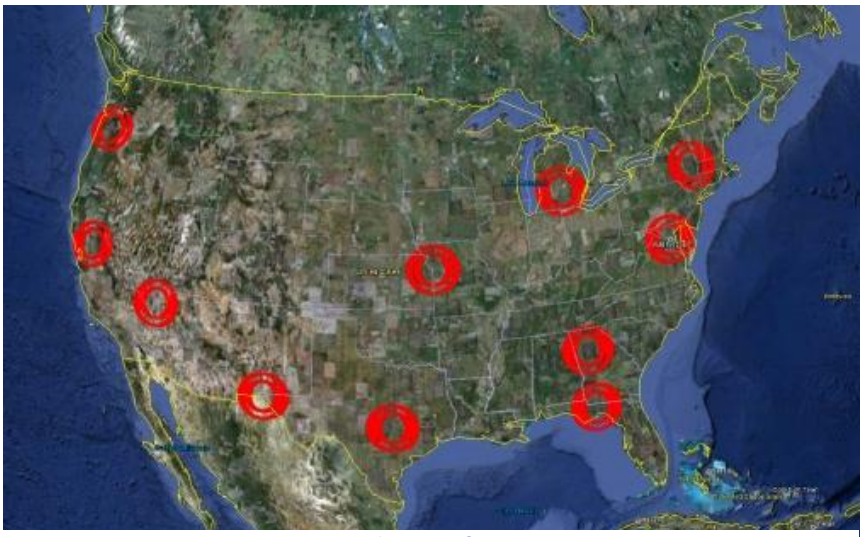
Latent Print Interoperability:

State and Local Perspectives



Represented Areas of Interviewees

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Abstract

This report summarizes the findings from interviews with select state and local law enforcement officials regarding the issues of latent fingerprint interoperability. Interoperability in this context is understood to be "the ability of two or more Automated Fingerprint Identification Systems (AFIS) networks, systems, devices, applications or components to exchange information between them and to use the information so exchanged *correctly and with minimal loss of accuracy".*

The interviews were conducted to gain a better understanding of latent fingerprint operations and existing or desired interoperability arrangements at the state and local levels. Findings reveal the desire for latent print interoperability among local and state AFIS examiners and managers. It further reveals the gaps which prevent the achievement of latent fingerprint interoperability.

Major findings include:

- A uniform interest to "Enter Once, Search Many"
- Interest in selective searching of nearby locales
- States are interested in state to state searches
- A few interoperable arrangements already exist
- Not all records are forwarded to State AFIS and Integrated Automated Fingerprint Identification System (IAFIS) / Next Generation Identification (NGI)
- Lack of personnel is a growing concern
- The processes and re-encoding of features necessary to search multiple systems (i.e. IAFIS, state, and local) are time-consuming and cumbersome
- Lack of funding limits expanded search opportunities
- Considerations for ways to best conduct latent print searches

The interviews reaffirmed the notion that examiners and administrators are looking for a seamless mechanism to search other databases without the need to reacquire the image, recode the image, and/or repeat each of the steps required in the previous search.

Noblis is greatly appreciative of the time and effort made by the interview respondents.

Contents

1 Introduction

The ability to search a latent fingerprint or palmprint against another state or neighboring local database is currently very limited and many potential searches that could identify and remove a criminal from the streets are never made. Within the law enforcement community, the lack of interoperability reduces the opportunity for law enforcement to make effective identifications through the many AFIS that are in use throughout the United States. The deficiency of interoperability has been recognized by the National Academies in their report *Strengthening Forensic Science in the United States: A Path Forward*.

In order to facilitate in improving interoperability among local and state law enforcement communities, the Noblis Interoperability Team was tasked with creating three documents: *Latent Interoperability Transmission Specification (LITS), Extended Feature Set (EFS) Profile Specification, and EFS Markup Instructions for Extended Friction Ridge Features.* Throughout the research and writing process, Noblis recognized the lack of a comprehensive understanding and knowledge regarding the current state of AFIS latent print interoperability at the state and local levels.

To resolve the issue, the Noblis Interoperability Team conducted interviews with state and local governments on the issue of latent fingerprint interoperability. Between April and November 2011, information was gathered from knowledgeable latent print examiners, AFIS practitioners, and administrators who work with these systems on a day to day basis. The Noblis Interoperability Team believes that the information obtained through these surveys is a valuable source for further study and that it provides a unique overview of operational practices and issues faced by latent examiner practitioners. Recognizing the needs of the local latent print community is the first step in creating viable solutions for interoperability.

1.1 About the Questions Asked

During the interview period, the questionnaire format evolved from a large array of topics to a more concise set of questions. While interviews were initially directed to state identification agencies, the focus later shifted to metropolitan areas that share a border with another jurisdiction and jurisdictions where criminal activities involve cross jurisdictional boundaries. These changes came about as a result of several factors:

- Needs expressed by the local AFIS agencies
- Interest communicated by the Office of Science and Technology Policy (OSTP) Latent AFIS Interoperability Task Force
- Recognition that issues faced by local agencies are not always well represented at State or Federal levels
- Feedback from both state and local examiners and administrators at meetings, conferences and presentations

The final version of the questionnaire can be found in Appendix section 4.1.

1.2 Participants

Many state AFIS agencies were interviewed including administrators from seven state AFIS agencies. In addition, Noblis interviewed with managers of the Western Identification Network (WIN) who provide tenprint and latent print identification services for the states of: Alaska, Idaho, Montana, Nevada, Oregon, Utah, Wyoming and Washington.

Six local agencies were interviewed including NOVARIS, a regional AFIS system in Northern Virginia. NOVARIS in particular provided not only interview information, but also met with the Noblis team at their AFIS site. The local areas were selected because they have population concentrations within close proximity to other political entities and AFIS systems.

The following agencies and personnel (by date of interview) were generous in their comments and commitment to address interoperability:

• Texas Department of Public Safety	Mike Lesko
• WIN	Ken Bishoff, Dusty Clark
• California Department of Justice	Derrick Morisawa, Chris Bodine
• Florida Department of Law Enforcement	Charles Schaeffer
• Kansas Bureau of Investigation	Kelly Woodward, Steve Cook, Brendan Jensen, Ely Meza
• Georgia Bureau of Investigation	Louis Kriel
• NOVARIS	Dave Russell, Dianna Sarver
• New York Division of Criminal Justice Services	Joe Morrissey, Janet Hoin, Mary Ann Pellitier, Donna Call, Charles Clock, Beth Bloodgood

• Michigan State Police	Greg Michaud
• Kansas City, Missouri Police Department	Carl Carlson
• Las Vegas Metropolitan Police Department	Alice Maceo
• El Paso, Texas Police Department	Bruce Orndorf
• Baltimore, Maryland Police Department	Sharon Talmadge
• Portland, Oregon Police Department	Kim Yada, Randy Yoshimura

A more detailed list of interviewees can be found in Appendix section 4.2.

2 Summary of Findings

Interviews with state and local AFIS managers and examiners across the country revealed the different state and local interests, a few existing interoperability arrangements, and some problems that need to be addressed in order for interoperability to work. Noblis found the following types of interoperability arrangements to exist:

- **Working Independently** –The majority of local AFIS users are standalone operations, meaning that for the most part, they only search their own local AFIS database. State AFIS operations are capable of one way interoperability with IAFIS/NGI, but they are not linked to each other or to the local systems except for a very limited number of cases.

- **Statewide System** – There are examples of states which have a state identification agency that provides tenprint and latent print services and maintains a central repository of fingerprint records as required by state law. Workstations exist at various locations throughout the state and latent print operations are uniform. Maintenance and upgrades are handled by a central source.

- **Informal Coordination** – Many jurisdictions report that periodic searches are conducted in another jurisdiction by their colleagues or in a jurisdiction that has been targeted because of investigative leads. These arrangements depend on personal relationships between the examiners and are usually practiced only for higher profile cases. Because the data is transferred manually, the process is highly inefficient in terms of examiner time utilization and in the timely delivery of the results.

- **Formal Cooperation** – There are several cooperative arrangements at the local and State levels. At the State level there is the Western Identification Network and at the local level there is the Washington D.C. area network comprising counties in Northern Virginia, neighboring Maryland counties, and Washington D.C. These arrangements are effective. In the first case (WIN) the agreements are quite formal with interoperability being well defined for the member States. In the second case with Virginia, Washington D.C. and neighboring Maryland counties, the arrangements tend to be informal and are based on the implicit agreement to use the same vendor equipment. Other regional systems have also been implemented with varying degrees of formality.

- **Defined Partnerships** – This target level of interoperability, where local jurisdictions, states, and federal AFIS have formal agreements to search each other, has not been largely realized. It has been achieved, in part, between the States and the Federal Bureau of Investigation (FBI) IAFIS/NGI.

2.1 State and Local Interests

Throughout the interviews, state and locals managers expressed an interest in expanding their search to other nearby AFIS systems. According to latent examiners and managers, the more databases available to search and the easier and faster it is to search, the better. Table 1 demonstrates this thinking. Currently states and localities do not conduct many searches on federal, state and local jurisdictions. However, if the searching were done seamlessly ("Enter Once, Search Many" i.e. no extra work has to be done to search another AFIS), then the percentage of searches they would conduct on the state, federal and local databases increases for all jurisdictions interviewed. The only exceptions are in cases where there are other constraints which limit the ability to search other databases.

Type of AFIS	Geographic Area	% Searches sent to FBI	If Seamless, % sent to FBI	% Searches sent to State	If Seamless, % sent to State	% Searches sent to Neighboring Jurisdictions	If Seamless, % Searches sent to Neighboring Jurisdictions
Local AFIS	El Paso, TX	1%	30 – 35%	1%	30 – 35%	1%	30 – 35%
	Northern Virginia	1%	40 – 50%	1%	40 – 50%	80 – 90%	Already Seamless[1]
State AFIS	Baltimore, MD	0%	0% [2]	100%	100% [3]	0%	0% [2]
	Kansas City, MO	10%	20 – 30%	100%	100%	0%	20-30%
	Michigan State	3 – 5%	100%	100%	100%	Rarely	100%
	New York State	80%	80%	100%	100%	10%	80% (All non-idents on state system)
WIN	Portland, OR (WIN)	15%	20-25%	100%	100%	All non-idents on state database [4]	All non-idents on state database
	Las Vegas, NV (local AFIS & WIN)	Very rare	All non-idents on local database	All non-idents on local database	All non-idents on local database	All non-idents on local database[4]	All non-idents on local database

Table 1. Percentage of Searches Sent to Federal, State, and Local (Neighboring) AFIS Currently and If Searching was Seamless (no recoding). These values are estimates only.

[1] NOVARIS currently has interoperability agreements in place with two neighboring jurisdictions, as described in section 2.2 of this report.

[2] In this case, very few searches would be conducted even with seamless searching because of an existing backlog of latent searches in the present system. Without the necessary personnel to conduct all the searches, these other databases cannot be taken advantage of by Baltimore examiners (see section 2.3).

[3] Note that terminals part of a state AFIS conduct all their searches on their own state AFIS. Seamless searching does not affect state AFIS examiners conducting a search on their own AFIS.

[4] WIN members will search their own local (i.e. Las Vegas) or state (i.e. Portland) AFIS first and then will conduct a search on WIN member states and jurisdictions. Therefore, a jurisdiction part of WIN may not be able to search *all* neighboring jurisdictions (i.e. Las Vegas cannot search Arizona AFIS - Arizona is not a WIN member).

If the current amount of records sent to other AFIS jurisdictions is different from what would be searched if the process were seamless, this implies that something is preventing AFIS systems from taking advantage of databases in other jurisdictions.

Uniform Interest to "Enter Once, Search Many"

Respondents have expressed the desire to be able to search whatever database they believe is most likely to result in identifications. This typically includes areas that are very close to their jurisdiction and crime scene. There is a great interest in searching federal databases as well. AFIS examiners and managers would like to have the option of searching whatever database they choose without spending the time to re-encode a print, physically travel to another AFIS, send extra emails and phone calls, etc.

The exact nature of the desired target search is unique to each AFIS manager and examiner. Some wanted only to search specific cities for reasons such as a highway connections or the city being the only major population nearby. Others expressed the need to search bordering states and/or federal databases such as FBI IAFIS/NGI, Department of Homeland Security's (DHS) Automated Biometric Identification System (IDENT), etc. Each AFIS interviewed had a unique situation which creates the need for a flexible system of interoperability.

Complete interoperability will only be achieved when examiners can encode once to search their own State AFIS, a target AFIS system in another jurisdiction, and IAFIS/NGI seamlessly. This means using the same encoding with no appreciable loss in accuracy.

Print Quality

The Kansas City Police Department searched a latent print on IAFIS which resulted in no hits. It wasn't until the Kansas state AFIS was searched that an ident was made. Even though a fingerprint record on the subject had been forwarded to the FBI, the record in IAFIS had distortion. On the other hand, Kansas AFIS had a much better quality tenprint image record. Even if states and locals did forward all their records to IAFIS/NGI, which currently doesn't happen, there still is a need to search state and local databases directly.

Interest is in Selective Searching of Nearby Locals

Almost all interviewees mentioned that they do not forward all their fingerprint data to the state and Federal AFIS (see section 2.3 for more details). This implies that local AFIS contain records which are not enrolled in state and federal databases. Because of this disparity, local agencies are very interested in searching local jurisdictions since local AFIS provide a valuable capability that is not provided by the State or Federal AFIS.

Currently, most local agencies will first search their local database and then conduct a search either on the respective state database and/or IAFIS/NGI. However, by doing so they frequently bypass records that a neighboring AFIS has that are not on the state or federal systems. Specific examples of situations in which local agencies have a desire to search the AFIS of nearby localities are as follows:

- El Paso, Texas desires to search Las Cruces, New Mexico and vice versa
- Las Vegas, NV desires to search San Bernardino, California and Riverside, California
- Michigan desires to search Canada

States Interested in State to State Searches

The state systems interviewed are interested in expanding latent print searches with adjacent states. States are willing to allow other states access to their databases in a reciprocal arrangement with appropriate legal and administrative directives. Currently there are several bilateral interoperability arrangements, however, these are not always reciprocal due to funding issues, contract terms, and other reasons (e.g. Kansas searches Missouri, but Missouri has difficulty searching Kansas). The following are a few examples of states and jurisdictions interested in searching nearby state AFIS:

- New York State desires to search New Jersey State and other surrounding states
- Las Vegas, Nevada desires to search Arizona state

Interest is in Searching Federal databases

The ability to search FBI's Criminal Justice Information Services (CJIS) IAFIS/NGI is highly desirable because it contains much of the state and local databases all over the country. Additionally, it is presently cheaper and easier than searching other local databases. However, many of the agencies find it difficult to search IAFIS/NGI because of a need to recode a fingerprint and a lack of direct connectivity to CJIS (in the case of local agencies only; state AFIS are able to connect directly). These difficulties prevent local and state AFIS examiners from searching the CJIS database as much as they would like (as seen in Table 1 shown earlier).

While there is much interest in searching CJIS IAFIS/NGI, there is also interest in searching other federal databases such as DHS and DOD. Michigan AFIS personnel, in particular, mentioned an interest in searching the DHS AFIS (IDENT) because of Michigan's high concentration of foreign born persons. They believe that access to IDENT would be of great value for border states.

Identity from US-VISIT (DHS)

A murder took place in the Detroit metro area in 2008. Both Michigan AFIS and IAFIS/NGI were searched, but returned with no hits. In 2010, Michigan finally reached out to US-VISIT (IDENT) by sending a printed copy of the latent print. DHS responded with an identification of the print. The identification turned out to be an immigrant who was not included in either the FBI or Michigan databases.

2.2 Examples of Interoperable Arrangements

Several examples of interoperable arrangements such as Las Vegas, Nevada, NOVARIS (Northern Virginia's local AFIS), and WIN (Western Identification Network) exist and reveal the benefits of interoperability. In most cases these relationships are based on a common vendor and vendors' cooperation with agencies to develop an effective Memorandum of Understanding (MOU). Conversely, if one agency changes the vendor, the interoperability relationship could be lost or at least put into jeopardy.

Las Vegas managers and administrators are currently working on an MOU with a district in California (San Bernardino and Riverside, CA) because the area has the same vendor, is close by, and lies on an interstate which connects both jurisdictions. However, they are not actively pursuing an arrangement with Arizona because the Arizona state AFIS has a different vendor and there remain uncertainties as to how interoperability would work between AFIS of various vendors. Las Vegas administrators and examiners still remain very interested in working with the state of Arizona.

NOVARIS, a Northern Virginia AFIS, presents a unique example of interagency collaboration with Washington D.C. (DC AFIS) and the adjacent Maryland counties of Prince George and Montgomery (RAFIS). These agencies are interoperable because they have the same vendor, same level of software, and administrative and legal agreements for cross-jurisdictional searches. NOVARIS is unique in that the examiner has access to two AFIS databases in the national capital area without the need to re-encode the latent. This makes it easy for a latent print examiner to search any of these three AFIS systems.

Successful NOVARIS Identification

An officer makes traffic stop at about 9 pm, but the driver crashes the van into the patrol car pinning the door before fleeing the scene. The driver abandons the vehicle and takes off on foot - a manhunt ensues. Laboratory personnel are called to the site and a bag of chips and PC equipment in the vehicle supply officers with a latent fingerprint at approximately 3 am. It is entered into NOVARIS via Prince William County. By 6 am, an identification is made and a mugshot is distributed to all local police. At 9 am the suspect is found in a local mall and taken into custody. This situation took a total of 12 hours to complete.

In contrast, latent searches on a different AFIS database, such as the Virginia State system, require the examiner to begin the search process nearly from the beginning by rescanning and re-encoding a latent print. Going on to search IAFIS/NGI is an additional time consuming process since examiners must re-encode the print once again and send a special request for a search. As a result, examiners conduct searches on NOVARIS and the participating agencies for the majority of latent print searches and only rely on the state and IAFIS for high profile cases.

Figure 1 below illustrates the search processes within the Washington D.C. area and the complexity of moving beyond to search a state and federal AFIS.

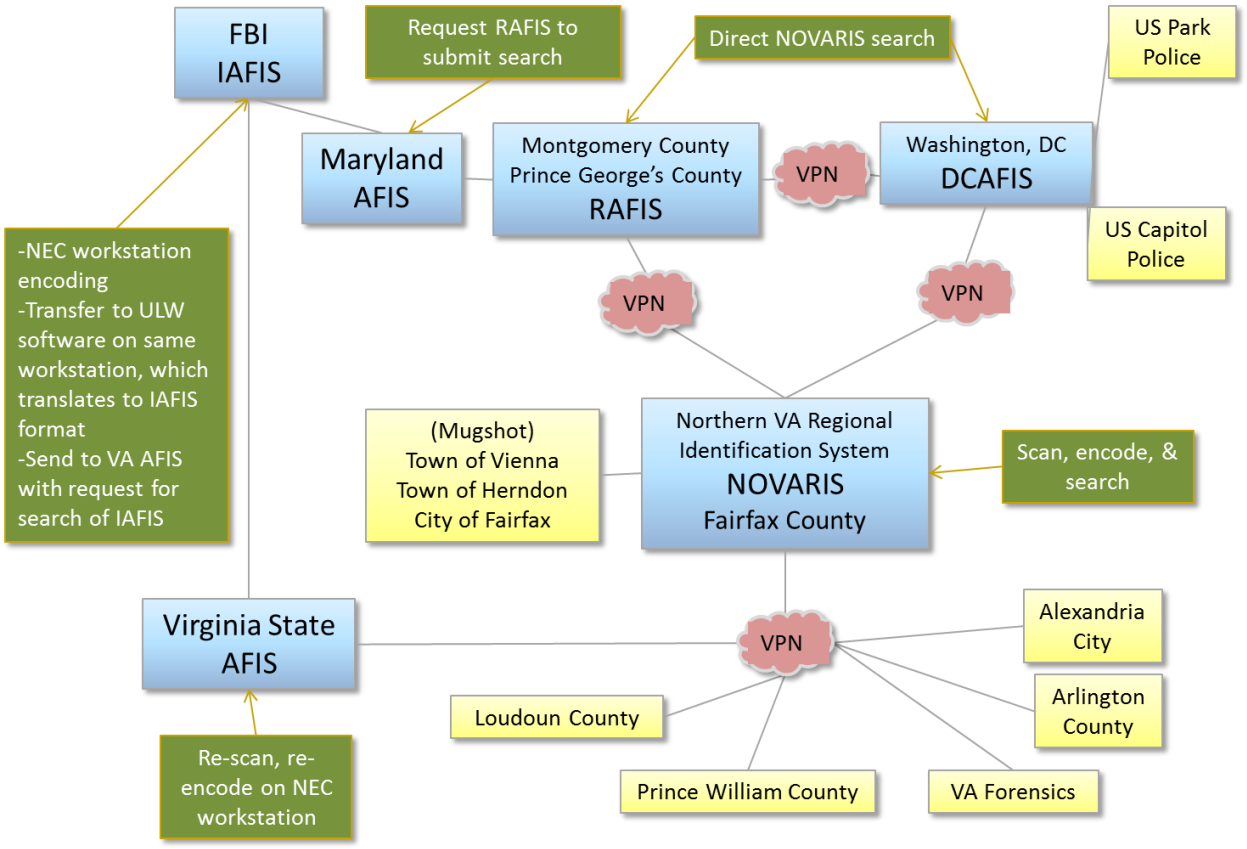

Figure 2. NOVARIS Interoperability Arrangements. With the ever increasing workload, the option to search another system is generally based on the type of crime, the workload for that day, the quality of the print, and the likelihood of a hit.

WIN operates as one big database consisting of fingerprint data from a few localities and the states of Alaska, California, Idaho, Montana, Nevada, Oregon, Utah, Wyoming and Washington. Once a state voluntarily decides to join WIN, it will forward tenprint records to WIN and will exclusively search WIN's database which contains the records of all member states. The member states' examiners are able to search the WIN database directly without any extra re-encoding. According to WIN, members have historically averaged 25% more tenprint identifications after gaining the ability to search records of nearby states through WIN. This shows that achieving interoperability between states and localities has great potential in increasing identifications.

Portland, Oregon and Las Vegas, Nevada are examples of jurisdictions which are a part of WIN. Las Vegas examiners will first conduct a search on their own local database and then will conduct a search

on WIN's database by using a drop-down menu. If no ident is obtained from searching WIN, latent examiners will then search IAFIS/NGI via the Universal Latent Workstation (ULW). In order to search IAFIS, a print must be re-encoded again and examiners must go through a time consuming emailing process.

2.3 The Current Environment of Interoperability

Interoperability is inhibited by many factors, of which the most common ones found from the interviews are described in this section.

NOT ALL TENPRINT RECORDS ARE FORWARDED TO STATE AND FEDERAL AFIS

When latent print examiners at the local and state level receive a latent fingerprint, they typically will search their AFIS database first. If appropriate, they will subsequently conduct a search on the state database or IAFIS/NGI. The success of achieving a hit through this process is dependent on the number and type of tenprint records local and state AFIS forward to IAFIS/NGI. Michigan state AFIS subject matter experts described the main reasons why IAFIS/NGI does not contain all the records stored in Michigan's AFIS:

- In the past, IAFIS did not accept records for low level crimes and did not store applicant records for latent print searches
- IAFIS rejects certain records
- Some local and state agencies do not forward all their tenprint records for various reasons, such as state and local laws

The collected interview data revealed that very few state and local AFIS systems forward 100% of their tenprint records, as can be seen in Table 2.

Geographic Area	Are All Records forwarded to the State and Federal AFIS?	Examples of records which aren't forwarded
Baltimore, MD	No	___
El Paso, TX	No	Class C (i.e. traffic tickets & drunk in public)
Kansas City, MO	Yes	___
Las Vegas, NV	No	___
Michigan State	Yes (if retainable)	___
New York State	No	Tenprint inquiry transactions & certain civil transactions
Northern Virginia	No	___
Portland, OR	Yes (if retainable)	___

Table 2. Tenprint Records Forwarded

Most of the local and state records are forwarded, but how many are forwarded is unknown and unique to each jurisdiction. Examples of records not forwarded include juvenile reports, drunk in public records, and disorderly conduct. The result is that state and local databases may be more desirable for some searches since the databases hold records which are not forwarded to CJIS. There were many instances

of identifications made from looking at records not found in IAFIS/NGI, which emphasizes the desirability for latent interoperability among states and locals.

As an example, one respondent spoke of a deceased who was found in a trailer. Authorities rolled the fingerprints and ran them through the local AFIS system. They were able to identify the prints because his fingerprints were on file as a class C (drunken) criminal offense. Class C records are not forwarded by the state to the FBI. Had the examiner only conducted an IAFIS/NGI search, the decedent would have remained unknown.

Lack of Personnel

The biggest hurdle to latent print interoperability was clearly the lack of personnel working with AFIS systems, especially the lack of latent print examiners. Almost every agency identified this as their biggest resource constraint. Lack of enough people to conduct searches leads to a backlog of latent print searches and limits additional searches. Loss of interoperability follows this issue. For example, when managers are overloaded with too many prints and too few staff, they may not be able search hierarchically connected AFIS systems, like IAFIS/NGI and state AFIS, since it is time consuming to re-encode a print all over again. Most crimes addressed by local and State agencies are by local criminals, and therefore the extra time to search what are perceived as low probability identification opportunities is simply not done. Even with the best technology, interoperability may not be fully utilized without the necessary personnel.

This issue is clearly demonstrated in Baltimore, Maryland's situation. From the interviews, this metro area has hardworking latent examiners and managers, but there are too few. This has led to a backlog of latent print searches. In Table 1 (section 2.1), The Baltimore AFIS respondent was one of the few interviewees who did not indicate that there would be an increase of searches against federal, state, and local jurisdictions if the process were seamless. The reason for this was the lack of latent examiners needed to handle the workload.

Latent print examiners are the human element in the interoperability equation. The easier it becomes to "encode once, search many" the more time there is for searches and verifications. However, even with the ability to search another database, examiners cannot still search every database possible since they have to spend time reviewing candidate lists returned from each search. There is a need to have a flexible system of interoperability where latent print examiners have the ability to choose the AFIS system most likely to produce identifications.

Time Consuming to Search Local, State, and Federal Databases

Lack of personnel leads to a lack of time spent on conducting searches on various AFIS systems. In the current system, latent print examiners must first scan, mark and search a latent print on the local AFIS system. If a hit is not made, the latent examiner must then decide on whether to spend the time to continue searching other AFIS systems, like the state AFIS, federal AFIS, or other neighboring AFIS. In most cases, searching for prints on other systems besides the home AFIS can be very time consuming.

To search a state, federal, or a local AFIS, latent print examiners often have to make a phone call or email, re-encode the print, or even bring it over in person. Some attempts have been made to make this process easier. An example is the Universal Latent Workstation (ULW), which is a useful tool for interoperability. Many latent examiners who had worked with fingerprints before ULW existed were grateful for the ULW software, which makes searching IAFIS/NGI must easier. However, many latent examiners noted that using ULW is still a time consuming process since a latent print must be recoded at least partially, and sometimes completely. This prevents local and state examiners from fully utilizing federal databases.

During interviews, it was found that some local latent print examiners travel to another location to conduct searches on a nearby AFIS by using the AFIS vendor's workstation. Sometimes latent examiners will even travel an hour or two out of their way to have the opportunity to search on a specific AFIS. Examiners and managers in El Paso, Texas travel one hour to the nearest metropolitan area, Las Cruces, NM, to have their latent prints searched on the Las Cruces AFIS. They also travel to Juarez, Mexico a few times a year to have their latent prints searched on the Mexican AFIS.

CANDIDATE LIST

There are two main tasks which take up latent examiners' time: encoding a latent print and reviewing the candidate list returned after a search. Faster, more accurate processing, and larger and more specialized databases will not necessarily result in more identifications. The challenge is to harness technology to free examiners from time consuming work so as to more fully utilize their ability to make comparisons.

Geographic Area	Ratio of Time Spent on Viewing Candidate List to Time Spent on Encoding
Baltimore, MD	2:1
El Paso, TX	Depends whether it's palm or fingerprinting and whether using ULW
Kansas City, MO	Majority of time spent on viewing candidate list
Las Vegas, NV	1:1 Searching WIN: More time spent on viewing candidate list
Michigan State	Majority of time spent on viewing candidate list
Portland, OR	1:1

Table 3. Estimated Time Spent Viewing a Candidate List verses Encoding for a Single Fingerprint.

Development of algorithms and strategies for the reduction of candidate list sizes is highly desirable from a viewpoint of minimizing examiner resource involvement and is now increasingly possible as shown in the latest NIST Evaluation of Latent Fingerprint Technologies: Extended Feature Sets (ELFT-

EFS). Interviews with latent examiners indicate that candidate list review can be more time consuming than the encoding process. Table 3 shows the difference between the amount of time spent viewing a candidate list verses spent encoding for a single fingerprint.

The time spent viewing candidates and encoding prints varies on the situation. For example, El Paso, Texas stated that more time is spent viewing a list of candidates for fingerprints, but this might not be the case for palmprints because palmprints have more mark up. When El Paso uses ULW, they mentioned that the time spent on encoding increases because the latent examiner must re-encode the print into ULW software.

Since interoperability will create the opportunity to search additional databases and reduce the time currently spent re-encoding latent prints, more candidate lists will be produced and latent print examiners will spend more and more of their time viewing candidate lists. Given that the examiners are already burdened, a reduction in candidate list review time is advantageous. An AFIS supervisor said that if examiners could enter a latent print, search seamlessly, and receive the respondents on one candidate list, it "would be great".

Limitations Imposed by Lack of Funding

Several agencies (e.g. New York, WIN) are upgrading their systems and will be able to utilize the benefits of IAFIS/NGI. However, it may be years before most agencies can upgrade or replace their identification systems. The greatest constraint which delays AFIS upgrades is lack of funds.

Implementing interoperability between states and localities becomes a challenge when the money is not available. For example, Michigan AFIS administrators stopped interoperability negotiations with the Illinois AFIS administrators because of limited funds. Michigan decided that connectivity with IAFIS/NGI, while not likely to provide the same opportunities for identification as a connection to Illinois, would be sufficient. Michigan administrators are not aware of the percentage of records forwarded to IAFIS/NGI by other states and localities. If this number was known, it would impact decisions of whether or not to incorporate interoperability with neighboring jurisdictions.

State and Local AFIS Capacity to Process Additional Latent Searches

Interviews conducted by Noblis staff with state and local AFIS administrators confirm that most AFIS systems have sufficient reserve to accommodate additional latent print searches, in particular on off peak hours such as nights and weekends. Guest latent print searches are generally given a lower priority than native searches, but the results remain relatively fast. If there is limited computing access to an AFIS, examiners from a neighboring AFIS could be restricted to searching during off-peak hours.

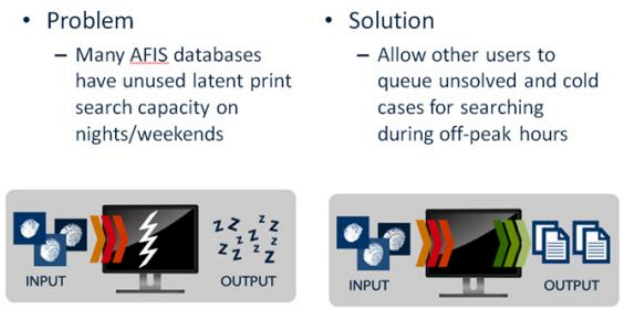

Figure 2. Demonstration of Potential Solution to Computation Capacity

2.4 Influential Factors on Interoperability

The Important Role of Vendors

Vendors always stand out as a big factor when dealing with interoperability among various jurisdictions. Agencies that had success with interoperability typically shared the same vendor, and the same vendor upgrades. Vendors have been helpful in contributing to some of these arrangements. Interoperability was attempted and is possible between Las Vegas and San Bernardino and Riverside, CA because both areas have the same vendor.

Some other examples are NOVARIS and Kansas AFIS. NOVARIS regional interoperability with Washington D.C., and Prince George's and Montgomery Counties works in part because all local systems are of the same vendor make and model. Kansas AFIS examiners search Missouri's AFIS since the base systems/architecture are essentially the same and both upgraded their systems at the same time.

Figure 3. Vendor Communication is Currently Difficult among Different Vendors.

Travel Corridors

When considering interoperability with another local AFIS, many administrators take into account the travel corridors between their AFIS and another AFIS. Most of the time, a highway or some other means of rapid travel connect the two different AFIS jurisdictions.

One example is NOVARIS, Northern Virginia's AFIS. Northern Virginia is right across the Potomac River from the Prince George's and Montgomery counties in Maryland and Washington D.C. There is a lot of travel between Northern Virginia and the Maryland counties and Washington D.C. because there are multiple bridges which span the Potomac, making it easy to travel between the three areas. This has made it important for the areas to be interoperable.

Las Vegas, Nevada and El Paso, Texas represent two cities which are connected to other large metro areas by major highways. Las Vegas is in the process of incorporating interoperability with the metro areas of San Bernardino and Riverside, CA because both jurisdictions reside along Interstate 15, one of the only major highways between these two areas. El Paso, Texas is located along Interstate 10, a major

highway connecting it to Las Cruces, New Mexico as shown in Figure 4. El Paso and Las Cruces also both have similar crime statistics. All cities mentioned here have expressed a strong desire for interoperability.

Figure 4. Map of Travel Corridor between El Paso, Texas (point A) and Las Cruces, NM (point B).

City	Violent Crime per 100,000 people	Population
El Paso, TX	456.6	618,812
Las Cruces, NM	492.6	94,024

Table 4. 2009 Violent Crime Statistics for El Paso, TX and Las Cruces, NM.

Michigan State is another example of the importance of analyzing travel corridors. Four violent cities in Michigan run along the Interstate 75 corridor. Interstate 75 is next to two border crossings into Canada and also links cities of Ohio with a high crime rate to Michigan. An additional highway, Interstate 94, connects Michigan to cities with high violent crime rates in Indiana and Illinois.

A final example is the many states along the east coast of the United States which are connected by Interstate 95, a road traveled by millions of people. There are many major cities with relatively high crimes rates along the east coast and all are connected by this major roadway. This provides opportunities for multi-state criminal activity. It is important for areas with relatively high crime rates and connected by travel corridors to have interoperable AFIS.

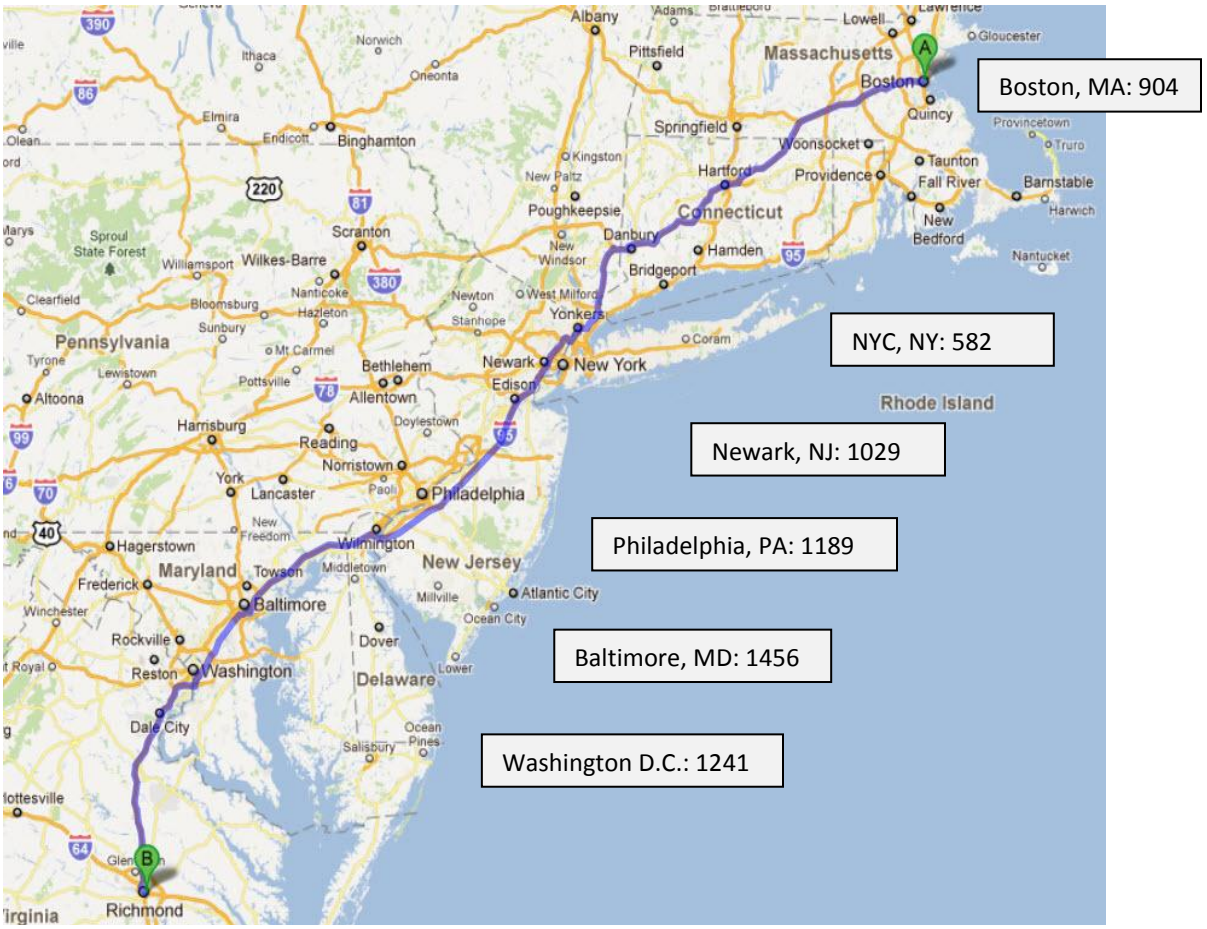

Figure 5. Map of East Coast Travel Corridor with 2010 Violent Crime rates per 100,000 people.

Direct Search of Local and State Leads to Faster Identifications

Being able to search local and state databases directly can save a lot of time and most importantly, prevent crime. This can be clearly seen in an example given by New York State AFIS respondents. In one case, a regional latent search on the New York State AFIS ended up with no Idents. New York AFIS examiners subsequently searched IAFIS and a successful identification was made to a candidate with a New Jersey record - the individual did not have a personal record on file in New York. The person's New Jersey tenprint card was obtained and searched against New York's unsolved latent file (ULF), and successfully identified to 17 different unsolved latent cases in the New York City metro area. Latent examiners and managers mentioned that if they would have been able to search New Jersey directly, they would have been able to make an identification at least a day or two faster.

There are instances of this in other areas as well. If El Paso, Texas examiners could have interoperability with Las Cruces, New Mexico, they could have identified more unsolved latents and accomplish it faster since they would not have to travel an hour to Las Cruces. If Portland, Oregon examiners had direct access to Washington State's AFIS, they would have possibly prevented a murder.

Interoperability Dependent on Request for Proposal (RFP)

Conversations revealed that how AFIS managers develop their RFPs is crucial to obtaining interoperability. One specific example came up with the Missouri AFIS. Kansas AFIS examiners can search Missouri AFIS, but Missouri AFIS examiners have difficulty searching the Kansas AFIS. This might seem strange, but part of the reason is because Kansas managers required the ability to search Missouri's database in their RFP. A manager in El Paso, Texas stated that it is important to clearly state what you desire when writing up an RFP.

Success Driven by Interest in Persons with Strong Leadership Abilities

The successful interoperable agencies are populated with individuals and leaders with vision, administrative skills, and knowledge of the operation. The challenge becomes one of expanding the number of these knowledgeable administrators or building on the examples provided by these leaders. A working group called Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST) currently establishes consensus guidelines and standards for forensic examination of friction ridge impressions. Perhaps the creation of a group of expert latent print examiners and managers similar to SWGFAST should be created that would analyze the whole latent print process from administration to fingerprint analysis.

Relationship with Investigators

During the interviews, there was a mixed reaction to a latent examiner's relationship with detectives/investigators. Some respondents believed that interaction with investigators while working on a case is very useful to have. One latent manager even stated that interoperability will be "driven by detectives". The reasoning is that detectives can supply information to help the latent examiner determine which area in the U.S. to search a latent print against. Others were doubtful about the interaction between latent print examiners and detectives since it could create an undue influence on the examiners impartiality.

2.5 AFIS Thoughts on Best Practices

Each AFIS manager and examiner interviewed expressed the desire to work productively by making as many identifications as possible. However, it became apparent that certain jurisdictions were more successful in making hits and reducing backlog than others. While some factors such as the lack of personnel are not under the control of AFIS examiners and managers, there are other issues that can be mitigated.

AFIS technology has advanced to where accuracy and throughput are at levels unimaginable just a few years ago. The introduction of NGI will provide examiners with not only a better coded and larger Criminal Master File with nearly 70 million records, but with better and faster matchers to improve search quality. This technology can successfully be taken advantage of by discovering and implementing best practices and solutions to efficiently run operations at local and state AFIS.

DEVELOP BUSINESS PROCESS MODEL FOR LATENT PRINT OPERATIONS

Interviews with latent operations staff across the country have identified a variety of approaches in their daily identification operations. Within the latent print community there are few reliable data points. As a result, the operating procedures typically grow from past practices rather than a business-like approach. While a business plan is not a prerequisite for interoperability, it is useful to address many of the problems identified as part of the interoperability concept development. These include:

- Development of search optimization (basis for trading off maximization of the number of identifications versus case specific criteria)
- Identification of optimal search strategies with respect to other jurisdictions
- Development of metrics for the rational allocation of resources and for statistical reporting that is necessary for effective planning and resource management
- Development of concepts for addressing the risk of error – degree of review, examiner qualifications

WIN is one AFIS agency which has developed some business practices. For example, they have latent inquiry best practices, a training website, and a yearly training activity to reemphasize best practices.

DETERMINE TYPES AND NUMBER OF LATENT PRINT SEARCHES TO MAKE

Examiners are faced with many options in launching a latent search. Included are the image features such as minutiae, core, skeleton and artifacts that are part of the Extended Feature Sets (EFS). The examiner can use the coder for selecting minutiae as well as artifact personally selected. If there is additional information such as finger number, pattern etc. these can be added to the search criteria[1].

HAVE ALL SEARCH OPTIONS AVAILABLE ON EACH LATENT PRINT TERMINAL

Las Vegas AFIS stated that they have all their search options (including non-fingerprint searching) for AFIS and all other necessary software (i.e. image processors and Microsoft Office) on each terminal or

[1] Selecting the wrong parameter can lead to a fatal error

input device. This prevents the examiner from moving to different workstations to complete all the work. Las Vegas stated that this is a great idea and saves time.

Ability to Choose Where to Search in IAFIS/NGI

When conducting a search on IAFIS/NGI, an examiner has a limited capacity to search the database according to location/jurisdiction. Michigan State AFIS examiners mentioned that the ability to execute latent searches on IAFIS/NGI by selecting a specific state or region would be very useful.

Develop Search Strategies

It was noticed that there are few standards and best methodologies known when conducting latent print searches (an example is WIN which has a training tutorial for maximizing latent searches). The introduction of EFS which supports several methods for conducting searches by offering a number of profiles provides the opportunity to reduce the examiner markup time while maintaining or even increasing the likelihood of making identifications. To optimize the usefulness of these capabilities, it would be useful for search strategies to be defined with respect to latent print quality and importance (search priority). Search strategies can help the examiner quickly decide if a latent requires manual involvement and the degree of that involvement. In the case of latent palmprints, additional decisions as to selection of an area of markup and even of number of minutiae to be encoded are needed to maximize accuracy while minimizing latent examiner efforts.

Parallel Verses Serial Searching

There are two different ways a latent print examiner can go about conducting searches on other databases: parallel searching of multiple AFIS at the same time or searching multiple AFIS one at a time. Some latent examiners complete searches via the first method and others use the second. From the interviews, each examiner has a way to do things and there is no consensus as to which method is better.

Latent Examiner Training Addressing Close Non-Matches

One respondent mentioned that there is a need for research addressing close, non-matching fingerprints (fingerprints which are very similar, but do not result in an ident). Close non-matches increase with database size and the amount of information in the latent print.

Guidance in Developing Search Strategies

While AFIS system resources may appear to be limitless, examiner resources are usually limited to 40 hours per week. Within that time the examiner must decide whether a latent is "of value", decide the best search strategy, launch a search, examine the

Jurisdictions Have Different Fingerprint Records

Kansas City, Missouri examiners make approximately 40% of their hits through the Kansas AFIS database. Many years ago all Kansas City arrests including misdemeanor were fingerprinted. Missouri AFIS officials, however, did not fingerprint misdemeanor events. Therefore, many individuals have records in Kansas, but do not have records in Missouri. The only way Kansas City examiners can access these prints is by searching Kansas' fingerprint database directly.

candidate list, decide whether to relaunch the search or save it in the unsolved latent file, search on the next level AFIS, etc.

Unfortunately there is no data that tells the examiner or manager how to develop a business approach to latent print searches. That is, what is the optimum to make the highest number of latent print identifications in those 40 hours? For example:

- Should all latents be searched only once?
- What latents should be saved in the UL file?
- Should any latent be saved in the UL file?
- When should a latent be searched on a neighboring or higher level AFIS?
- Why do some examiners make more identifications?

Again, each AFIS has different approaches to each of these points and there doesn't seem to be consensus as to which approach is the best for similar situations.

3 Conclusions

Interviews with various AFIS latent examiners and managers have provided valuable insight into latent AFIS Interoperability. The interviews showed that the majority of AFIS, if not all, would like to see increased interoperability between local and state jurisdictions. This will be possible when the problems impinging upon the effectiveness of AFIS are solved and when searching other AFIS can be conducted seamlessly without any extra work on latent examiners. The few interoperability arrangements in existence affirm that local and state AFIS examiners, administrators, and managers believe interoperability is a worthwhile endeavor since these AFIS participants were willing to put in a large amount of time, effort, and money to make interoperability a reality.

As the biometrics community moves forward to create an environment with increasing connectivity and shared information, it is important to be aware of the thoughts and concerns of persons who actually use AFIS on a day to day basis. They see problems and solutions which may not always be obvious to someone on the outside. It is hoped that the information supplied by the interview respondents will help all local, state, and federal AFIS have the chance to be interoperable with any jurisdiction they so choose.

Special Acknowledgements

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- Rachel Wallner and Peter Komarinski who were the principal authors of the report.
- George Kiebuzinski for his input and comments.
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- State and local AFIS latent print examiners, managers, and administrators for their contributions and effort in helping shape the findings in this report.

Greg Michaud, Michigan AFIS

"AFIS interoperability improvements for Michigan law enforcement is vital and has been needed for many years… It is not safe to assume that IAFIS interoperability (FBI) is all that is needed. Too many individuals slip through the cracks, avoiding apprehension and/or identification. Having the ability to conduct both known and latent fingerprint searches against *all* of our neighbors' databases is essential to maximizing public safety here in Michigan."

4 Appendix

4.1 Example Questionnaire

Purpose of Interview

Noblis is working with the National Institute of Standards and Technology and the U.S. Department of Justice to develop specifications for use in peer-to-peer latent print searches. We are reaching out to state and local partners to solicit background on current latent print processing and the potential for latent print interoperability.

Local AFIS Background

1. Identify jurisdictions/agencies, (including your own) within metro area, own State, and nearby State(s) with their own AFIS (include regional AFIS if any) which is used for searching latent prints.
2. Description of your local AFIS latent print processing capabilities
    - Jurisdiction & AFIS vendor
        - Year bought/upgraded
            - AFIS:
    - Latent print workstations currently in use
        - Number and types, i.e., home AFIS vendor's, state AFIS vendor's, ULW, or other
    - Near term plans for upgrade/new acquisition
        - AFIS:
        - Workstations:
    - Functional capabilities
        - Fingerprint, palmprint, reverse searches etc.
        - Number of Idents per day, month or week (for AFIS search) – per image or per person basis?
        - Are two finger records (e.g. from mobile device) retained in the database of the AFIS for latent print searches?
- What is the size of the fingerprint database that can be used for latent print searches? What is the size of the palmprint database that can be used for latent searches?
- What percentage of time is spent on encoding versus viewing a list of the candidates? From getting image to time spent searching on another system.

Operational Constraints

3. Are there any resource constraints (i.e. latent examiners overloaded, insufficient capacity) which lead to a backlog of latent print searches? If so, describe how these constraints are resolved (i.e. process only serious crime). Do you have sufficient capacity to handle additional searches?
4. Are there any legal, operational, or other constraints (i.e. funding) that may inhibit interoperability for each agency within the metro area, own State, and nearby State(s)?
5. Current Interoperability processes

- Hierarchical interoperability for latent print searches
    - How is home AFIS searched by other agencies within the metro area?
    - How is the State AFIS searched? (are latent prints re-encoded manually, rescanned into another workstation, image sent to colleague, etc.)
    - How is IAFIS searched? (are latent prints re-encoded manually, rescanned into another workstation, image sent to colleague, etc.)
- Peer-to-peer interoperability
    - What provisions, if any, are there for latent print searching of neighboring AFIS?
    - What interoperability among neighboring jurisdictions exists or has been attempted? Are there any known constraints?
- Approximately how many latents (fingerprints, palms) are searched against your home AFIS by your jurisdiction's staff?
- Of all your latent print searches, what is the approximate percent of searches sent to…
    - IAFIS/NGI?
    - State?
    - Neighboring jurisdictions?
- Do you forward all your records to the State and Federal AFIS? If not, which ones don't you send? (tenprint records)
    - What percentage of records do you not send to the State AFIS? Federal AFIS?

<u>Potential Use of Interoperability</u>

6. If interoperability were seamless (no re-encoding, code once to search many from same workstation) and you could individually target the system to be searched, what percent of searches would you conduct on:

- IAFIS?
- State?
- Neighboring jurisdictions?

7. Can you tell us a story of a real situation in which interoperability between local and state/federal jurisdictions would have been helpful or in which searching a local AFIS helped you solve a latent print?
8. Is there anything else you would like to tell us that would help us understand the problem of interoperability among local AFIS systems?

4.2 List of Interviewees

Metro Area: Texas State
Organization: Texas Department of Public Safety (DPS)
Interviewed: Mike Lesko
Interviewers: George Kiebuzinski, Austin Hicklin, Peter Komarinski, John Mayer-Splain, Will Chapman
Date & Time: 1:00 pm April 22, 2011
Type of Interview: Via Conference

Metro Area: Western States
Organization: Western Identification Network (WIN)
Interviewed: Ken Bischoff, Dusty Clark
Interviewers: George Kiebuzinski, Austin Hicklin, Peter Komarinski, John Mayer-Splain, Will Chapman
Date & Time: 11:00 am on April 25, 2011
Type of Interview: Via Conference

Metro Area: California State
Organization: California Department of Justice (DOJ)
Interviewed: Chris Bodine, Derrick Morisawa
Interviewers: George Kiebuzinski, Austin Hicklin, Peter Komarinski, John Mayer-Splain, Will Chapman
Date & Time: 2:00 pm on April 26, 2011
Type of Interview: Via Conference

Metro Area: State of Florida
Organization: Florida Department of Law enforcement
Interviewed: Charles Schaeffer
Interviewers: George Kiebuzinski, Austin Hicklin, Peter Komarinski, John Mayer-Splain, Will Chapman
Date & Time: 10:00 am on April 28, 2011
Type of Interview: Via Conference

Metro Area: Kansas State
Organization: Kansas Bureau of Investigation
Interviewed: Kelly Woodward, Steve Cook, Brendan Jensen, Ely Meza
Interviewers: George Kiebuzinski, Austin Hicklin, Peter Komarinski, John Mayer-Splain, Will Chapman
Date & Time: 1:00 pm on May 5, 2011
Type of Interview: Via Conference

Metro Area: Georgia
Organization: Georgia Bureau of Identification
Interviewed: Louis Kriel
Interviewers: Peter Komarinski, George Kiebuzinski
Date & Time: 10:00 am on June 27, 2011
Type of Interview: Via conference

Metro Area: Northern VA, DC, Prince George/Montgomery Co MD
Organization: NOVARIS (Northern Virginia AFIS)
Interviewed: Dave Russell, Dianna Sarver
Interviewers: Peter Komarinski, John Mayer-Splain, George Kiebuzinski
Date & Time: 11:00 am on July 7, 2011
Type of Interview: Via conference

Metro Area: Northern VA, DC, Prince George/Montgomery Co MD
Organization: NOVARIS (Northern Virginia AFIS)
Interviewed: Dave Russell, Dianna Sarver
Interviewers: Melissa Taylor, Robin Jones, Rachel Wallner, John Mayer-Splain, George Kiebuzinski
Date & Time: 11:00 am on August 18, 2011
Type of Interview: Via conference

Metro Area: New York State
Organization: New York State Division of Criminal Justice Services
Interviewed: Joe Morrissey, Donna Call, Charles Clock, Janet Hoin, Beth Bloodgood, Mary Ann Pelletier
Interviewers: Rachel Wallner and Peter Komarinski
Date & Time: 11:00 am on October 14
Type of Interview: Via conference and on site

Metro Area: Michigan State
Organization: Michigan State Police
Interviewed: Greg Michaud
Interviewers: Rachel Wallner and Peter Komarinski
Date & Time: 1:00 pm on October 14
Type of Interview: Via conference and on site

Metro Area: Kansas City, MO
Organization: Kansas City Police Department (KCPD)
Interviewed: Carl Carlson
Interviewers: Rachel Wallner, John Mayer-Splain, and Peter Komarinski (Noblis)
Date & Time: 2:30 pm on Tuesday, October 18, 2011
Type of Interview: Via conference call

Metro Area: Las Vegas, NV
Organization: Las Vegas Metropolitan Police Department
Interviewed: Alice Maceo
Interviewers: Rachel Wallner and Peter Komarinski
Date & Time: 3:00 pm on October 25, 2011
Type of Interview: Via conference call

Metro Area: El Paso, TX

Organization: El Paso Police Department
Interviewed: Bruce Orndorf
Interviewers: Rachel Wallner and Peter Komarinski
Date & Time: 4:00 pm on October 27, 2011
Type of Interview: Via conference call

Metro Area: Baltimore, MD
Organization: Baltimore Police Department
Interviewed: Sharon Talmadge
Interviewers: Rachel Wallner and Peter Komarinski
Date & Time: 10:00 am on October 27, 2011
Type of Interview: Via conference call

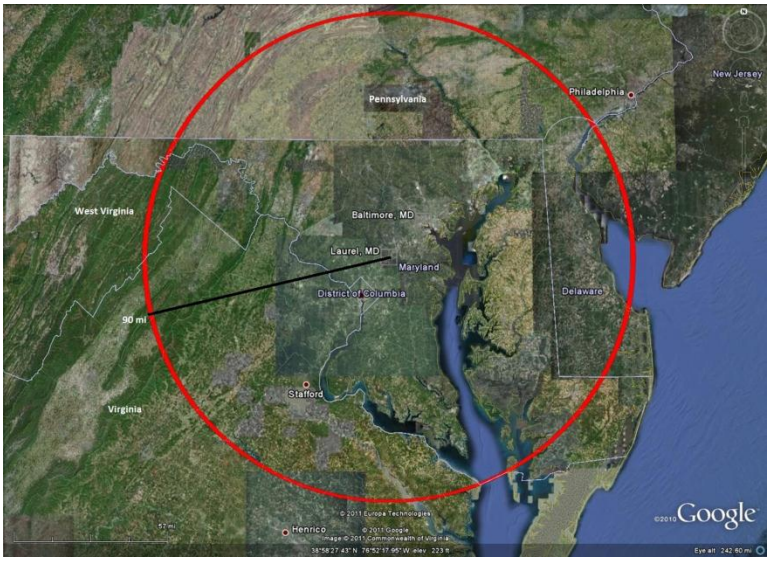
Metro Area: Portland, OR
Organization: Portland Police Department
Interviewed: Kim Yada, Randy Yoshimura
Interviewers: Peter Komarinski; Rachel Wallner
Date: 12:00 noon on 11/3/2011
Type of Interview: Via conference call

4.3 Research Data on Metro Areas across the U.S.

This section presents a sample of metro area data research and the particular sample shown is the Baltimore/Washington D.C. Metro Area. The information shown here was not discussed in detail throughout this document. The following may be of value to anyone wishing to further investigate the issues behind interoperability by incorporating geography and crime data, which are factors AFIS consider when deciding which jurisdictions to be interoperable with.

Metropolitan data similar to below was also collected for the following cities: Chicago, IL; Detroit, MI; El Paso, TX; Jacksonville, FL; Kansas City, MO; Last Vegas, NV; Memphis, TN; New York City, NY; Portland, OR; San Diego, CA; St. Louis, MO. If you are interested obtaining data regarding these cities, contact the Noblis Interoperability Team at Interop@noblis.org.

D.C./Baltimore Metro Area is approximately…
1-36 miles from Virginia state
30 - 50 miles from Pennsylvania state
45 - 60 miles from West Virginia state
45 - 70 miles from Delaware state (Chesapeake Bay lies between MD & DE)
Baltimore is approximately…
35 miles northeast of D.C.
22 miles from Annapolis, MD (state capital)
40 miles from Frederick, MD (2nd largest MD city)
90 miles from Philadelphia, PA
D.C. is approximately…
30 miles from Annapolis, MD (state capital)
40 miles from Frederick, MD (2nd largest MD city)
96 miles from Richmond, VA (state capital)
Cities in between D.C. and Baltimore:
Gaithersburg, MD
Rockville, MD
Bowie, MD
Annapolis, MD



MSA	2010 Population
Baltimore-Towson, MD	2,710,489
Washington-Arlington-Alexandria, DC-VA-MD-WV	5,582,170
Total	8,292,659

City		Population	Violent Crime	Murder	Forcible rape	Robbery	Aggravated assault	Property Crime	Burglary	Larceny-Theft	Motor Vehicle Theft	Arson
Baltimore, MD	2009		9,664	238	158	3,707	5,561	29,163	7,798	16,741	4,624	347
	2010	639,929	9,316	223	265	3,336	5,492	28,280	7,573	16,298	4,409	321
Washington D.C.	2009		7,587	144	150	3,998	3,295	27,007	3,696	18,012	5,299	55
	2010	601,723	7,468	132	184	3,914	3,238	27,138	4,224	18,050	4,864	49

4.4 Helpful Documents for AFIS

NIST OLES has produced several documents to assist in minimizing the administrative and legal impediments to interoperability. These include the *Writing Guidelines to Develop an MOU for Interoperable Automated Fingerprint Identification Systems* and the *Writing Guidelines in Proposal Development for Automated Fingerprint Identification System.* Agencies can look to these documents for suggested language for an MOU and/or to incorporate the *Latent Interoperability Transmission Specifications* into their RFP or upgrade agreement.