

Biometrics:

BIG DATA, ANALYTICS, &

BIOMETRIC-ENABLED INTELLIGENCE

— FOR DEFENSE, INTELLIGENCE,
HOMELAND SECURITY AND LAW ENFORCEMENT —

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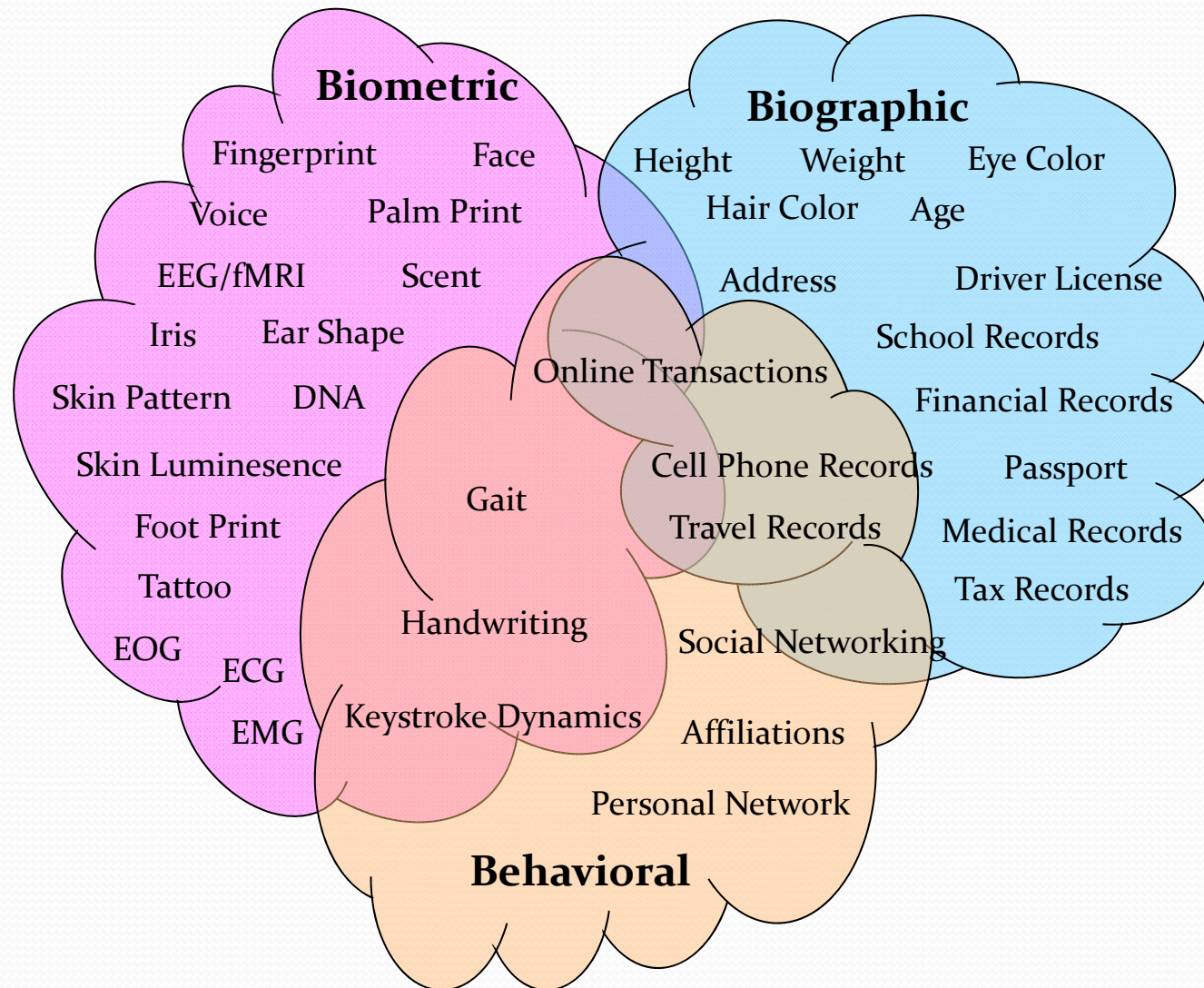
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FBI Perspectives and Initiatives

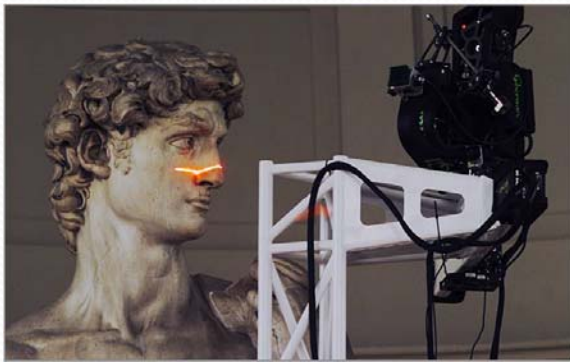
Biometrics and Big Data Analytics

James Loudermilk

Elements of Human Identification

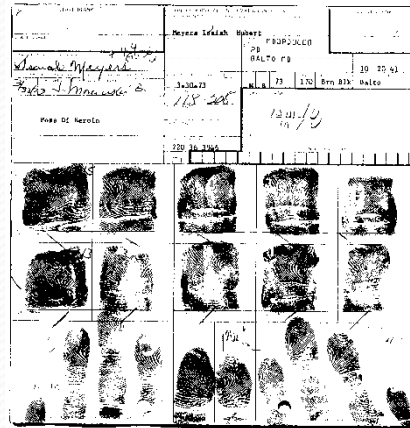


Primary Criminal Justice Identification Modalities



Face Matching – Sketches/Mugshots since 1800's, Emerging as a Biometric

Fingerprints
Since 1904



DNA Analysis
Since 1988

Large Scale Biometric Systems



Identification
Automated
Services

1989



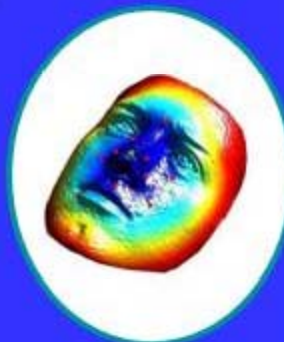
Combined DNA
Index System

1998



Integrated
Automated
Fingerprint
Identification
System

1999



Automated Face
Detection and
Recognition

2010



Next Generation
Identification

2014

FBI Biometric Initiatives

Fingerprint Based Identification



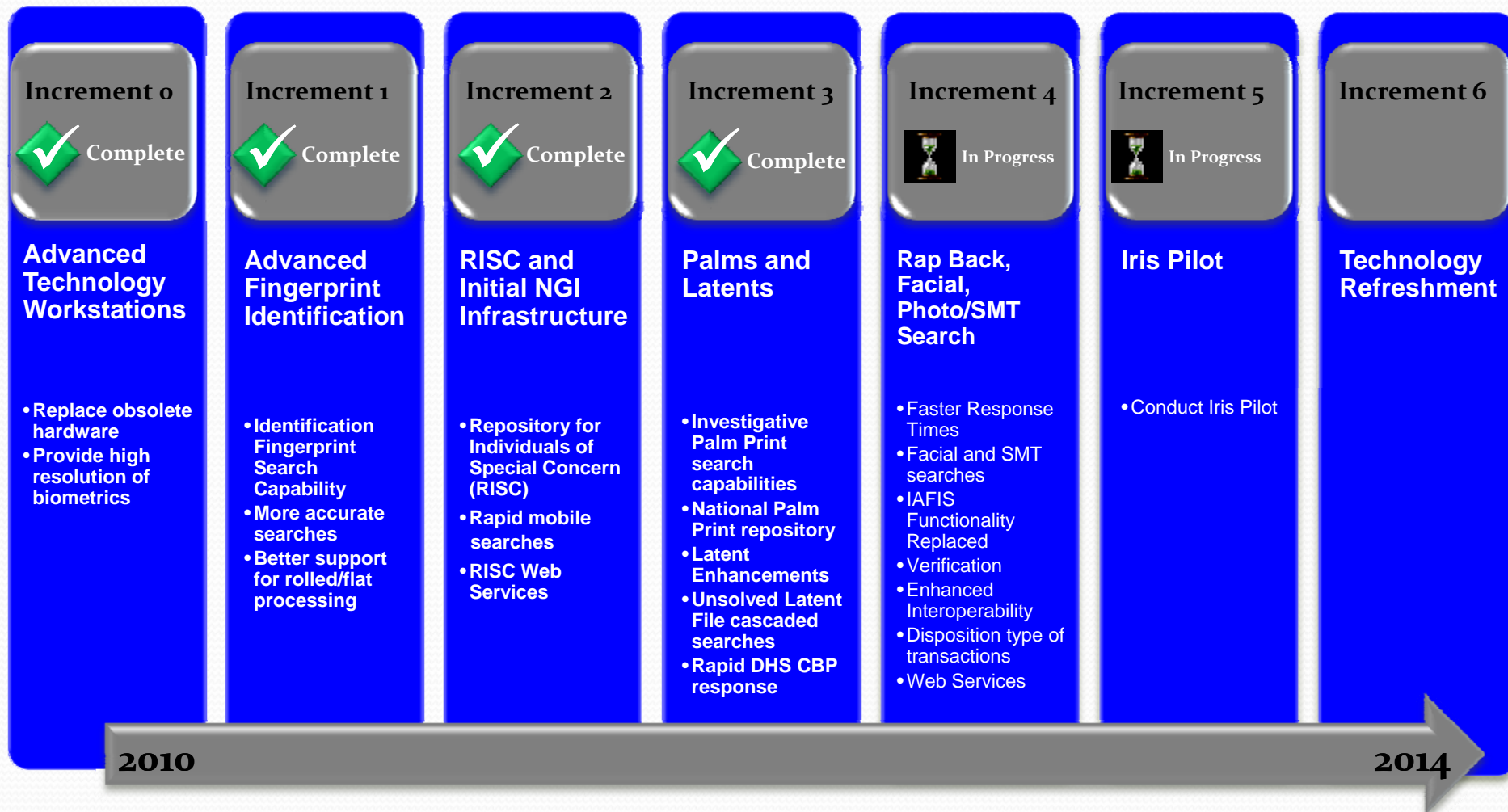
FBI Fingerprint Identification Services

- 106 Million Subjects on File
 - 67 M Criminal
 - 39 M Civil
 - ≈ 195 TB fingerprint identification data
- 170 K Search requests / day
 - 55% Criminal & National Security
 - 45% Civil Background Checks
 - Record 300, 113 in/297,816 out - 4/2010
- 100% received electronically (since July 2012)
- 76% “lights out”
- Special Concern Search ≈ 5 sec
- Criminal response: ≈ 6.1 min
- Civil response: ≈ 60 min
- ≈ 16,400 Fugitive Hits/Month



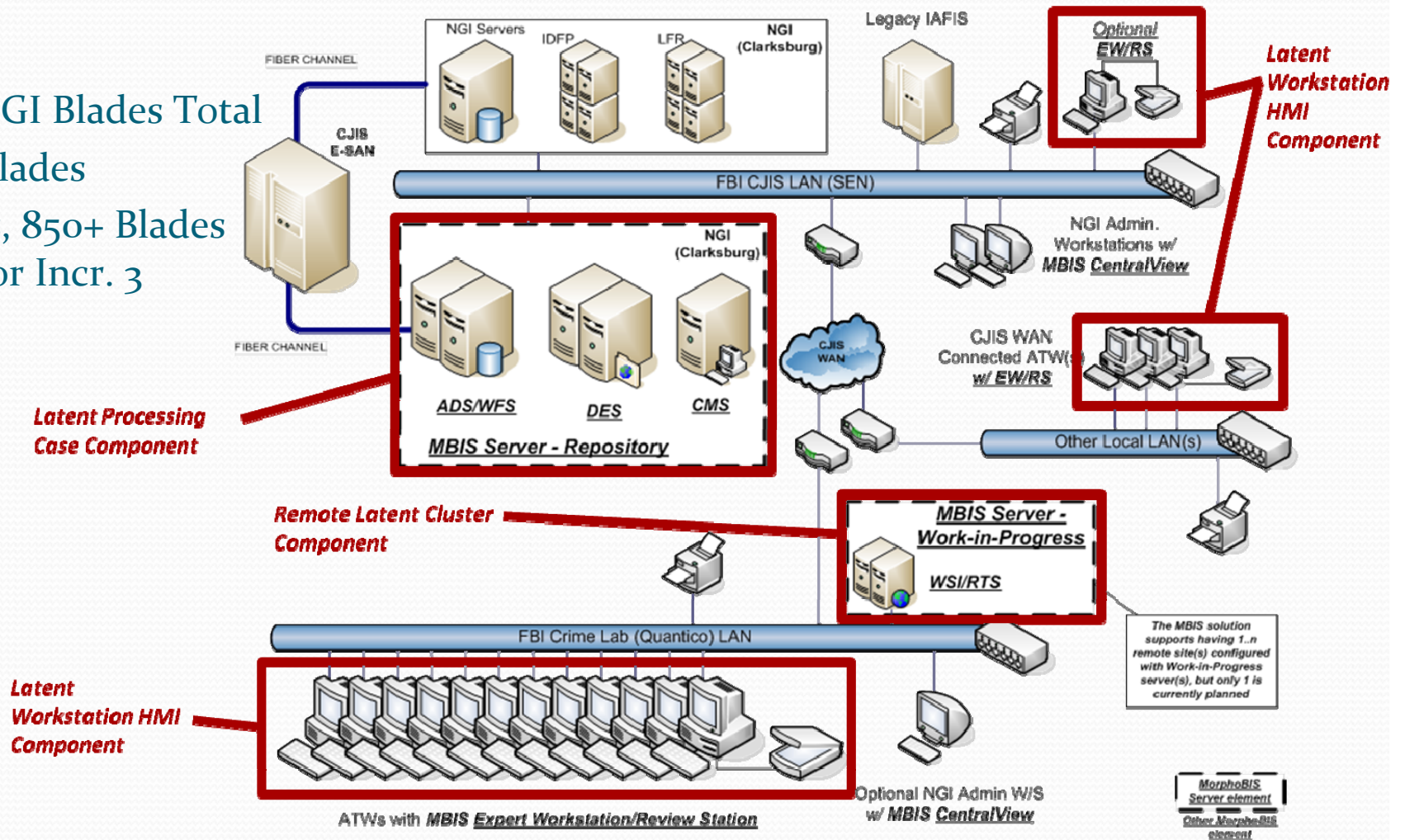
BSS is housed at FBI facilities in Clarksburg, WV

Next Generation Identification (NGI)



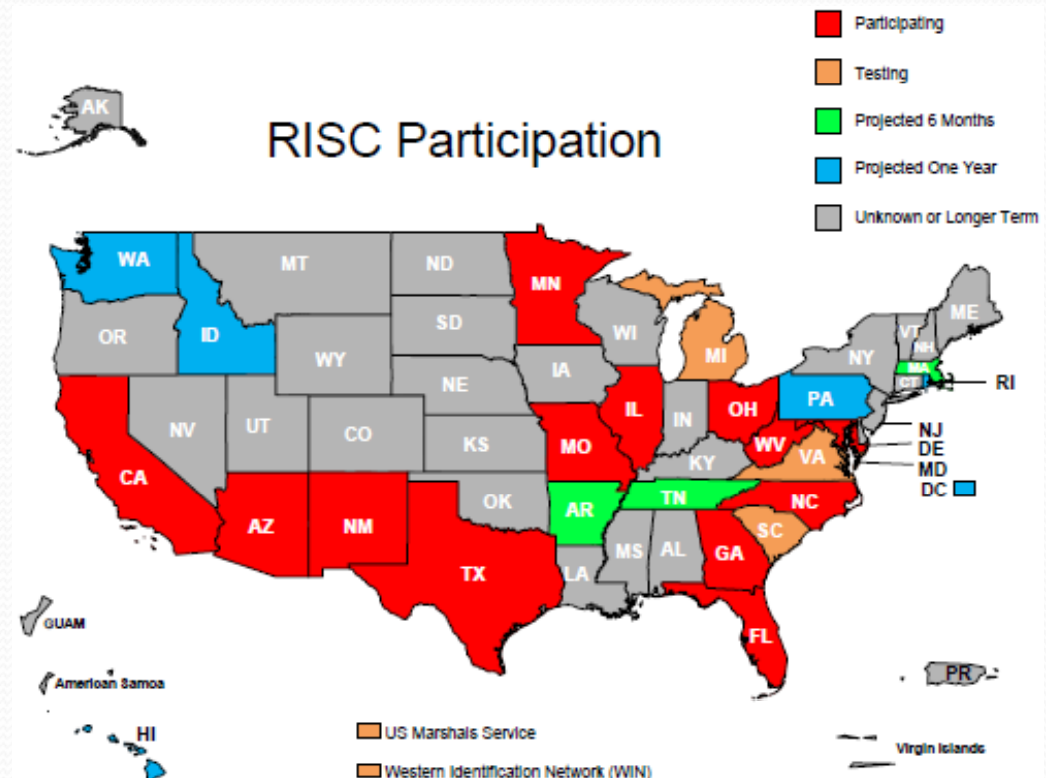
NGI Through Increment 3

- ≈ 1100 NGI Blades Total
- 4 Core Blades
- 30 Racks, 850+ Blades Added for Incr. 3

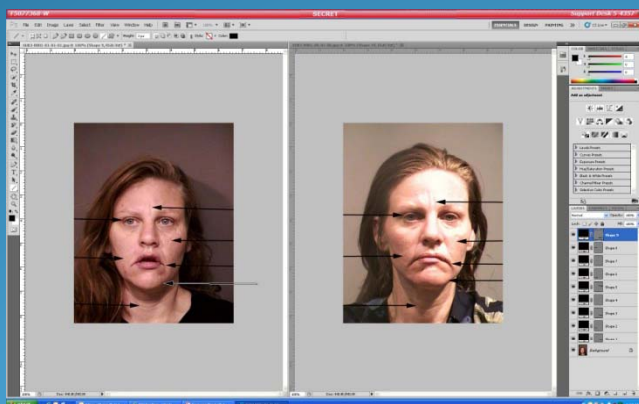
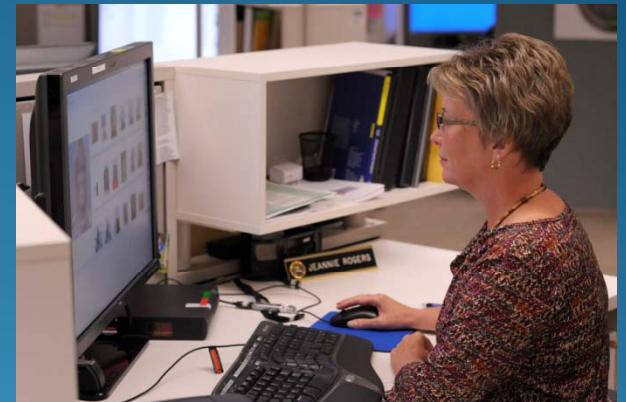
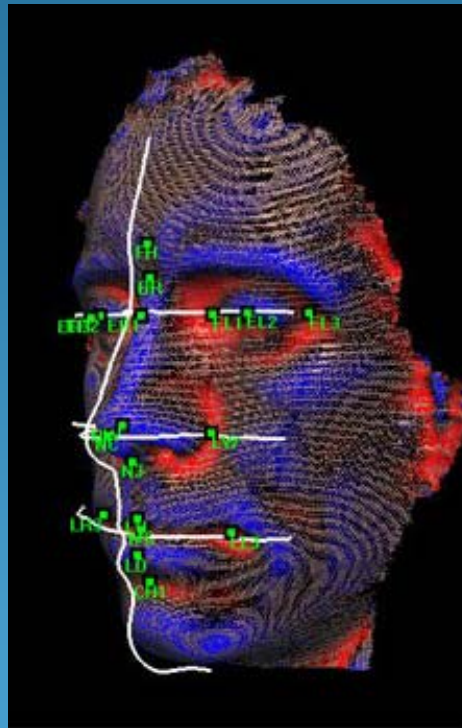


RISC and Initial NGI Infrastructure (Increment 2)

- Average 900 searches per day
 - 1,074 on 9/27/2012
- Over 855,000 Searches
- Average Red Hit Rate: 6-10%
 - Wants 72%; SOR's 28%
- AVG Response Time: 5.1 sec.
- 13 States/532 Agencies Participate



Face Matching and Lead Generation

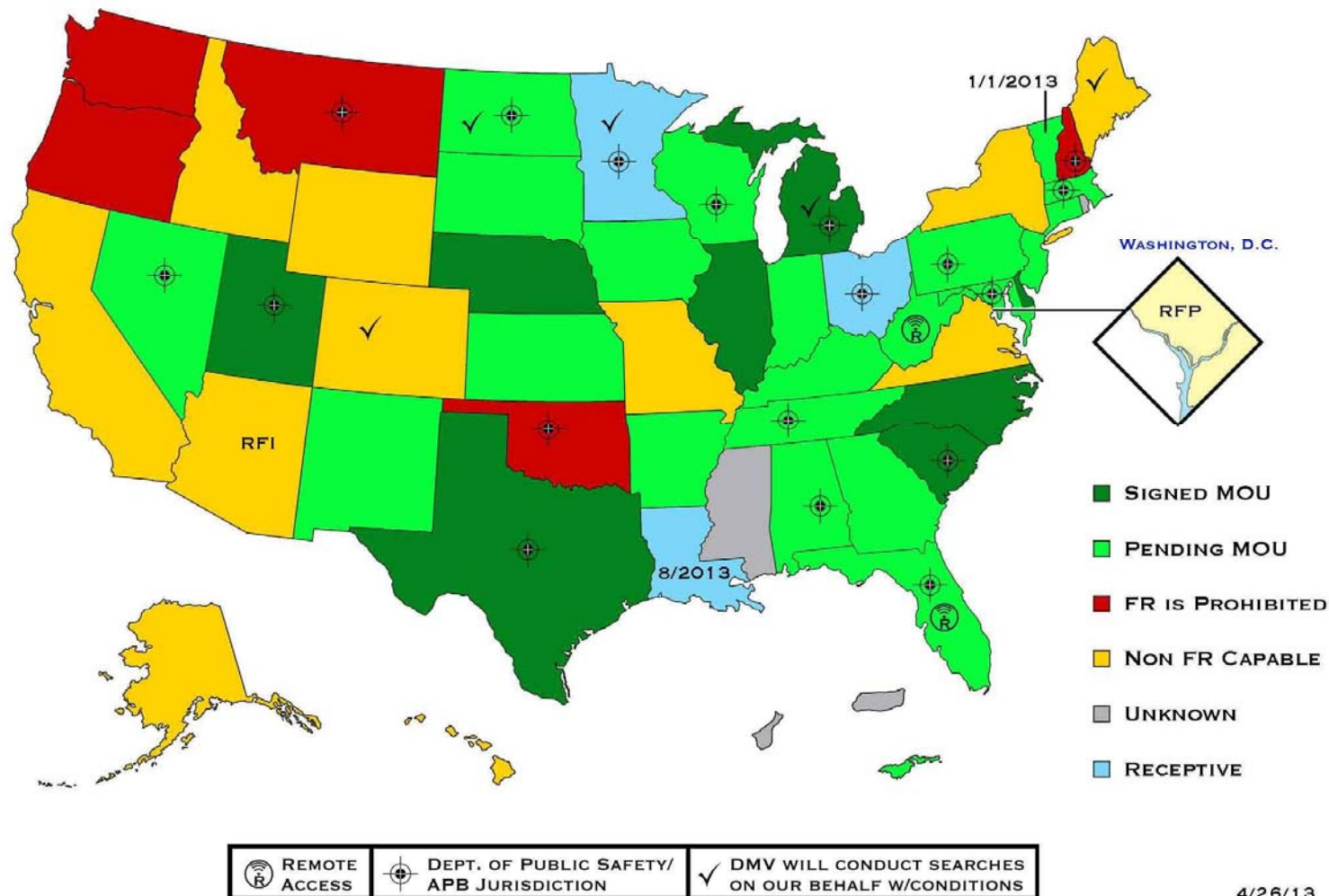


Face Matching Lead Generation

- NGI National Law Enforcement Booking Mugshot Search in Increment 4
 - ❖ Investigative Leads; **NOT** Positive Identification
 - ❖ Database: Criminal Mug Shots Taken by LE Officer During Booking
 - ❖ Coordinating Bulk Submissions from States and Federal Agencies
 - ❖ Potential for 160+ M Criminal Mugshots (frontal & profile) ≈ 10 TB
- Universal Face Workstation
- Interstate Photo System Facial Recognition Pilot (IPSFRP) Underway
 - ❖ 17+ Million Local/State/Federal Searchable Photos
 - ❖ 22,500+ Search Transactions Processed
 - ❖ Michigan Participating
 - ❖ 11 More States and US Border Patrol Plan to Participate in Pilot
- Face Analysis , Comparison and Evaluation Services (CJIS/BSS/FACE)
 - ❖ Limited to FBI Casework Support
 - ❖ Beyond Mugshots Provides DMV Photo, DOS Visa, and other Searches
 - ❖ FR Search access to ≈ 267.5 million images
 - ❖ Support Requires an Investigative Predicate

DMVs Participating with FBI in Face Recognition

(When There is an Investigative Predicate)



4/26/13

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Identification from DNA

DNA Analysis – Not Big Data / Big Analytics



- 12.2 million known subjects
- 515 thousand forensic profiles
- CODIS Record is 54 bytes
- Rapid DNA Analysis Technology
- SCOTUS 6-3-2013 Maryland v. King Decision



Maryland v. King

Supreme Court of the United States

June 3, 2013

“When officers make an arrest supported by probable cause to hold for a serious offense and they bring the suspect to the station to be detained in custody, taking and analyzing a cheek swab of the arrestee’s DNA is, like fingerprinting and photographing, a legitimate police booking procedure that is reasonable under the Fourth Amendment.”



Likelihood of Hits a Function of Database Size

Hugely Effective Investigative Aide – FY 2013

- 4,880 Case to Case Hits
- 3,096 Interstate Hits
- 24,079 Intrastate Hits

Poised for Substantial Known Subject Increase

- \approx 1 Million Known Subject Increase FY2013
- \approx 63 thousand Forensic Subject Increase FY2013
- \approx 8.4 million federal arrest cycles annually
 - Committed by \approx 5.9 million persons
 - \approx 2 million persons with first criminal encounter

Rapid DNA Equipment

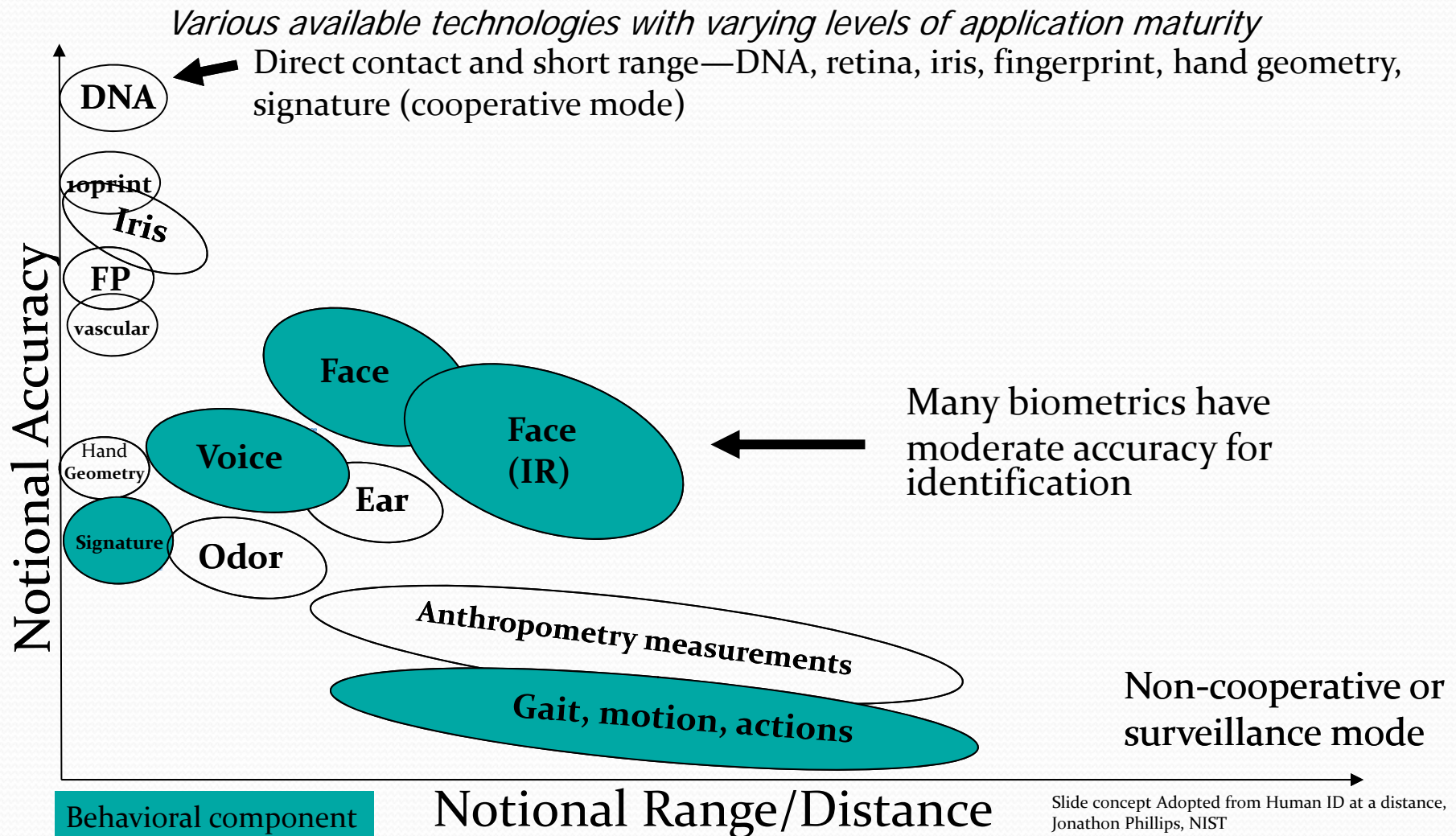


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Many Other Biometrics

(Some Could Become Big Data)

State of the Art Biometrics Excellence Roadmap

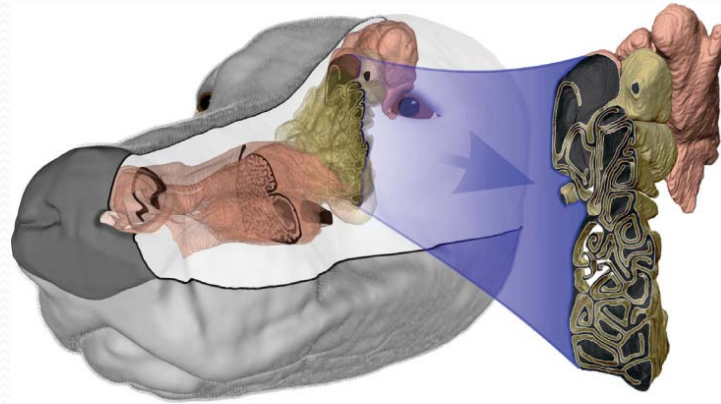


Other Investigative Biometrics

Handwriting



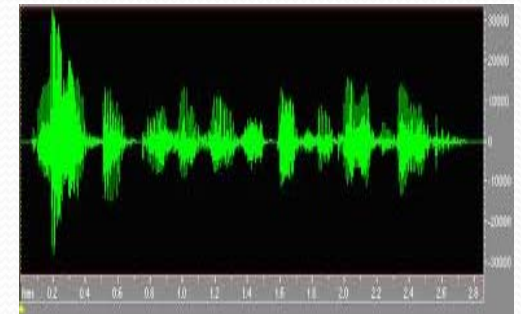
Scent



Scars, Marks & Tattoos



Speaker Identification



Many Other Biometrics Available

1ST Generation Biometrics

- Hand Geometry
- Computer Keystroke Dynamics
- Skin Patterns
- Gait

2nd Generation Biometrics

- Electrophysiological
 - electrocardiogram (ECG) – heart activity
 - electroencephalogram (EEG) – brain activity
 - electromyogram (EMG) – muscle activity
 - electrooculogram (EOG) – eye movement
- Vein Pattern
- Ear Shape
- Anthropometry
- Dental
- Skin Luminescence
- Simultaneous Face and Iris
- Face / Iris at a Distance
- Scent
- Periocular
- Cheiloscopy
- Bone Acoustic Resonance
- Skin Impedance
- Cardio-Thoracic
- Phonomyogram
- Facial Skin Thermography
- Skeletal SAR at Distance

} Currently Direct
Contact Required



Assessing Modalities & Technologies

- Is it consistent with law and public policy
- What are the privacy & civil liberty impacts
- Can it realistically be introduced
 - Source of known subject database
 - Point of collection issues
- Does it materially advance existing capabilities
- Would it significantly support other missions
- Does it provide substantial new useful capability
- Is it cost effective

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Center of Gravity Could Shift

Crowd Sourcing Leads to Big Data





Crowd Sourcing is Not New

REWARD
(\$5,000.00)

Reward for the capture, dead or alive,
of one Wm. Wright, better known as
“**BILLY THE KID**”


Ages 18. Height, 5 feet, 3 inches.
Weight, 125 lbs. Light hair, blue
eyes and even features. He is
the leader of the worst band of
desperadoes the Territory has
ever had to deal with. The above
reward will be paid for his capture
or positive proof of his death.

JIM DALTON, Sheriff

DEAD OR ALIVE!
“**BILLY THE KID**”

JN 14
 DSW

WANTED



JOHN HERBERT DILLINGER

On June 10, 1934, EDWARD J. BREMER, Attorney General of the United States, under the authority vested in him by act of Congress approved June 9, 1934, offered a reward of

\$10,000.00 \$5,000.00

For the capture of John Herbert Dillinger or a reward of

For information leading to the arrest of John Herbert Dillinger.

DESCRIPTION

Age, 28 years; height, 5 feet 7 1/2 inches; weight, 140 pounds; hair, reddish brown; eyes, blue; nose, straight; mouth, closed; teeth, even; 1/2 inch, near back left ear, small mole; wears lig. blue straw fed. coat, gray slacks, over shirt, light blue button-down shirt.

All claims to war of the above-named subject and all questions and disputes that may arise as a result incident to the foregoing arrests shall be placed open to the attorney general and his assistant, and the subject shall be held in custody until he is delivered and delivered previous to any trial and brought to the United States, together with the following conditions: to pay and to show other or evidence of the government of Justice.

If you are in possession of any information regarding the whereabouts of John Herbert Dillinger, immediately inform by telephone or telegram to the nearest office of the Bureau of Investigation, the United States Department of Justice, the local authorities of which you are aware or in the person alive of this notice.

WILL reward
 good conduct
 good character

1000 REWARD
 DEPARTMENT OF JUSTICE
 UNITED STATES DEPARTMENT OF JUSTICE
 WASHINGTON, D. C.


June 10, 1934

[illegible][illegible]


FBI TEN MOST WANTED FUGITIVE

Bank Robbery • Unlawful Flight and Armed Prosecution • Armed Robbery, Theft (Liquor) (Burglary) (Stolen)


VICTOR MANUEL GERENA



Photograph taken
in 1993



Photograph
retaken in 2004



Computer Age
Enhanced
Photograph

Multimedia Images

Aliases:
Victor Ortiz, Victor M. Ocasio Ortiz

DESCRIPTION

Date(s) of Birth Used:	June 24, 1973	Race:	Brown
Place of Birth:	New York, New York	Eyes:	Green
Height:	5'4" to 5'7"	Complexion:	Dark Medium
Weight:	165 to 169 pounds	Sex:	Male
Build:	Medium	Scars:	Wrist (Migraine)
Occupation(s):	Machinist, Security Guard	Nationality:	American (born in Puerto Rico)

Scars and Marks: Gerena has a scar on nose and a scar on his right shoulder blade.

Remarks: None

CAUTION

Victor Manuel Gerena is becoming more active in connection with the armed robbery of approximately \$7 million from a jewelry company in Connecticut in 1993. He allegedly took two security employees hostage at point-of-sale and then handcuffed, brand and sprayed them with a tear-gas substance in order to further elude them.

REWARD

The FBI is offering a reward of up to \$1 million for information leading directly to the arrest of Victor Manuel Gerena.

CONSIDERED ARMED AND EXTREMELY DANGEROUS

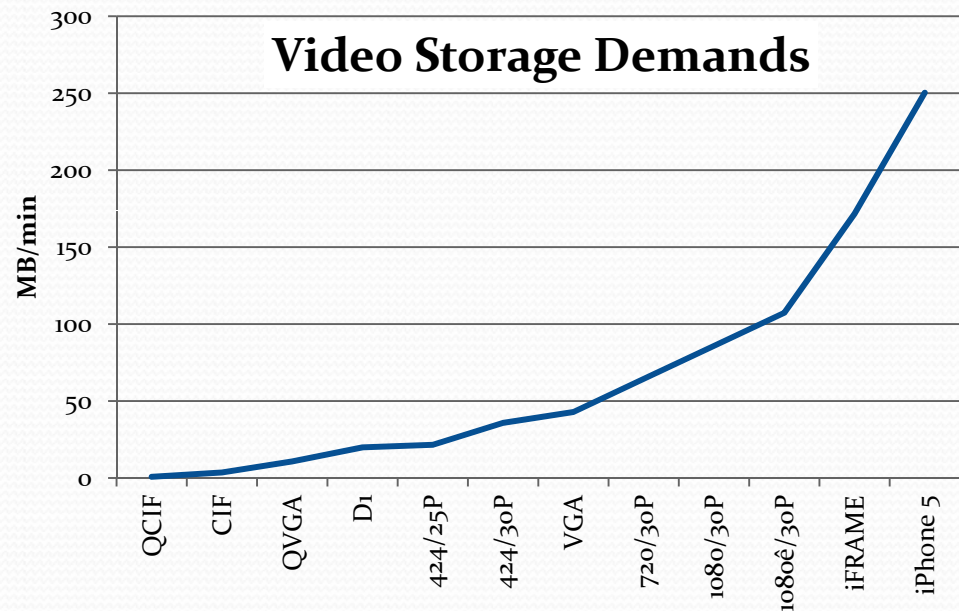
If you have any information concerning this person, please call your local FBI office or the nearest Airborne Embassy or Consulate.

Field Office: New Haven, Pa. Jan

May 1994
Police Revised/Issued 2004

But the Crowd's Response has Changed

- Nearly everyone carries a camera
(if only in their mobile phone)
- Personal engagement → big response
- Camera resolution has exploded



A major incident in a crowded, media covered, venue yields 100's of terabytes



Video Analytics Issues

- Collection of Still & Video Evidence
- Sharing and Storing of Video Evidence
- Organizing Video Evidence
- Exploiting Video Evidence (still largely brute force)
- Managing Video Analytics During A Major Event

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Challenges & Opportunities



Biometric Systems Difficult to Scale

- At capture it is unstructured data;
- Once features are extracted **limited** structure emerges;
- It is difficult to reduce the search space;
- Parallel image and feature improvement programs while maintaining traceability;
- Retention over long periods;
- Search difficulty increases non-linearly with repository;
- Limited Quality Control over Contributors; and
- Challenging to assess impact of algorithm change



Looking Ahead

- Shifting Focus from Biometrics to Identity
- Continuing Importance of Interoperability
- Steady Improvement in Face Matching Accuracy
- Crowd Sourcing
- Video Analytics
- Point of Encounter Biometric Query
- Mutilated and Surgically Altered Fingerprints
- “Rap Back” Impact on Civil Files
- Speaker Recognition & HLT
- Other Biometrics and Forensics

Biometric Technology Center

(Occupancy 2014)

