

Appendix 5. Final Reports from Participants

Provider Directory Pilot Feedback Form

This document will be used to collect feedback from the pilots that will help the EHR/HIE Interoperability Workgroup (IWG) to provide feedback to Office of the National Coordinator for Health IT (ONC), so that the Provider Directory standards and implementation guides can be improved.

Business and Operational Aspects: The business feedback will highlight the business use cases and other operational aspects. We would like the pilots to answer the following questions, where applicable:

1. Was the pilot conducted with live data or test data?
The pilot was conducted with test data.
2. Who are the IT vendors supporting the pilot?
MedAllies and Mirth support NYeC/Healthelink provider directory pilot.
3. What was the business use cases that were piloted?
 - a. For e.g. (Find Providers by Last Name, First Name, Find Organizations by Specialty)
Find providers by city, last name, first name, and specialty
4. Were any providers engaged in the pilot? If so, how many?
There were not any providers engaged in the pilot.
5. If applicable, what level of training was provided, if any, to the providers to use the system?
Not applicable.

Technical and Standards aspects: The technical and standards aspects questions collect information about the technologies used and the standards implemented by the pilot. We would like the pilots to answer the following questions:

1. Which provider directory standards were piloted by each participating organization?
 - a. IHE HPD
 - b. IHE HPD with CP--601
 - c. IWG HPD+ 1.0**
 - d. IWG HPD+ 1.1
 - e. ONC ModSpec 1.0
2. Was there any integration (actual or considered) with an EHR as part of the pilot? If so, please provide details on vendor, product, version and any other information that may be useful.
There were no integrations with an EHR as part of the pilot. Mirth used their web based instance for this pilot.
3. How many of the provider directory standards were analyzed by the pilot participants?
Pilot participants explored solely the option of HPD+ 1.0 standards.
4. Why were the provider directory specifications used in the pilot chosen over others?
The specifications used were considered universally accepted specifications by provider participants. HPD+ protocol was considered to be the most discoverable and accessible of the suggested models.
5. Were any parts of the Implementation Guide (IG) confusing to implement? **None**

- a. If so, please explain
6. Please describe the transactions and use cases that were supported by the implementation. Mirth and MedAllies queried multiple provider directories in a test environment searching by physician name, city specialty. Resulting search from queries is displayed below:

Dr. Llanes, Chris X.
ENT

DIRECTORY
MedAllies

CONTACT
Practice Phone (845) 896-0191 *(primary)*
Practice Fax *(no primary practice fax on file)*
DIRECT Address chris@direct.medalliesdirect.org *(primary)*

PERSONAL INFORMATION
No Personal Information Available

LOCATIONS
Mailing Address 123 Main Street
 Fishkill, NY 12570
 Map

OTHER INFORMATION
Primary License ENT
 Type
 License No. UNK
 Name Unknown

HPD Directory source: MirthMail

SUCCESS

Provider Name	Gibson, Sean Sean Gibson
description	Allopathic & Osteopathic Physicians
gender	M
hcIdentifier	NPI:1013
hcProfession	Allopathic & Osteopathic Physicians
hcSpecialization	Family Medicine
Languages Spoken	Spanish
Practice Address	primary: 2538 Bart Blvd. San Andreas, CA 93452
mail	seang@mirthcorp.com
telephoneNumber	+1 858 555-5737

HPD Directory source: MA National
(successful query)

7. How was the implementation tested for conformance to specification?
N/A
8. Please describe the interoperability issues faced during the pilot
- Any mismatches in messages, data definitions, field lengths, schemas, WSDL's etc.
Current implementations of federated searches require pre---knowledge of: Directory URL, Bind DN (i.e., a user identity with search capabilities), Bind password
 - Other (onboarding, exchange of certificates, etc.) None
9. How was federation addressed in the pilots?
- What was successful? Explain. Federation was successful in a test environment but further work is needed.
 - What needs improvement? Explain. To enable federated searched, HPD+ Directories would need to be discoverable and accessible. Current implementations of federated searches require pre---knowledge of Directory URL, Bind DN, and Bind Password. Current implementations of HPD+ Directories do not exercise "referrals" (i.e. "also, search HPD #2) or "chaining" (i.e. "this HPD will also search HPD #2 and return results")
10. What kind of guidance would be required above and beyond the IG for implementers?
Guidance on security, technology standards, and acceptable policy across the states would be required to continue exploring HPD+ Directories and making them viable in the near future.
11. What kind of tools would be helpful for the implementers?
A list of accepted standards used across the industry would be the most helpful for implementers. Combining policy and technology to create a real framework to make HPD+ Directories and discoverable and accessible is the ultimate goal.

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Business and Operational Aspects: The business feedback will highlight the business use cases and other operational aspects. We would like the pilots to answer the following questions, where applicable:

1. Was the pilot conducted with live data or test data?

The IWG Provider Directory Pilot was part of a larger California Trust Framework (CTF) Pilot conducted during the latter half of 2013. As part of the CTF Pilot, all participants that successfully completed onboarding to the pilot were required to use “live data” representing real providers using the Direct systems with which they were associated.

The Direct (and Provider Directory) portion of the CTF Pilot included eight participants. All participated in development of the consensus policies and procedures that governed exchange of personal identification information (PII) through provider directories in the Pilot. They onboarded and exchanged data as follows:

- North Coast Health Information Exchange (NCHIN) – successfully onboarded to exchange live data
- RAIN --- Live Oak Health Information Exchange and Telemedicine Network – successfully onboarded to exchange live data
- Sujansky & Associates, LLC (a CHCF pilot implementation) – did not onboard due to conflict between consensus policies and current operating procedures
- Orange County Partnership Regional Health Information Organization (OCPRHIO) – successfully onboarded to exchange live data
- San Diego Health Connect – successfully onboarded to exchange live data
- Santa Cruz Health Information Exchange – successfully onboarded to exchange live data
- UC Davis Health System – did not onboard due to inability of its vendor to support HPD during the pilot
- CHeQ program at UC Davis Health System– successfully onboarded to exchange live data

The CTF Pilot is continuing beyond the end of the IWG Pilot. Some of these organizations have not yet exchanged data, but those onboarded are enabled to do so.

2. Who are the IT vendors supporting the pilot?

Vendors differed by participant:

- NCHIN – Mirth

- RAIN---Live Oak---internally---developed solution
- Sujansky & Associates, LLC – internally---developed solution
- OCPRHIO – Mirth
- San Diego Health Connect – Mirth
- Santa Cruz HIE – Mirth
- UC Davis Health System – Epic / Surescripts
- CHeQ program at UC Davis Health System– internally---developed solution

3. What were the business use cases that were piloted?

The primary use case anticipated was to discover direct addresses for individual or organizational providers. However, pilot participants expanded the use case to locating individual providers (for any purpose) by last name, first name, and/or specialty, locating organizations by location (and perhaps by specialty), and locating individual providers that were members of an organization.

4. Were any providers engaged in the pilot? If so, how many?

Unfortunately, few providers were engaged in the IWG Pilot due to its short duration. At least some providers were engaged at NCHIN, which has been participating in provider directories through NATE for several months.

5. If applicable, what level of training was provided, if any, to the providers to use the system?

One hour or less, each.

Technical and Standards aspects: The technical and standards aspects questions collect information about the technologies used and the standards implemented by the pilot. We would like the pilots to answer the following questions:

1. Which provider directory standards were piloted by each participating organization?

1. IHE HPD
2. IHE HPD with CP---601
3. IWG HPD+ 1.0
4. IWG HPD+ 1.1
5. ONC ModSpec 1.0

Standards differed by participant vendor:

- NCHIN – Mirth, IWG HPD+ v1.1
- RAIN---Live Oak---internally---developed solution, IHE HPD with CP---601
- Sujansky & Associates, LLC – internally---developed solution, IWG HPD+ 1.0
- OCPRHIO – Mirth, IWG HPD+ v1.1
- San Diego Health Connect – Mirth, IWG HPD+ v1.1
- Santa Cruz HIE – Mirth, IWG HPD+ v1.1

- UC Davis Health System – Epic / Surescripts, NA
- CHeQ program at UC Davis Health System— internally---developed solution, supported both IHE HPD with CP---601 and IWG HPD+ v1.1, with IHE HPD preferred

2. Was there any integration (actual or considered) with an EHR as part of the pilot? If so, please provide details on vendor, product, version and any other information that may be useful.

One organization (UC Davis Health System) was planning to use its Epic EHR as a Direct client. There may have been some planned integration with provider directories as well, but the Epic solution was not realized.

One organization (Santa Cruz HIE) is conducting integration testing using XD transport with an Epic EHR, but there is no planned integration of provider directories at this time.

One organization (RAIN --- Live Oak) created a stand---alone query client that could be used to query provider directories – either individual directories or the statewide service.

For most organizations, query of a provider directory was provided by a service integrated into a stand---alone Direct client.

3. How many of the provider directory standards were analyzed by the pilot participants?

All of the listed standards were discussed with CTF Pilot participants.

4. Why were the provider directory specifications used in the pilot chosen over others?

We agreed to support IHE HPD with CP---601 in California as a preferred standard, since it is maintained by the SDO that created HPD. A prominent vendor (Mirth) selected HPD+ v1.1 instead, based on (at least perceived) IWG pressure to do so.

In all cases, the participant was limited to the software provided and supported by their Direct vendor.

5. Were any parts of the Implementation Guide (IG) confusing to implement?

Yes. In fact, the current specifications from IHE and from IWG are closer to statements of a standard than an implementation guide.

There was a great deal of discussion on how to interpret the overall structure of the underlying LDAP implementation, the exact format for values of fields in HPD/HPD+, what enumerated values should be used for fields within HPD/HPD+, how to construct complex queries, etc. Many of these items are detailed in the IHE HPD specification but not in the IWG HPD+ specification. Some are not detailed in either.

Both HPD and HPD+ still provide many options, and we still believe there is significant need for a true implementation guide.

6. Please describe the transactions and use cases that were supported by the implementation.

The primary use case for Direct within California was for referrals or other transitions of care. Therefore, the primary use case for provider directories was to discover Direct addresses to use in referrals or other transitions of care. However, Direct is still an emerging means of exchange in California.

7. How was the implementation tested for conformance to specification?

Testing with other peers in the pilot. One of the recurring comments was that there was a need for a test or reference implementation, but none exists (to our knowledge). There was little evidence that delivered vendor systems underwent significant testing.

IHE has released HPD for trial implementation, which is its standard procedure for testing and evaluating a new standard.

8. Please describe the interoperability issues faced during the pilot

There were a number of issues identified:

1. There were differences in the level and method of authentication required for web service connections.
2. There were different interpretations of fields within the LDAP implementations. For example, identification of "state" within an address field might include spaces in the text string or might not, might include standard two---letter state abbreviations or other representations, etc.
3. There were different interpretations of the enumerated values in fields that might be used as filters in a query. For example, specialty was sometimes represented using the AMA provider taxonomy and sometimes using the ISO standard 21298.

9. How was federation addressed in the pilots?

California exposed a single statewide orchestration service ("statewide directory service" or "SDS") with knowledge of all local provider directories. The preferred method for placing queries in California was to place them against the SDS, which in turn placed queries against appropriate local directories, collecting and aggregating responses as a single response. Individual peer---to---peer queries were enabled as well, but not encouraged and not as widely implemented.

1. What was successful? Explain.

To some extent the pilot was successful. The CTF Pilot is still underway. However, California has been a member of NATE using the SDS federation concept for some time.

2. What needs improvement? Explain.

The primary issues are not with federation, but with the standards that are implemented by all participants in the federated model. Inconsistencies in implementations due to a lack of clarity in the specifications created issues in producing successful federated queries.

10. What kind of guidance would be required above and beyond the IG for implementers?

A full and complete implementation guide would be useful. The current IHE and IWG specifications are not complete enough to implement a solution unambiguously.

11. What kind of tools would be helpful for the implementers?

A reference implementation and/or a test system.

Provider Directory Pilot Feedback Form from Santa Cruz HIE

This document will be used to collect feedback from the pilots that will help the EHR/HIE Interoperability Workgroup (IWG) to provide feedback to Office of the National Coordinator for Health IT (ONC), so that the Provider Directory standards and implementation guides can be improved.

Business and Operational Aspects: The business feedback will highlight the business use cases and other operational aspects. We would like the pilots to answer the following questions, where applicable:

1. Was the pilot conducted with live data or test data? **Test Data**
2. Who are the IT vendors supporting the pilot? **Mirth**
3. What was the business use cases that were piloted? **Find Providers by Last Name, First Name, must search by at least first 3 characters of names --- Find Organizations by Specialty**
4. **Were any providers engaged in the pilot? If so, how many? 3 Test providers**
5. If applicable, what level of training was provided, if any, to the providers to use the system? **1 hour or less each**

Technical and Standards aspects: The technical and standards aspects questions collect information about the technologies used and the standards implemented by the pilot. We would like the pilots to answer the following questions:

1. Which provider directory standards were piloted by each participating organization?
 - a. IHE HPD
 - b. IHE HPD with CP---601
 - c. IWG HPD+ 1.0
 - d. **IWG HPD+ 1.1**
 - e. ONC ModSpec 1.0
2. Was there any integration (actual or considered) with an EHR as part of the pilot? If so, please provide details on vendor, product, version and any other information that may be useful. **We are testing with Epic XDR but the vendor needs to make some changes to support the particular authentication that Epic is requiring and that will not be done till mid---December.**
3. How many of the provider directory standards were analyzed by the pilot participants? **Yes, we looked at A, C and E from your list above.**
4. Why were the provider directory specifications used in the pilot chosen over others?
5. Were any parts of the Implementation Guide (IG) confusing to implement?
 - a. If so, please explain
6. Please describe the transactions and use cases that were supported by the implementation.
Referrals
7. How was the implementation tested for conformance to specification?
8. Please describe the interoperability issues faced during the pilot
 - a. Any mismatches in messages, data definitions, field lengths, schemas, WSDL's etc.

- b. Other (onboarding, exchange of certificates, etc.) We did have
9. How was federation addressed in the pilots?
- a. What was successful? Explain. **Yes, it worked and broke at various points between the participants as we installed updates.**
 - b. What needs improvement? Explain. **There appear to be multiple specialty code sets – The AMA Provider Taxonomy code and the ISO standard ISO 21298 and vendors are not consistently implementing one**
10. What kind of guidance would be required above and beyond the IG for implementers?
- a. Suggest a minimum data set that HISP's shall populate. In some cases we successfully queried other HISPS including HISPS using different technical platforms only to find that only minimal information was being populated, some entries only contained a name and direct address. More is needed to be useful to end users. Direct users need to be able to select with certainty the unique individual they are sending data to. In some cases, a sender will want to provide information to a patient, so complete and accurate information is important. Perhaps, phone numbers, street addresses for the PRACTICE (don't want to send patients to the billing office or to a payment lock box), specialty, For example, in our area we have 2 Dr William Hopkins, one is a Podiatrist and the other a Dermatologist. If we hassle our users to look in multiple systems in order to send data to the right place, the value and adoption of Direct will be challenged.
 - b. CHeQ started work on this but was at the end of its funding so did not progress beyond a few conversations.
11. What kind of tools would be helpful for the implementers? A single standard to follow and an authoritative Implementation Guide.

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Business and Operational Aspects: The business feedback will highlight the business use cases and other operational aspects. We would like the pilots to answer the following questions, where applicable:

1. Was the pilot conducted with live data or test data? **All test data.**
2. Who are the IT vendors supporting the pilot? **Secure Exchange Solutions**
3. What were the business use cases that were piloted? **Find providers by last name.**
UHIN would like to continue with this pilot and begin the query process. Only messages and attachments were exchanged during testing. These were deliberately sent to a designated address.
 - a. For e.g. (Find Providers by Last Name, First Name, Find Organizations by Specialty)
4. Were any providers engaged in the pilot? If so, how many? **No**
5. If applicable, what level of training was provided, if any, to the providers to use the system?
N/A. Testing was limited to internal.

Technical and Standards aspects: The technical and standards aspects questions collect information about the technologies used and the standards implemented by the pilot. We would like the pilots to answer the following questions:

1. Which provider directory standards were piloted by each participating organization?
 - a. IHE HPD
 - b. IHE HPD with CP-----601 ----- **Used in testing with CA (CHeQ, at UC Davis)**
 - c. IWG HPD+ 1.0
 - d. IWG HPD+ 1.1 – **test environment at SES and test site hosted by Mirth**
 - e. ONC ModSpec 1.0
2. Was there any integration (actual or considered) with an EHR as part of the pilot? If so, please provide details on vendor, product, version and any other information that may be useful.

None

3. How many of the provider directory standards were analyzed by the pilot participants?

Only HPD with CR601 and HPD+ 1.1 were considered and analyzed.

4. Why were the provider directory specifications used in the pilot chosen over others?

Practical reasons (what was already implemented by participants) and breadth of adoption. HPD+ 1.0 did not get much traction, ModSpec is in constant change and hopefully will merge with HPD/HPD+.

5. Were any parts of the Implementation Guide (IG) confusing to implement? No
 - a. If so, please explain
6. Please describe the transactions and use cases that were supported by the implementation. Primary use case is a search for provider Direct address. Search based on name, address, and specialty. We did not get to full use case due to the need to work on technical connection with NATE and then the ability for the test partner to use our specification.
7. How was the implementation tested for conformance to specification? Returned results were analyzed manually. Internally tested by SES
8. Please describe the interoperability issues faced during the pilot
 - a. Any mismatches in messages, data definitions, field lengths, schemas, WSDLs, etc.

Yes, we did find issues with the interoperability that prevented us from finishing. We plan to continue working on the interoperability issues.

Plenty of these, even in limited use case. Some to be expected, some resulting on the loose specifications. WSDLs of the HPDCR601 and HPD+ are sufficiently different to require distinct implementations, which is far from ideal. Results were also differing with regard to specification. For example, the format of the postal address (awkward as it is) could have key tags for address elements as "\$CITY" or "\$ CITY" which makes it harder to parse. Specialty search terms are also inconsistent across implementations as some use NUCC nomenclature and others – ISO.

Direct addresses also can be found in different parts of the model depending on implementation, though it should be noted that wherever they are placed, the queries to find Direct address may have to be executed in more than one step, which makes this an expensive (resource-----wise and bandwidth-----wise) exercise. The purpose of the specs is provider search (by a patient?), not Direct address search (for another provider), so even as HPD seems applicable being about the only option, it is at cross purposes with provider Direct address search which will hamper adoption and meaningful use.

- b. Other (onboarding, exchange of certificates, etc.)

This was fairly straightforward since the pilot was within NATE infrastructure and certificates are posted to the NATE bundle and distributed through it.

9. How was federation addressed in the pilots?

N/A. There is a federated environment in CA, but not across NATE, so that was not a focus of the pilot.

- a. What was successful? Explain.
 - b. What needs improvement? Explain.
10. What kind of guidance would be required above and beyond the IG for implementers?

Not familiar with IG – perhaps I have not received it, so it is hard to comment, but there is a definite need for consistency, primarily constraining some looseness of the specification in data representation, and defining consistent search terms and taxonomies.

A testing utility would be helpful as well as backwards compatibility to the spec versions and Mod Spec.

1. What kind of tools would be helpful for the implementers?

A testing utility

Test environments that support different versions of the standard. It is not possible or practical for any implementer to create and maintain service responders that simulate every variation of the standard, so having consistent end-----points for two or three top standards to test query responses and to establish standard WSDL format for each would be very helpful and would help to coalesce various implementations.

Provider Directory Pilot Feedback Form

Pilot: Snowbird Pilot

Participants: FLHIE, MiHIN and Surescripts

Date: December 4, 2013

This document will be used to collect feedback from the pilots that will help the EHR/HIE Interoperability Workgroup (IWG) to provide feedback to Office of the National Coordinator for Health IT (ONC), so that the Provider Directory standards and implementation guides can be improved.

Business and Operational Aspects: The business feedback will highlight the business use cases and other operational aspects. We would like the pilots to answer the following questions, where applicable:

1. Was the pilot conducted with live data or test data?
 - a. The pilot was conducted with test data. Production data was loaded after the test data load was verified.
2. Who are the IT vendors supporting the pilot?
 - a. None
3. What were the business use cases that were piloted?
 - a. For e.g. (Find Providers by Last Name, First Name, Find Organizations by Specialty)
 - i. Phase 1 – provided an exchange between all three participants of their Health Provider Directories
 - ii. Phase 2 – Federated exchange between two of the participants
4. Were any providers engaged in the pilot? If so, how many?
 - a. No providers were engaged in the pilot
5. If applicable, what level of training was provided, if any, to the providers to use the system?
 - a. Non applicable – no providers were engaged in the pilot

Technical and Standards aspects: The technical and standards aspects questions collect information about the technologies used and the standards implemented by the pilot. We would like the pilots to answer the following questions:

1. Which provider directory standards were piloted by each participating organization?
 - a. IHE HPD
 - b. IHE HPD with CP---601
 - c. IWG HPD+ 1.0 Surescripts
 - d. IWG HPD+ 1.1 MiHIN
 - e. ONC ModSpec 1.0
2. Was there any integration (actual or considered) with an EHR as part of the pilot? If so, please provide details on vendor, product, version and any other information that may be useful.
 - a. N/A

3. How many of the provider directory standards were analyzed by the pilot participants?
 - a. We began using ONC's S&I ModSpec and HPD+ 1.0. On September 25, 2013, a Provider Directory Standards meeting was held with all the pilots. This solidified the Snowbird pilot's direction to use HPD+ 1.1, which we had chosen after reviewing all of the standards. We had also discovered HPD+ 1.0 terminology had been obsoleted by the HPD+ 1.1 harmonization. We are presently using ModSpec implemented in REST, HPD+ 1.1, and DSML 2.0 gateway
4. Why were the provider directory specifications used in the pilot chosen over others?
 - a. We reached the same consensus as the standards meeting concluded; HPD+ 1.1 had the most user friendly naming standards and was most complete in its definition.
5. Were any parts of the Implementation Guide (IG) confusing to implement?
 - a. If so, please explain --- Yes, the standards are confusing. The documents describing 1.0 and 1.1 definitions are not consistent within themselves and this led to errors in our implementation (e.g. some of the 1.1 documents had pictures from 1.0).
6. Please describe the transactions and use cases that were supported by the implementation.
 - a. We were able to import and export each other's provider data using spreadsheets so that we demonstrated replicated directories that each implementation's client could use to search for external providers. In practice, several participants imported full images from other participant's directories.
7. How was the implementation tested for conformance to specification?
 - a. Phase 1 --- Informal testing of import and export was done, however there is no specification for this type of interchange and so no conformance was demonstrated.
 - b. Phase 2 – currently in progress between two participants
8. Please describe the interoperability issues faced during the pilot
 - a. Any mismatches in messages, data definitions, field lengths, schemas, WSDLs, etc.
 - i. We experienced a difference in some field validation rules (e.g.: Fax numbers were required by Surescripts and not required by MiHIN – Surescripts opted to change their edit rules). Generally, the mismatches were easy to reconcile, however lack of agreement on required fields and permissible values between systems was a constant source of challenges. In particular, the systems in production did not support the same electronic service conventions and the HPD+ service relationship model is considerably more complicated than could be supported in two of the participants' directories.
 - b. Other (onboarding, exchange of certificates, etc.)
 - i. none
9. How was federation addressed in the pilots?
 - a. What was successful? Explain.
 - i. Phase 1 --- Federation was achieved by replication
 - ii. Phase 2 --- Search query orchestration in phase 2 could be extended to achieve federation among multiple HPD instances
 - b. What needs improvement? Explain.
 - i. Implementation and specification guides

- ii. More consistent definitions. For example, ModSpec means different things to different organizations.
- iii. The multi-parameter/multi-object use cases (ex: Find Organizations for Unique Provider) are complicated queries to implement because of the use of DSML 2.0 as the query interface and language. The language constructs do not allow for join operations in a query so any multi-object query must be implemented as multiple (in most cases 3 distinct) queries. In the stated example a query would be done on the Provider based on an attribute. This would then be followed by a query on the Memberships using information found for the provider. Finally a query would need to be performed on the Organizations using data from Memberships. This not only has an impact on implementation but may also impact operation performance of such use cases.

10. What kind of guidance would be required above and beyond the IG for implementers?

- a. There is still a lot of confusing and inconsistent documentation describing these standards. Harmonization has certainly helped, but there is still a lot of vagueness in the purposes and semantics of many of the data fields that will make real interoperability challenging for some time to come. The HPD+ Service relational data model is also quite complicated, requiring relational joins to implement it efficiently. Federation and interoperability of directories supporting this model will not be feasible using the DSML/LDAP level of access protocol. What is needed is a higher-level query API – at the ModSpec 7 level, for example – that scales better when transmitted over networks.

11. What kind of tools would be helpful for the implementers?

- a. An automated acceptance test suite that issued a set of well-defined queries and verified the responses against a canonical provider database would facilitate the development of multiple, interoperable systems. Without this, developers will struggle to achieve any real interoperability or federation of directories.