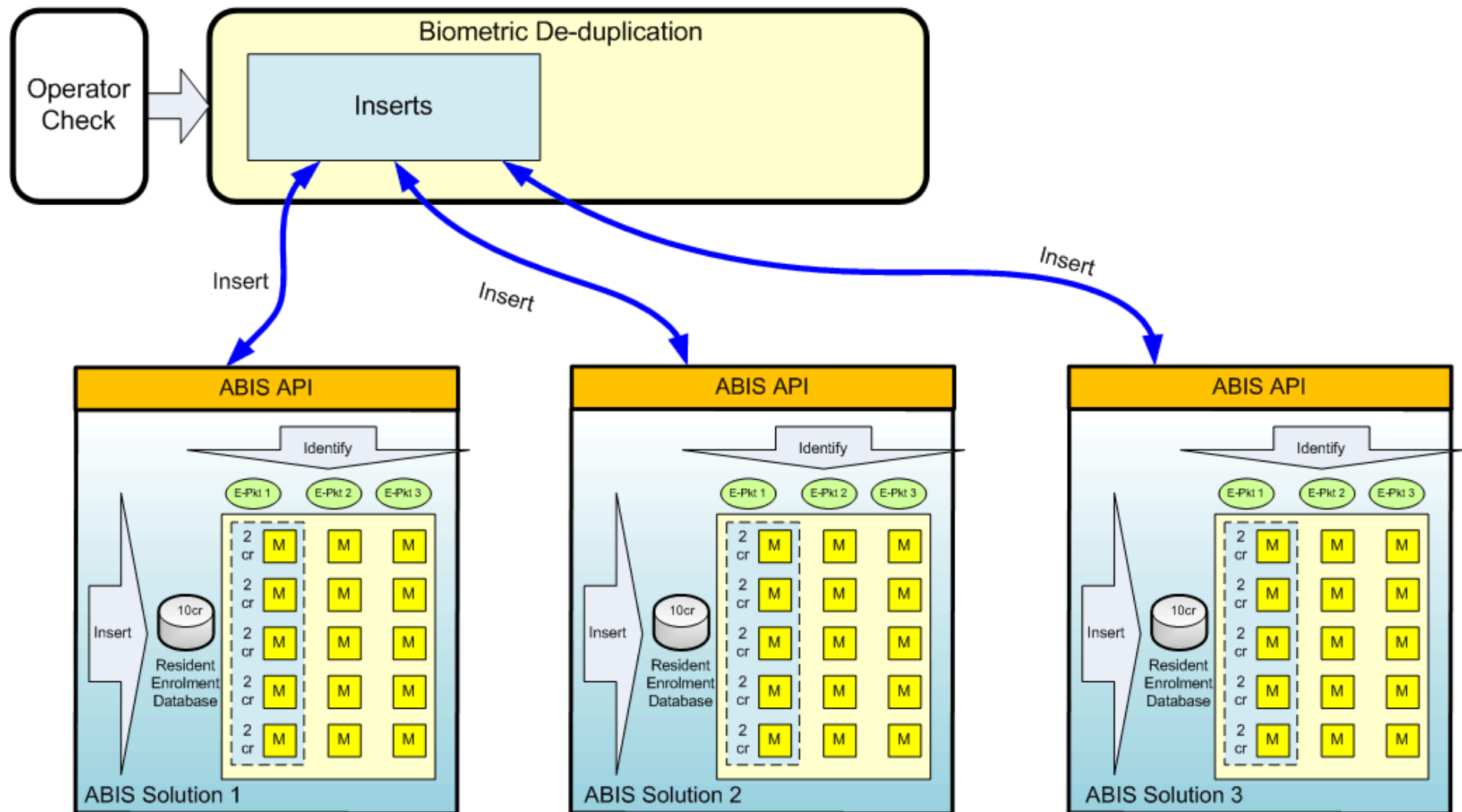


Accuracy Methods

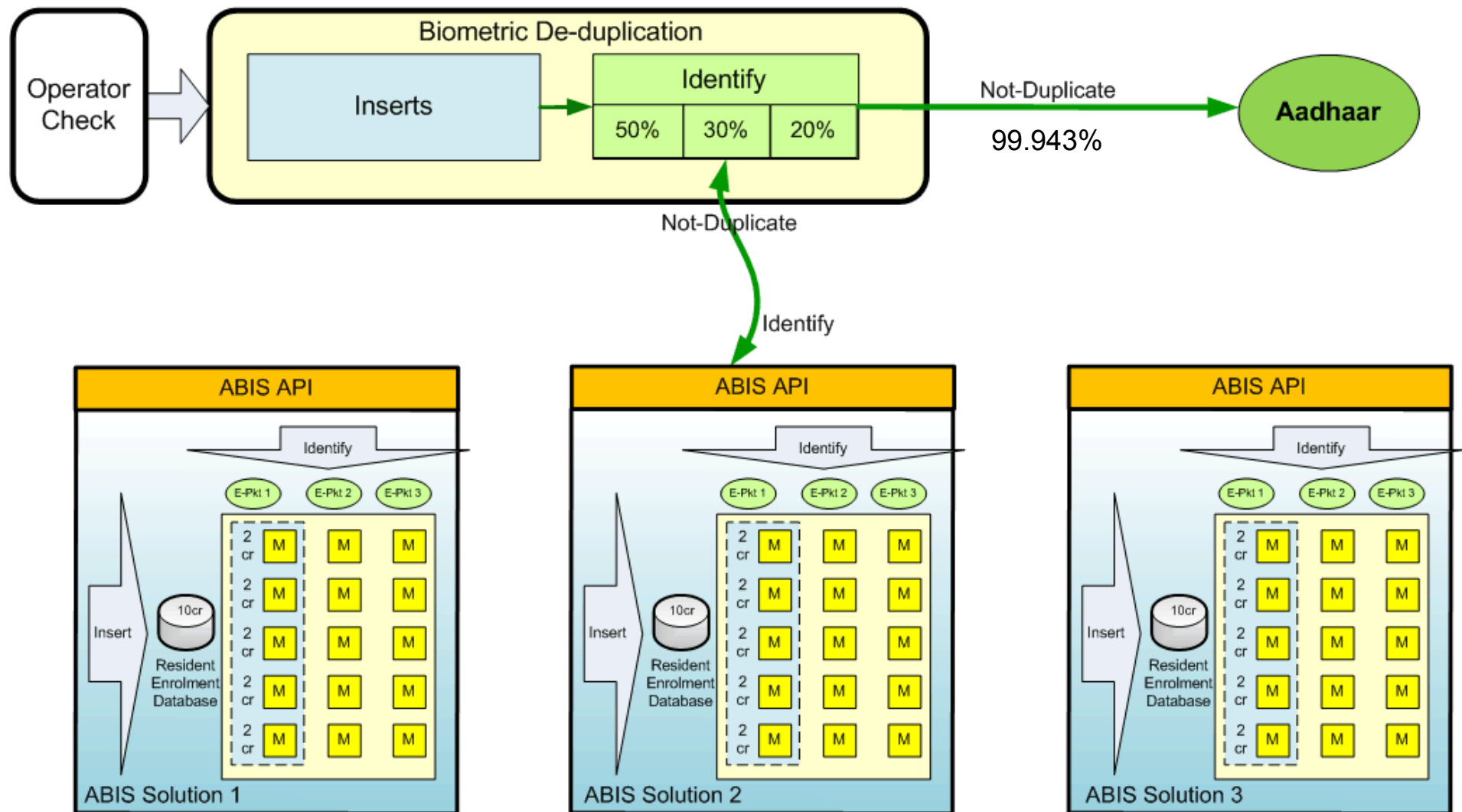
- Absolute
 - Traditional method - Ground truth is pre-determined
- Relative
 - Multi-Algorithm comparison and manual review



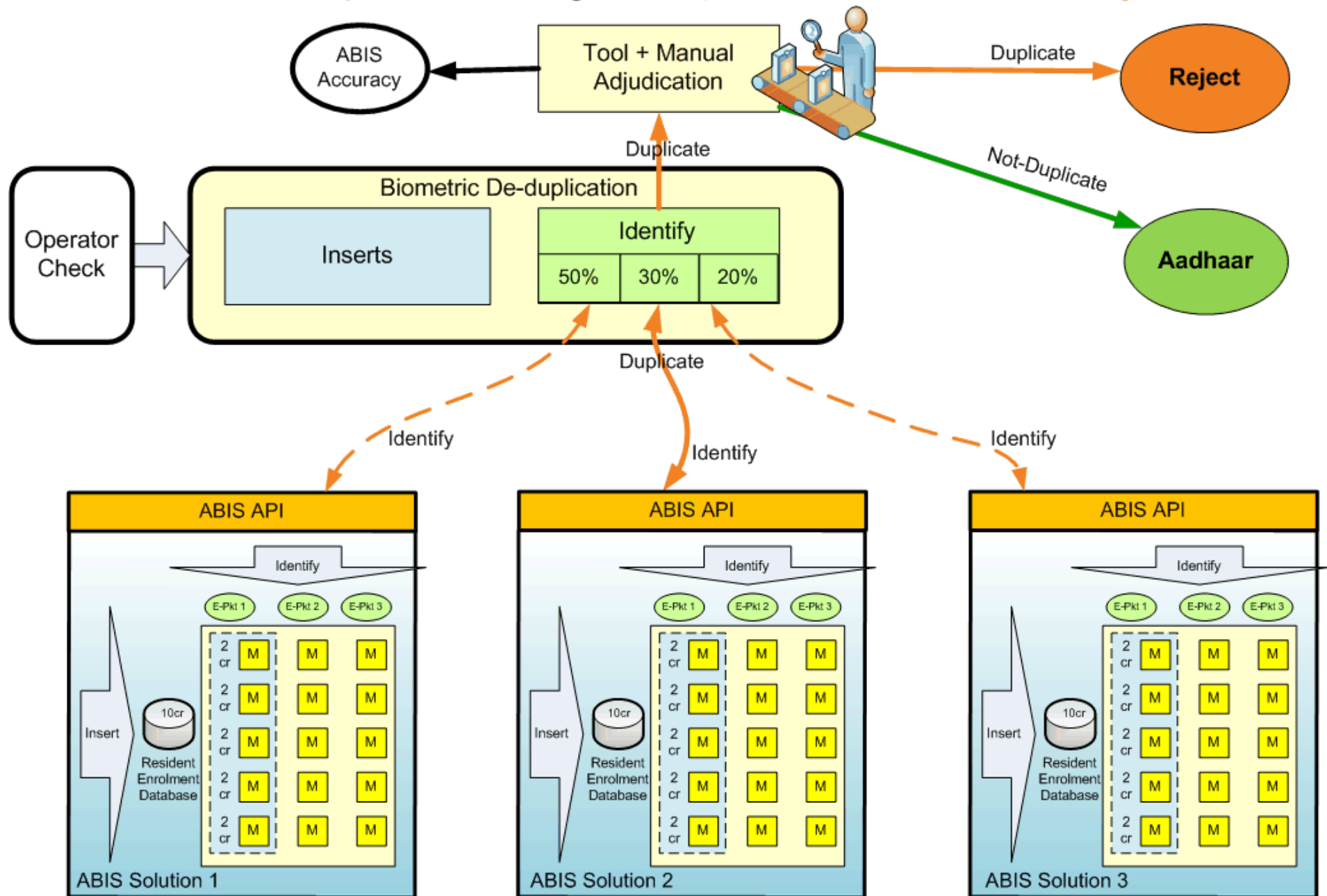
Biometric De-duplication Stage – Step 1 Insert



Biometric De-duplication Stage – Step 2 Identify



Step 3 – Tool + Manual Adjudication



Multi ABIS Multimodal Results

- FPIR
 - Probe size: 4M
 - False rejects: 2,309 (eg. A1 – HIT, A2 – NO-HIT, A3 – NO-HIT)
- FNIR
 - Probe size: 32,000
 - False accept: 11

- FPIR: **0.057%**
 - FNIR: **0.035%**
- } @ Gallery = 84 Million

- NIST 7112 Ten FP Results
 - FPIR: 0.035% @ Gallery= 1 Million

**Multiple modality provides similar accuracy
For 100X larger gallery**



Verified by Absolute Method

- Gallery: 130 Million
- 21,000 Demographically verified duplicates as probes
- FNIR: 0.0004%

Note: These duplicates seemed to have better image quality to overall population

Relative method produces comparable results



Mixed and Anomalous Biometrics

- 40% of suspected duplicates
- Operator using their biometrics to help residents
- Mixed
 - Different persons in different attempts
 - New process eliminates them
- Anomalous
 - Different persons in an attempt
 - Problematic for ABIS doing sequential fusion



Lessons

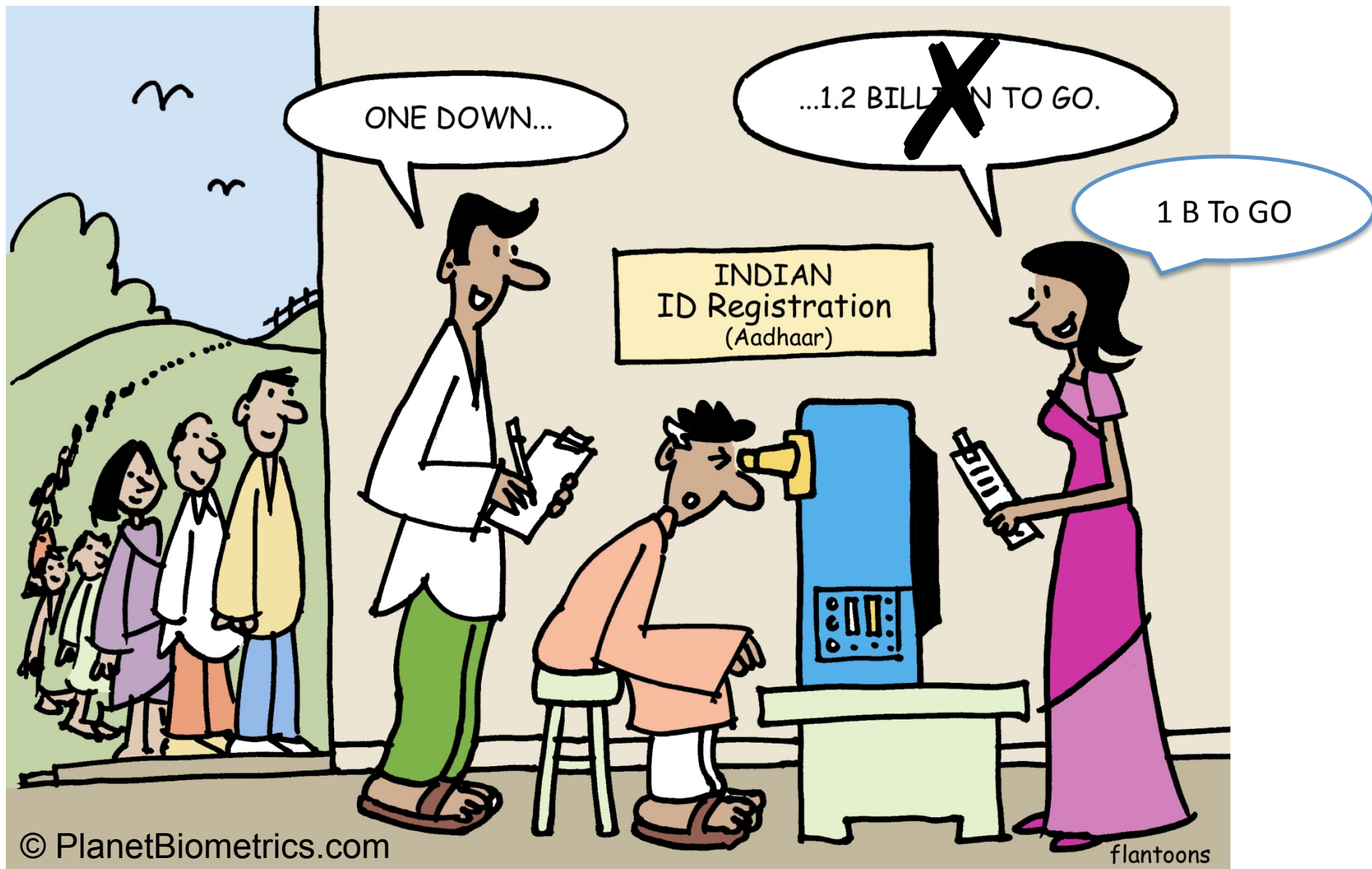
- 10 to 100X improvement through 2 modalities
- Competitive advantage of using 3 ABIS & SDKs
- Continuous FPIR/FNIR measurements
- Possible to maintain low FPIR/FNIR over wide range of gallery size



References

- Enrollment:
 - http://uidai.gov.in/images/FrontPageUpdates/role_of_biometric_technology_in_aadhaar_jan21_2012.pdf
 - http://uidai.gov.in/UID_PDF/Front_Page_Articles/Documents/Publications/Aadhaar_ABIS_API.pdf
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Thank You

