A Solid-based Architecture for Decentralised Interoperable Location Data

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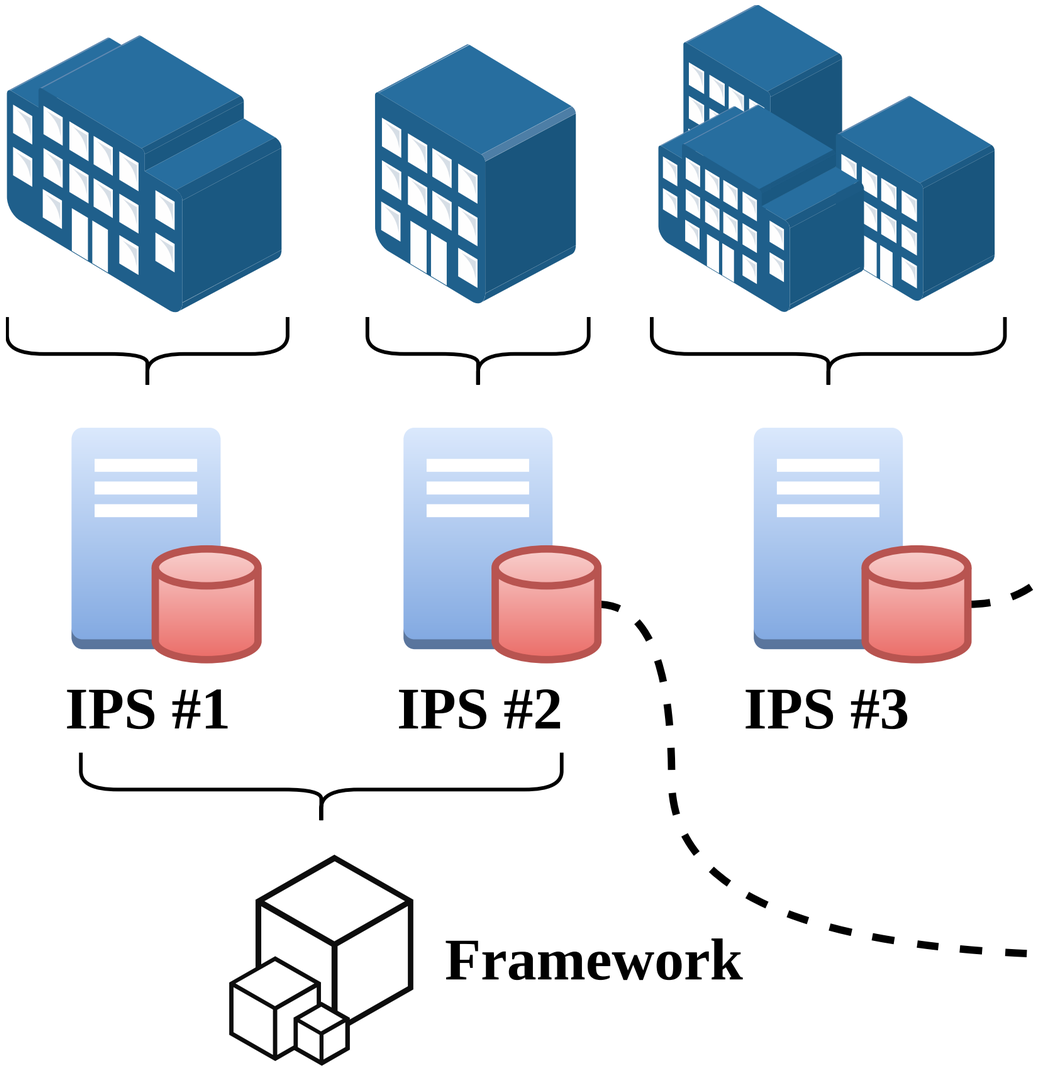
Current indoor positioning systems (IPS)

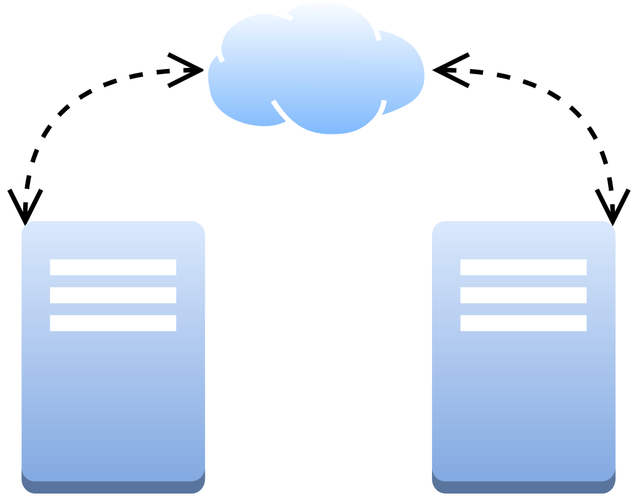


Database IPS #3
User 1: { name: "User 1", lat: ..., lng: ...
User 2: { name: "User 2", lat: ..., lng: ...

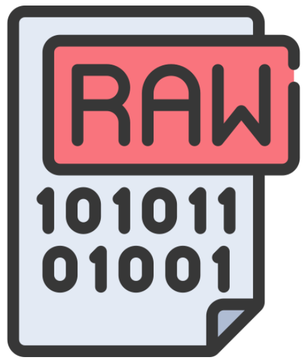
Database IPS #2
User 1: { name: "User 1", lat: ..., lng: ...
User 2: { name: "User 2", lat: ..., lng: ...

Problems with current IPS'

1. Users not in **control** of their **data**
2. No **interoperability** between positioning **systems**
3. No **interoperability** between (navigation) **applications**



Accessibility



Readability

Understandability

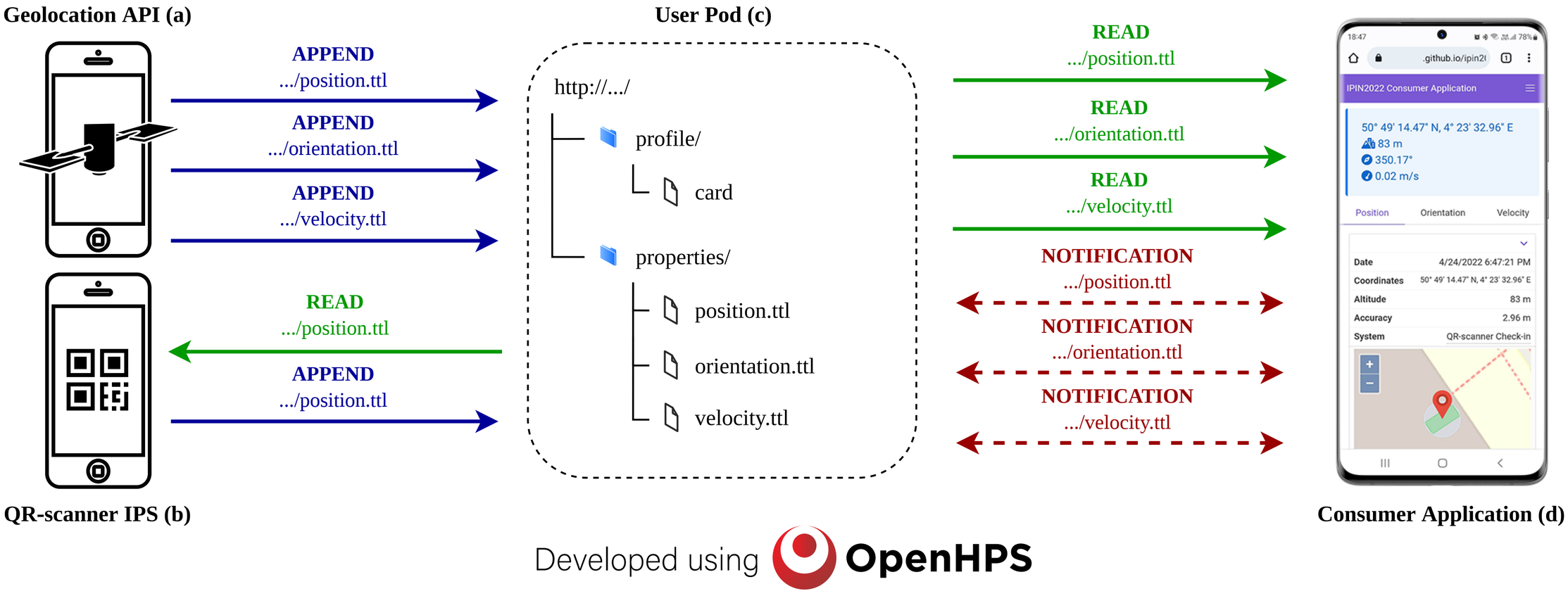
Decentralised interoperable architecture

Decentralised interoperable architecture

Core vocabularies: SOSA, SSN (W3C®)

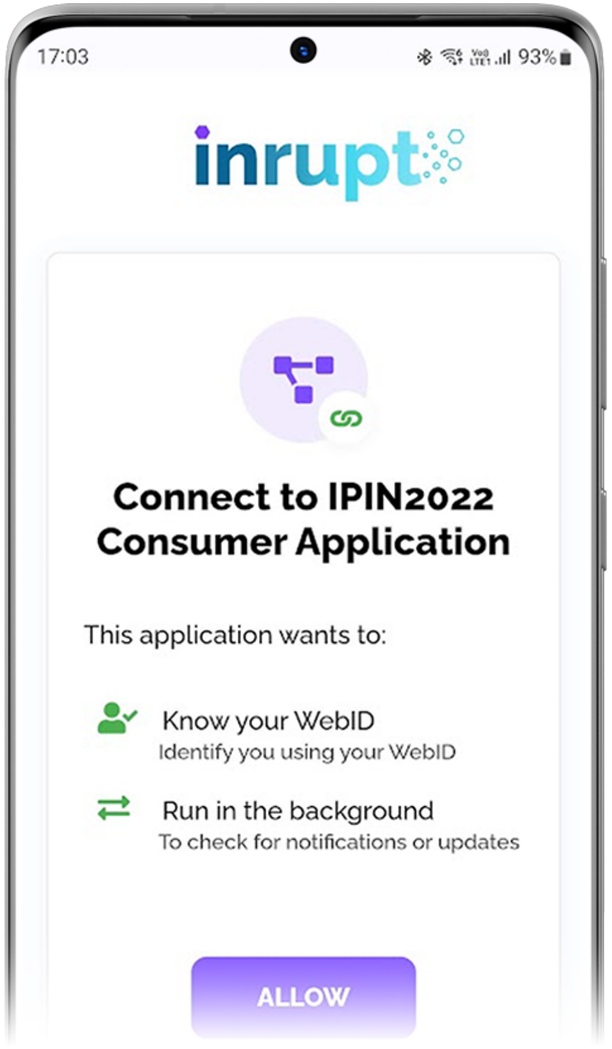
Allignment vocabularies: GeoSPARQL (Open Geospatial Consortium®), QUDT

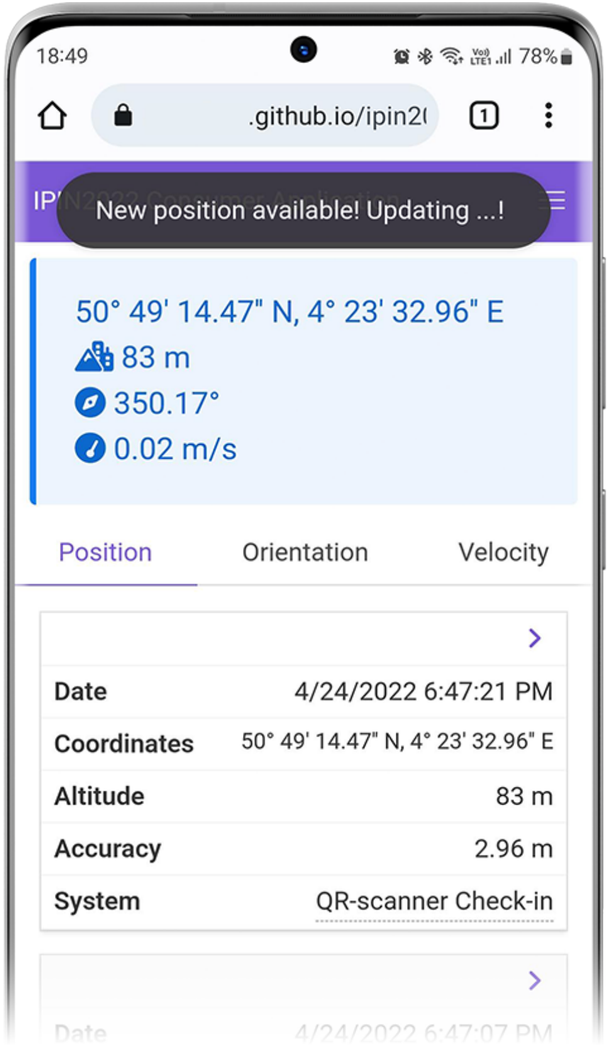
PoC demonstrator

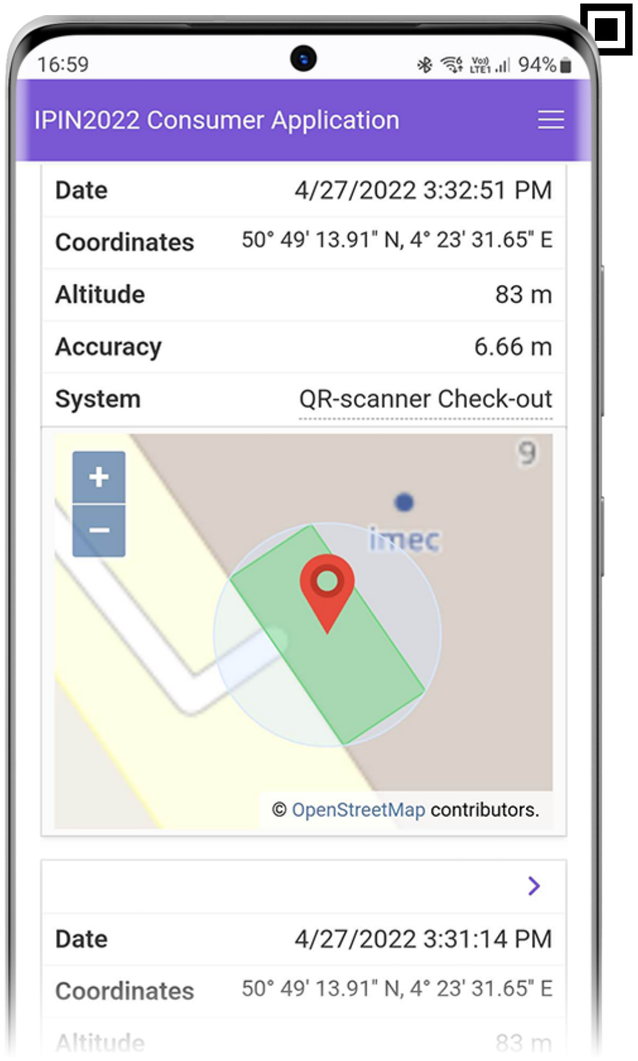


Developed using OpenHPS

PoC demonstrator …







PoC demonstrator ...

https://ipin2022.solidweb.org/profile/card

```
:me
    a schema:Person, sos:FeatureOfInterest, foaf:Person;
    vcard:bday "2010-09-15"^^xsd:date;
    vcard:fn "John Doe";
    vcard:role "Test Account";
    acl:trustedApp
            [
                acl:mode acl:Append, acl:Read, acl:Write;
                acl:origin <https://openhps.github.io>
            ];
    ldp:inbox inbox:;
    space:preferencesFile </settings/prefs.ttl>;
    solid:oidcIssuer <https://solidweb.org>;
    ssn:hasProperty
        </properties/orientation.ttl>, </properties/position.ttl>,
        </properties/velocity.ttl>;
    foaf:name "John Doe".
```

PoC demonstrator ...

https://ipin2022.solidweb.org/profile/card

```
:me
    a schema:Person, sos:FeatureOfInterest, foaf:Person;
    vcard:bday "2010-09-15"^^xsd:date;
    vcard:fn "John Doe";
    vcard:role "Test Account";
    acl:trustedApp
            [
                acl:mode acl:Append, acl:Read, acl:Write;
                acl:origin <https://openhps.github.io>
            ];
    ldp:inbox inbox:;
    space:preferencesFile </settings/prefs.ttl>;
    solid:oidcIssuer <https://solidweb.org>;
    ssn:hasProperty
        </properties/orientation.ttl>, </properties/position.ttl>,
        </properties/velocity.ttl>;
    foaf:name "John Doe".
```

PoC demonstrator ...

https://ipin2022.solidweb.org/properties/position.ttl

```
<>
    a sos:ObservableProperty;
    rdfs:comment "Geographical position of John Doe"@en;
    rdfs:label "Geographical Position"@en;
    ssn:isPropertyOf c:me.
:1651064675234
    a sos:Observation;
    sos:hasFeatureOfInterest c:me;
    sos:hasResult
            [
                a geosp:Geometry;
                ipi:inDeployment ipi:deployment_pl9_3_32;
                geosp:asWKT
                    "POINT Z(4.392020345921735 50.820629700445664 82.99999999813735)"^^geosp:wktl
                geosp:coordinateDimension 3;
                geosp:dimension 3;
                geosp:hasSpatialAccuracy
```

PoC demonstrator ...

```
SELECT ?posGeoJSON ?datetime ?accuracy {
    ?profile a sosa:FeatureOfInterest ;
            ssn:hasProperty ?property .
    ?observation sosa:hasResult ?result ;
                sosa:observedProperty ?property ;
                sosa:resultTime ?datetime .
    ?result geosparql:hasSpatialAccuracy ?spatialAccuracy ;
            geosparql:asWKT ?posWKT .
    BIND(geof:asGeoJSON(?posWKT) AS ?posGeoJSON)
    ?spatialAccuracy qudt:numericValue ?value ;
                    qudt:unit ?unit .
    OPTIONAL { ?unit qudt:conversionMultiplier ?multiplier }
    OPTIONAL { ?unit qudt:conversionOffset ?offset }
    BIND(COALESCE(?multiplier, 1) as ?multiplier) # Default 1
    BIND(COALESCE(?offset, 0) as ?offset) # Default 0
    BIND(((?value * ?multiplier) + ?offset) AS ?accuracy)
} ORDER BY DESC(?datetime) LIMIT 20
```

Conclusion and future work