



# Evaluation of Latent Fingerprint Technologies (ELFT)



# What are Latents?

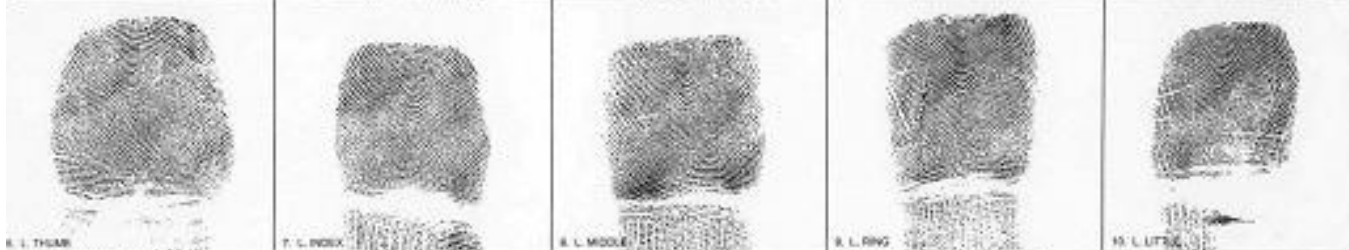
- **Residual marks** from fingers & palms
- Also toe and footprints (all friction ridge skin)
- **Ubiquitous** (found on almost all surfaces)
- Arbitrarily **poor quality**
- ... but from ***Very High Value Subjects***

# Conventional Fingerprints (not latents)

**Rolls**



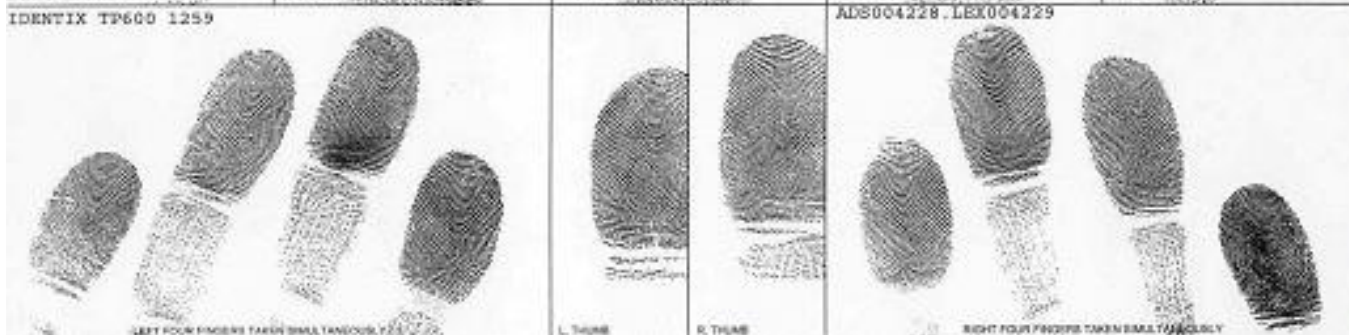
**Rolls**



IDENTIX TP600 1259

ADS004228 . LEX004229

**Slaps  
(Flats)**



# Latent vs. Conventional Prints

## Captured Fingerprints

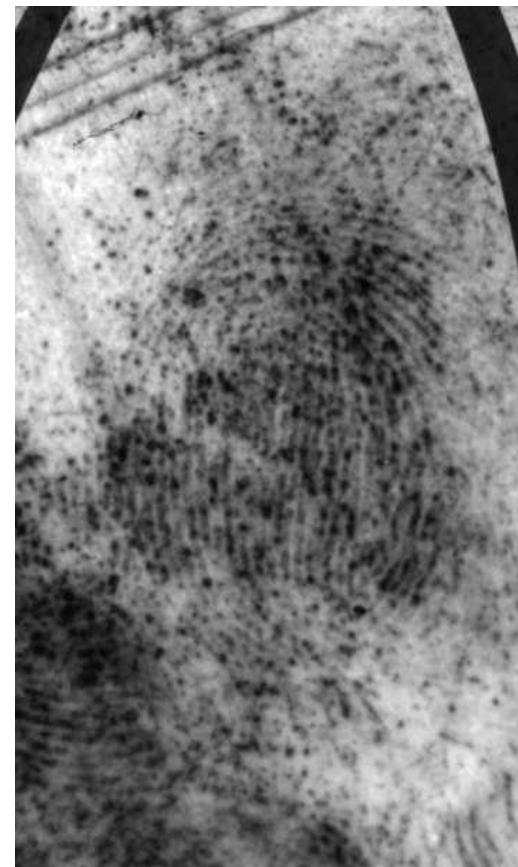
Rolled Impression



Flat Impression



Latent Fingerprint  
(powder lift)



# Why Are Latents Difficult?

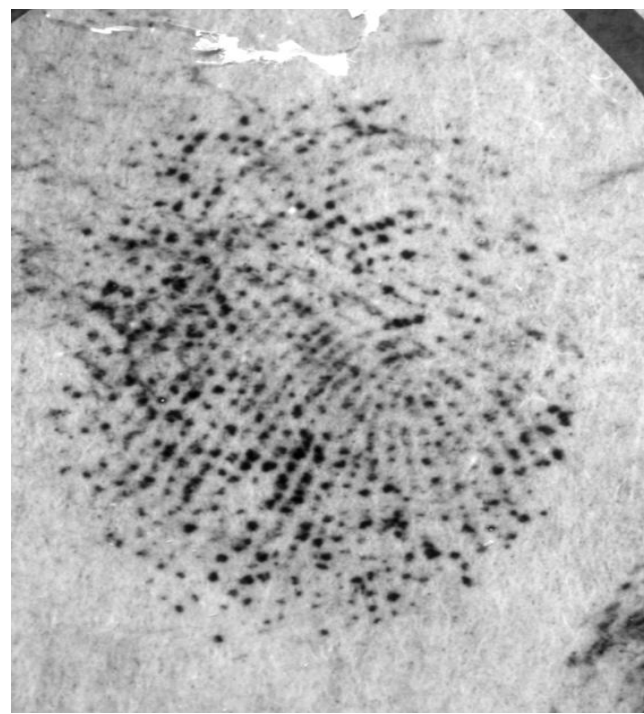
Tips



Smudges



Weathering

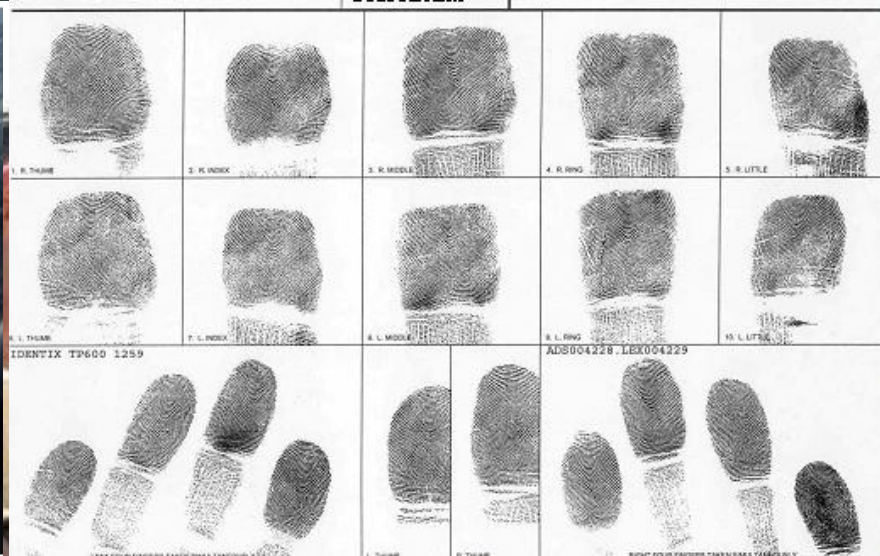




# Why Are Latents Important?

## Homeland Security

## Law Enforcement & Intelligence

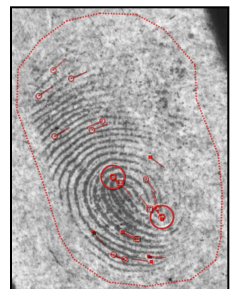




# Latent AFIS Technology

## Automated Fingerprint Identification System (AFIS)

Image + features (for search)



Input

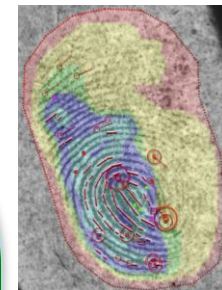


Output

## List of Candidates

Rank	Subject ID	Candidate Print
1	0733091	
2	1304033	
3	3952340	
...		
20	0847121	

Image + features (for comparison)



Mark

Mark



Latent Examiner



Latent Examiner

# Latent AFIS Technology Problems?

- **Manual workload ...**

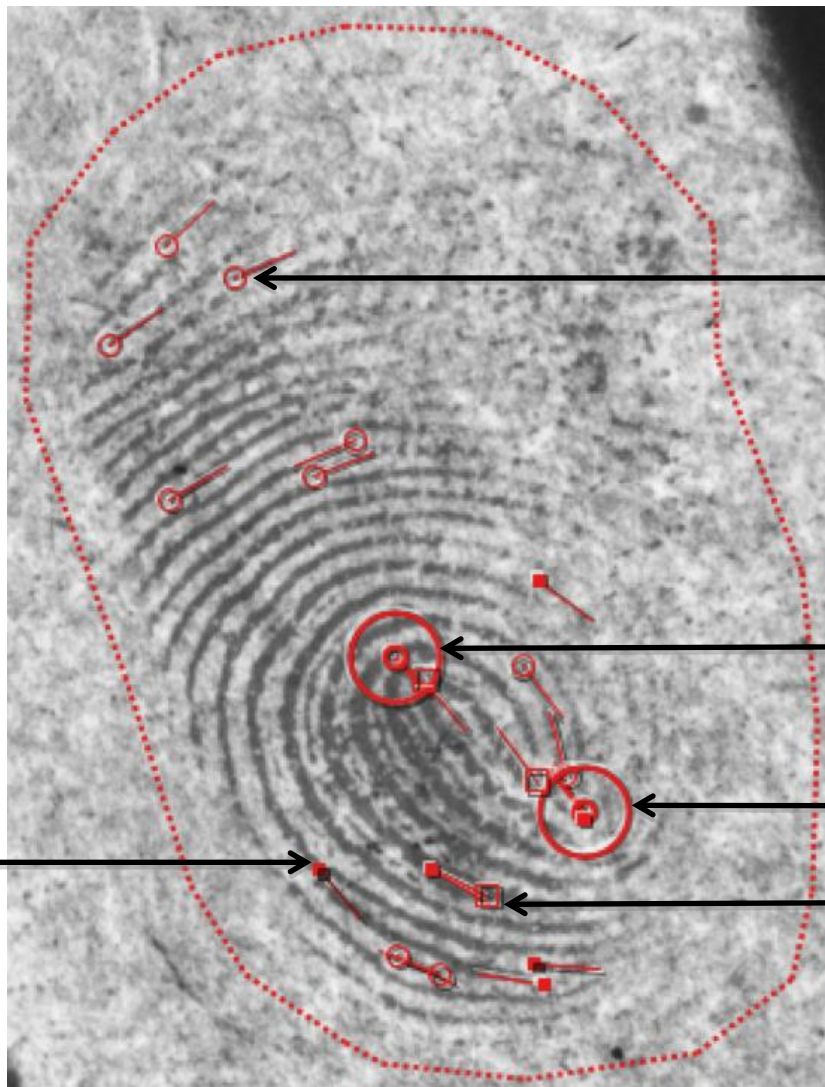




# AFIS ID step: Manual Feature Markup



**Examiner & Workstation**



Ridge ending

Core

Core

Bifurcation

Indeterminate

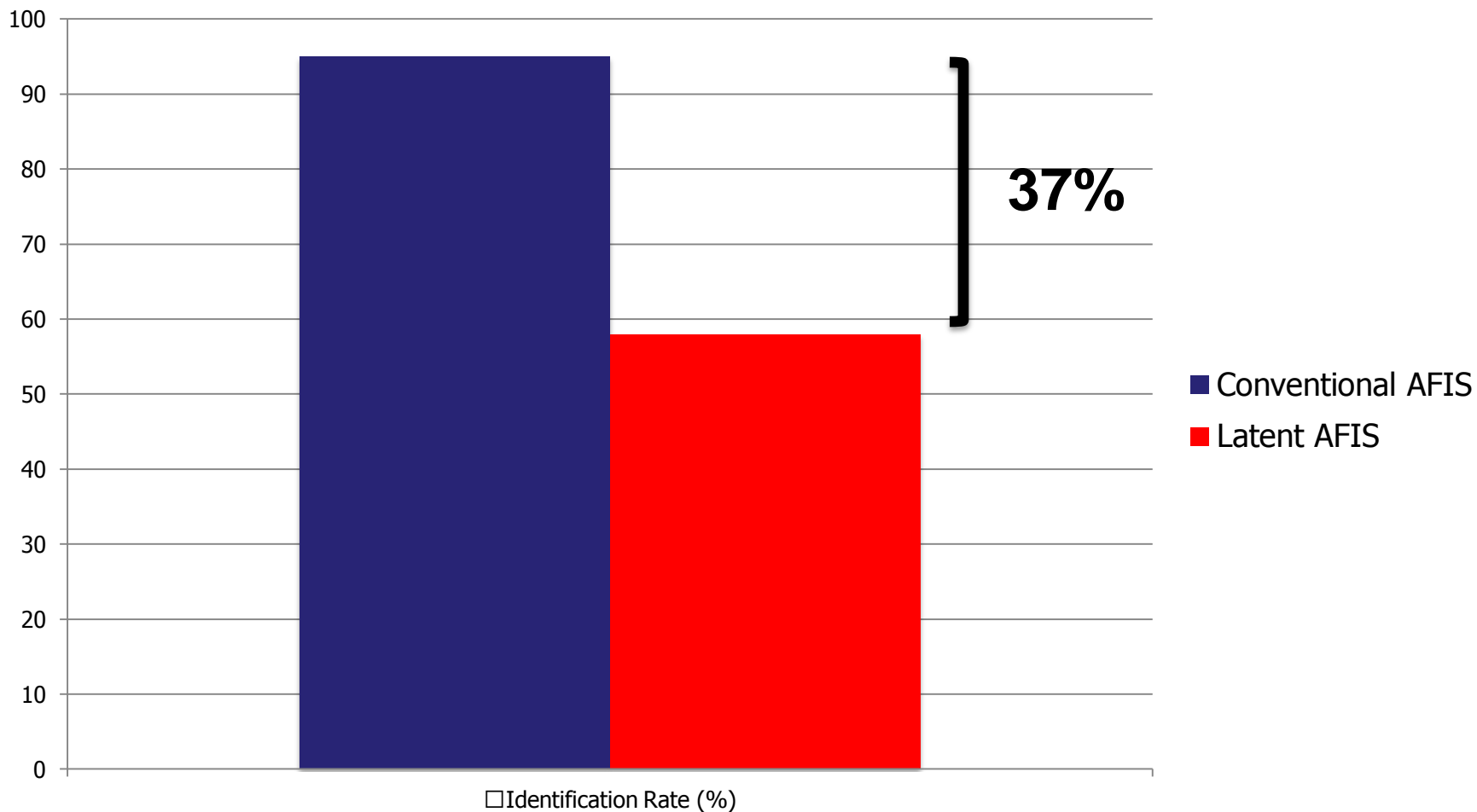
**Latent Workstation Screenshot**

# Latent AFIS Technology Problems?

- **Manual processing ...**
- **Accuracy ...**



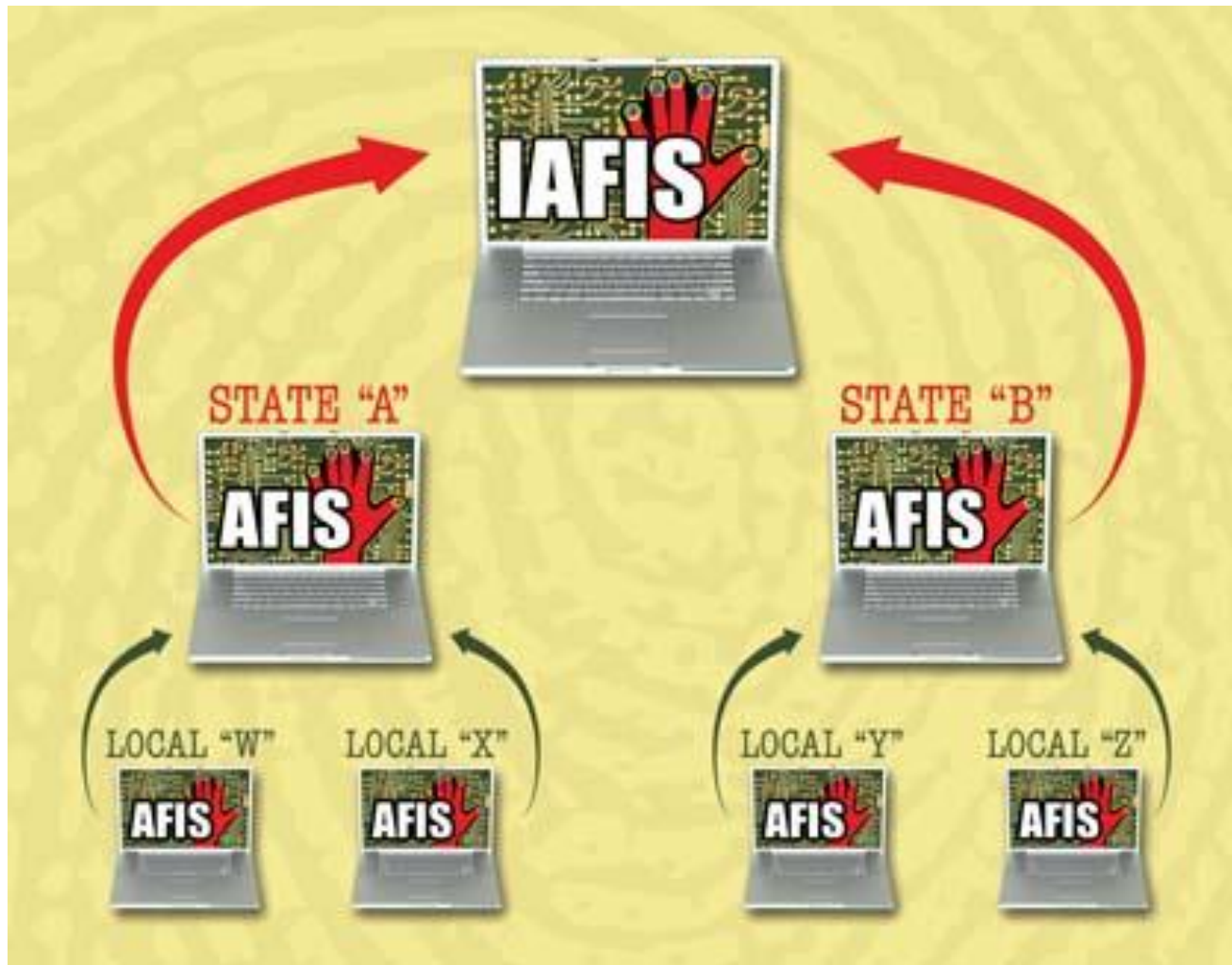
# Conventional vs. Latent ID Rates



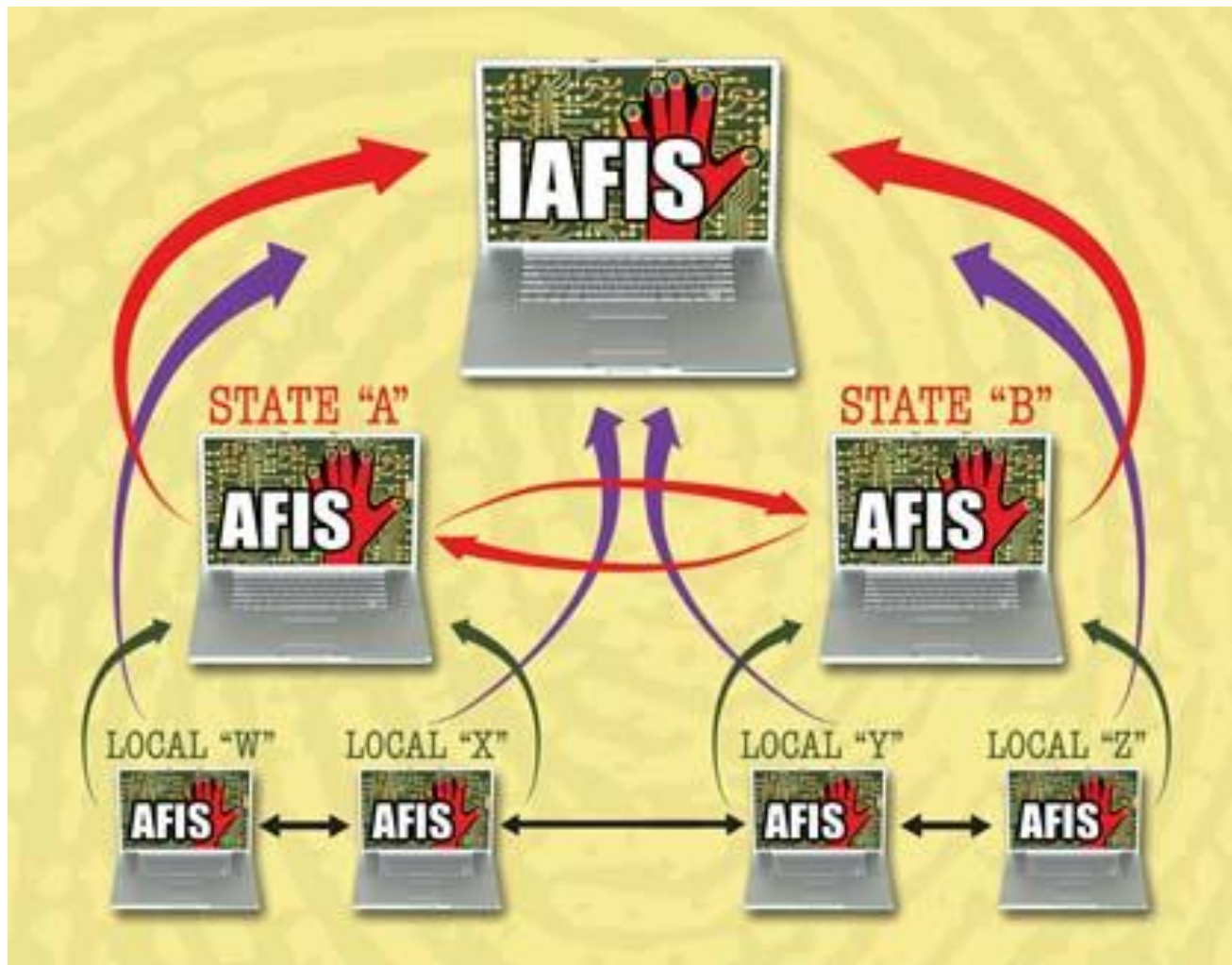
# Latent AFIS Technology Problems?

- **Manual processing ...**
- **Accuracy ...**
- **Interoperability ...**

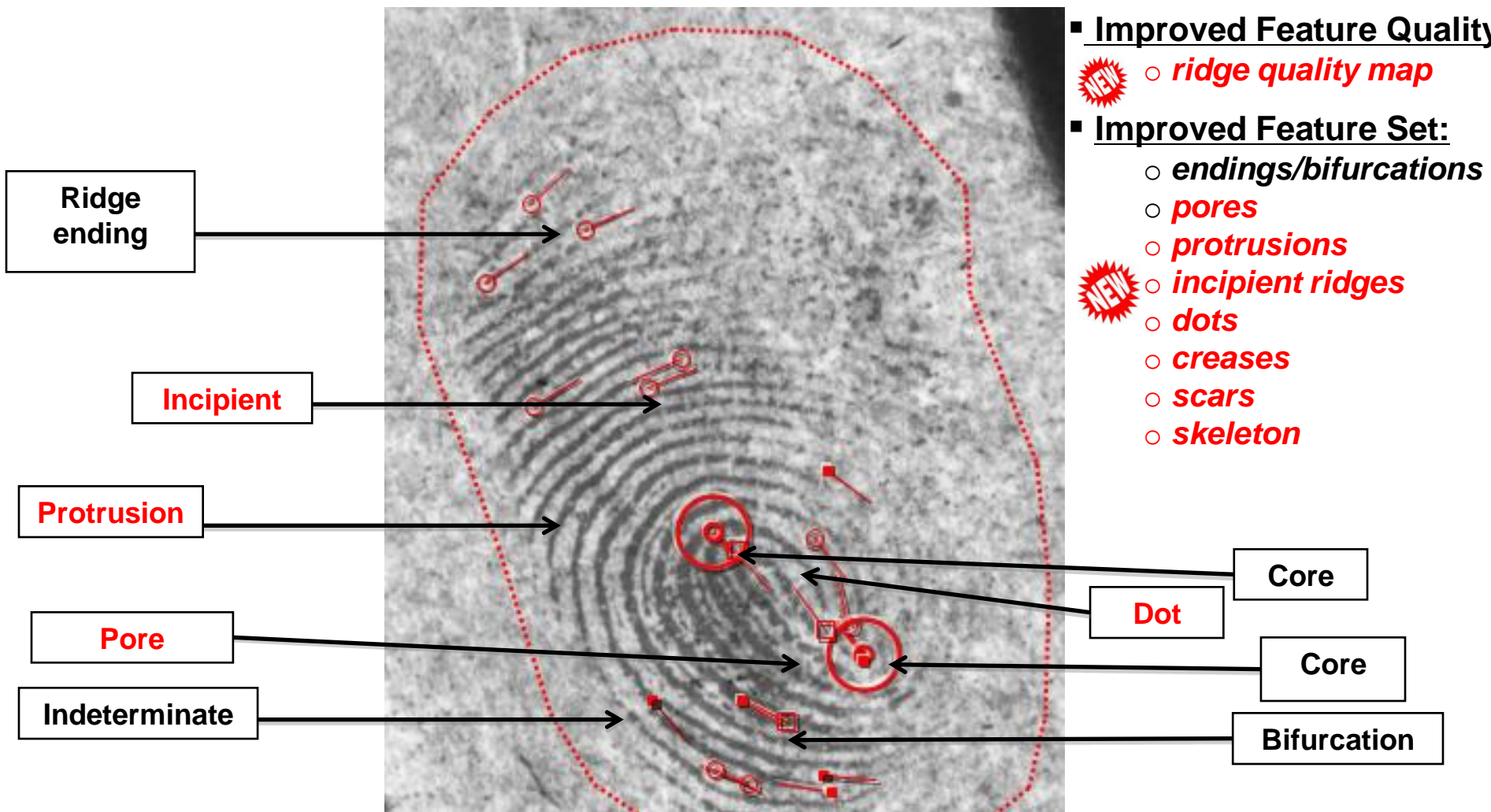
# AFIS Interoperability: Now



# AFIS Interoperability: Future



# Extended Feature Set (EFS)

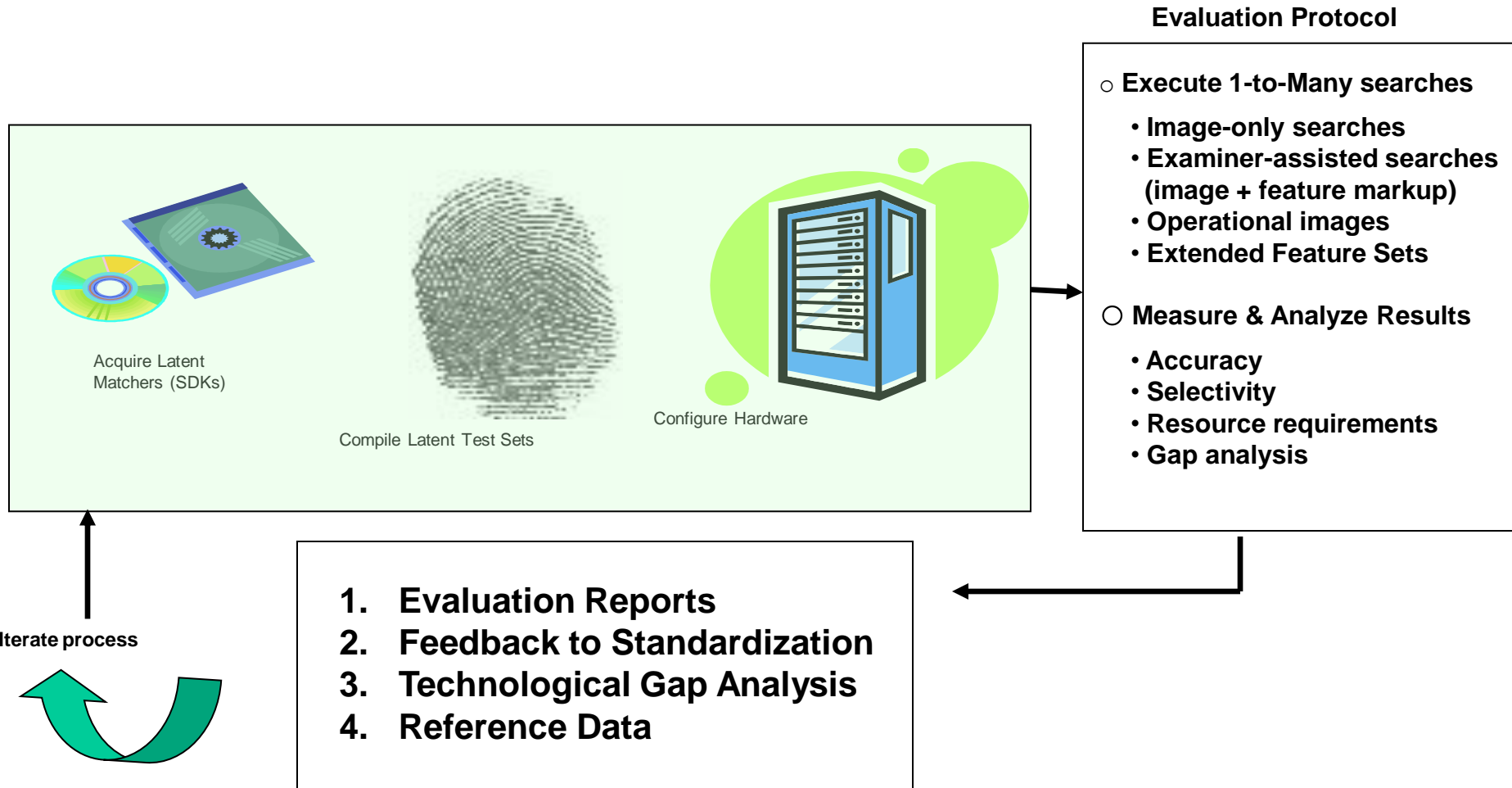


# What is ELFT?

- Open evaluation of Automated Latent Fingerprint Identification Systems (**AFIS**) using automatic feature extraction and matching and standardized features hand-marked by human experts (**EFS**).
- Interactive effort between NIST and latent AFIS community to improve accuracy, promote interoperability, and reduce reliance on human examiners.



# ELFT Testing Architecture



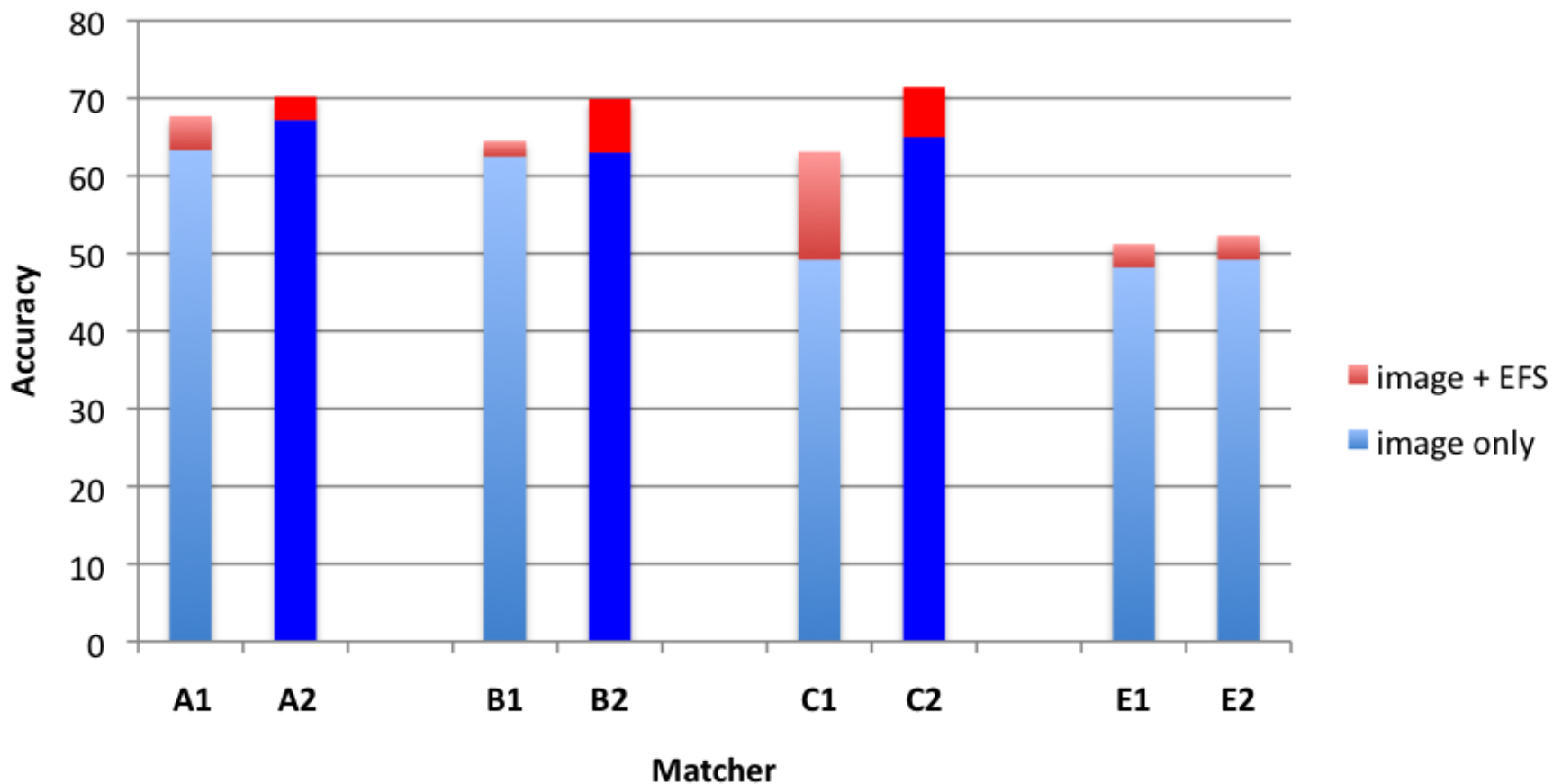


# ELFT History

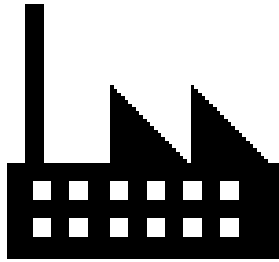
- 2006 NIST Latent Fingerprint Testing Workshop
- 2007 **ELFT Phase I Evaluation**
- 2008 **ELFT Phase II Evaluation**
- 2009 NIST Latent Fingerprint Testing Workshop  
ELFT Phase II Miss Analysis Sessions  
**ELFT-EFS Public Challenge**
- 2010 **ELFT-EFS Evaluation #1**  
ELFT-EFS Miss Analysis Sessions
- 2011 **ELFT-EFS Evaluation #2**



# Measured Accuracy Improvement (ELFT-EFS 1 vs. 2)



# Customers and Community



Industry

- **Developers & Researchers:**
  - Measurement & failure analysis
  - Standards
  - Conferences, Journals
  - Reference data



Academia

# NIST



Government

- **Users & Practitioners:**
  - Performance rankings
  - System integration & tuning
  - Standards
  - Conferences, Workshops



Law Enforcement

# Path Forward

- Develop best practices to reduce manual workload
  - *lights-out processing of some operational workload*
  - *searching and encoding strategies*
  - *quality metrics*
  
- Evaluate state-of-the-art latent fingerprint and (new) palmprint AFIS
  - *interoperability testing (LITS/EFS profiles)*
  - *matcher and data fusion*
  - *candidate reduction techniques*
  
- Expand scale of ELFT testing
  - *operational scale tests*
  - *operational vs. research algorithms*

# Questions?

