Overview

● MIMI user discovery enables a message sender to locate messaging service providers on which a particular recipient can be reached
  ○ Eliminating the need for prior knowledge of the recipient's specific service

● The draft defines requirements for user discovery using globally unique identifiers, such as email addresses, and phone numbers
Terminology

- **Service Specific Identifier (SSI):** A unique identifier for a user within a single messaging service (e.g., X/Twitter handle)

- **Cross-Service Identifier (CSI):** A globally unique identifier for a user across services (e.g., phone number, email address)

- **Messaging Service Provider (MSP):** An entity that provides messaging services (e.g., WhatsApp, Signal)

- **Cross-Service Identifier Provider (CSIP):** An entity that issues, manages, and verifies CSIs (e.g., phone companies, email providers)

- **Discovery Provider (DP):** An entity that facilitates the creation and discovery of CSI to MSP mappings
The Discovery Problem

- Asserting verifiable mappings between CSIs and MSPs
- Looking up mappings to determine MSPs for which a CSI can be reached
- Additionally:
  - Prioritize user privacy
  - Allow users to control their discoverability
  - Integrate well with E2EE and other MIMI protocols
Requirements

Authenticating Mappings
Operational

Discovery Protocol

Preferences

Security & Abuse Prevention
Authenticating Mappings

- Jointly computed
- Client proof of possession
- MSP confirms reachability
- Prevent independent DP assertions
- Publicly verifiable

+14081231234 ⇒ {Wire, metadata, signature}
## Authenticating Mapping Requirements

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>DP MUST verify user's CSI possession through proof-of-possession challenges through a CSIP, certificate authority or designated parties</td>
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<tr>
<td>2</td>
<td>MSP MUST confirm CSI reachability on its service</td>
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<td>3</td>
<td>Client, MSP, and DP MUST jointly compute a verifiable mapping representation of CSI-to-MSP</td>
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<td>4</td>
<td>DP MUST NOT be able to create a verifiable mapping without CSI holder and MSP involvement</td>
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<tr>
<td>5</td>
<td>DP MUST NOT be able to falsely claim user completed proof-of-possession</td>
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<tr>
<td>6</td>
<td>Other users MUST be able to verify CSI holder's participation in mapping creation</td>
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</table>
Preferences

- Preferences of multiple stakeholders:
  - Sender seeking reachability information
  - Recipient with the mapped identity
  - DPs (and collaborating MSPs)
- Requirements considered *recipient preferences* only (CUJs):
  - Sender mapping preferences
  - Same-app preferences
  - No-random mapping preferences
  - No-duplication preferences
  - Per-sender preferences
  - Closed/Open-ended group preferences
- Decisions:
  - Deferred detailed preferences/capabilities to implementations
  - Includes a basic requirement
Authenticated mappings MUST include a preference index or string to allow recipients to control their preferred contact method.
Discovery Protocol: requests

- Define message format for requests
- CSI: telephone number or email address
  - Globally unique, backing source of truth, user ownership proof, and cross-service usability
- Parameters:
  - Federation: Control whether the DP queries other DPs
  - MSP filter: Scope responses to specific MSPs of interest
  - DP list: Guide query federation decisions with sub-options for:
    - DP-preferred federation
    - Client-selected federation
    - All DPs
Discovery Protocol: processing

- Protect user discovery social graph either by making the querier anonymous or the CSI and mapping confidential
- Disclose default behavior (e.g., do not federate for performance, privacy or regulatory reasons) and comply with federation defaults
- Allow client rate-limiting for non-default queries
- Allow other DPs rate-limiting if they have low-throughput
- Define sub-protocols to facilitate communication and data exchange between DPs and MSPs
Discovery Protocol: responses

- Accommodate scenarios with varying numbers of MSPs or mappings in the discovery results
- Support verbose and compact response formats:
  - Verbose: includes unique list of mappings discovered with metadata for mappings verification
  - Compact: such as a bit string, where each set bit indicates the CSI is reachable at the MSP assigned to that bit position
## Discovery Protocol Requirements

<table>
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<tr>
<td>8</td>
<td>Discovery requests MUST support any globally uniqueCSI with backing source of truth (CISP for telephone), ownership proof, and cross-service usability.</td>
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<tr>
<td>10</td>
<td>Discovery requests MUST support federation, MSP filter, and DP list query parameters.</td>
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<tr>
<td>11</td>
<td>DP MUST disclose default behavior and follow the agreed-upon federation default.</td>
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<tr>
<td>12</td>
<td>DP MAY rate-limit non-default queries given their higher processing costs.</td>
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<tr>
<td>13</td>
<td>DP MAY rate-limit requests sent to low-throughput DP endpoints.</td>
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<tr>
<td>14</td>
<td>DP MUST protect at least the querier's identity or the target CSI in requests.</td>
</tr>
<tr>
<td>15</td>
<td>Discovery responses MUST accommodate zero, one, or multiple MSPs in results. MUST define both verbose and compact response formats, where verbose responses include detailed mapping information and metadata, while compact responses provide a simple indication of CSI reachability on returned MSPs.</td>
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</tbody>
</table>
Operational

- Making changes
  - Obtain new CSI (retire mappings with old CSI)
  - Update existing mappings (e.g., key rotation)
  - Invalidate/delete existing mappings

- Timeliness
  - Remove outdated mappings promptly, considering legacy system limitations (telephone number routing/assignment)
  - Enable discoverability of new CSI mappings within a specified timeframe
**Operational**

**Scenario: One TN CSI, Two users**

<table>
<thead>
<tr>
<th>Time</th>
<th>Discovery results</th>
<th>Possible mitigations</th>
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</table>
| **t_3** | Incorrect TN,MSP_1 mapping because TN is now inactive | (1) DP should subscribe to inactive TN pool channel (challenging)  
(2) MSP should broadcast new TN updates by users (with consent) to enable old TN mappings deletion |
| **t_4** | Incorrect TN,MSP_1 mapping for new TN user | DP should subscribe to TN reassignment channel |
| **t_5** | Correct and incorrect mappings (TN,MSP_2 and TN,MSP_1) | DP should confirm if mapping is first and broadcast invalidation requests to other DPs to void existing mappings |
## Operational Requirements

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<tr>
<td><strong>16</strong></td>
<td>Discovery service <strong>MUST</strong> remove mappings made outdated by CSI re-assignment to a new user within a reasonable time.</td>
</tr>
<tr>
<td><strong>17</strong></td>
<td>Older mappings generally take precedence over newer ones for the same CSI unless explicitly invalidated by the original CSI holder or superseded by a stricter proof of possession verification.</td>
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<tr>
<td><strong>18</strong></td>
<td>DP <strong>MUST</strong> verify if a mapping is the first mapping for a given CSI and, if so, broadcast invalidation requests to other DPs to invalidate any existing mappings for that CSI.</td>
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<tr>
<td><strong>19</strong></td>
<td>Users <strong>SHOULD</strong> be provided with mechanisms to invalidate existing mappings or create replacement mappings for their CSIs.</td>
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<tr>
<td><strong>20</strong></td>
<td>New CSI mappings <strong>SHOULD</strong> be discoverable within some standardized maximum time limit (e.g., 24 hours).</td>
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Security and Abuse Prevention

- Blackhole prevention
  - Prevent malicious MSPs from falsely claiming CSI association to hijack discovery of legitimate mappings

- DDoS, enumeration, and spam prevention
  - Implement robust mechanisms to thwart attacks and abuse (e.g., rate limiting, obfuscation, and differential access based on reputation)

- Encryption and authentication
  - Ensure all communication between clients, DPs, and MSPs is encrypted and authenticated
## Security & Abuse Prevention Requirements

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<tr>
<td>21</td>
<td>Discovery service MUST leverage contractual and technical means to prevent malicious MSPs from falsely claiming CSI association</td>
</tr>
<tr>
<td>22</td>
<td>Discovery service MUST incorporate anti-DDoS, anti-flagellation, and anti-spam mechanisms</td>
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<tr>
<td>23</td>
<td>All communication between clients, DPs, and MSPs MUST be encrypted in transit and authenticated</td>
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</tbody>
</table>
Additional areas critical for user discovery/implementation

- Federation mechanisms
  - Define protocols for communication and data exchange between DPs
- Data sovereignty
  - Respect data locality and jurisdictional laws (e.g., GDPR)
- Registry
  - Service Host for DP metadata and service configurations in a federated DP scenario
Summary

- These requirements are for a secure, privacy-friendly, and efficient user discovery service for MIMI
- By specifying/implementing these requirements, we can empower users with greater control over their discoverability and create a more interoperable messaging landscape
- **The authors extend their sincere gratitude to the working group for their invaluable feedback and insightful discussions during the MIMI interim meetings**
- We encourage continued engagement from the working group
Next Steps

- Changes?
- Additional requirements?
- Call for adoption?