

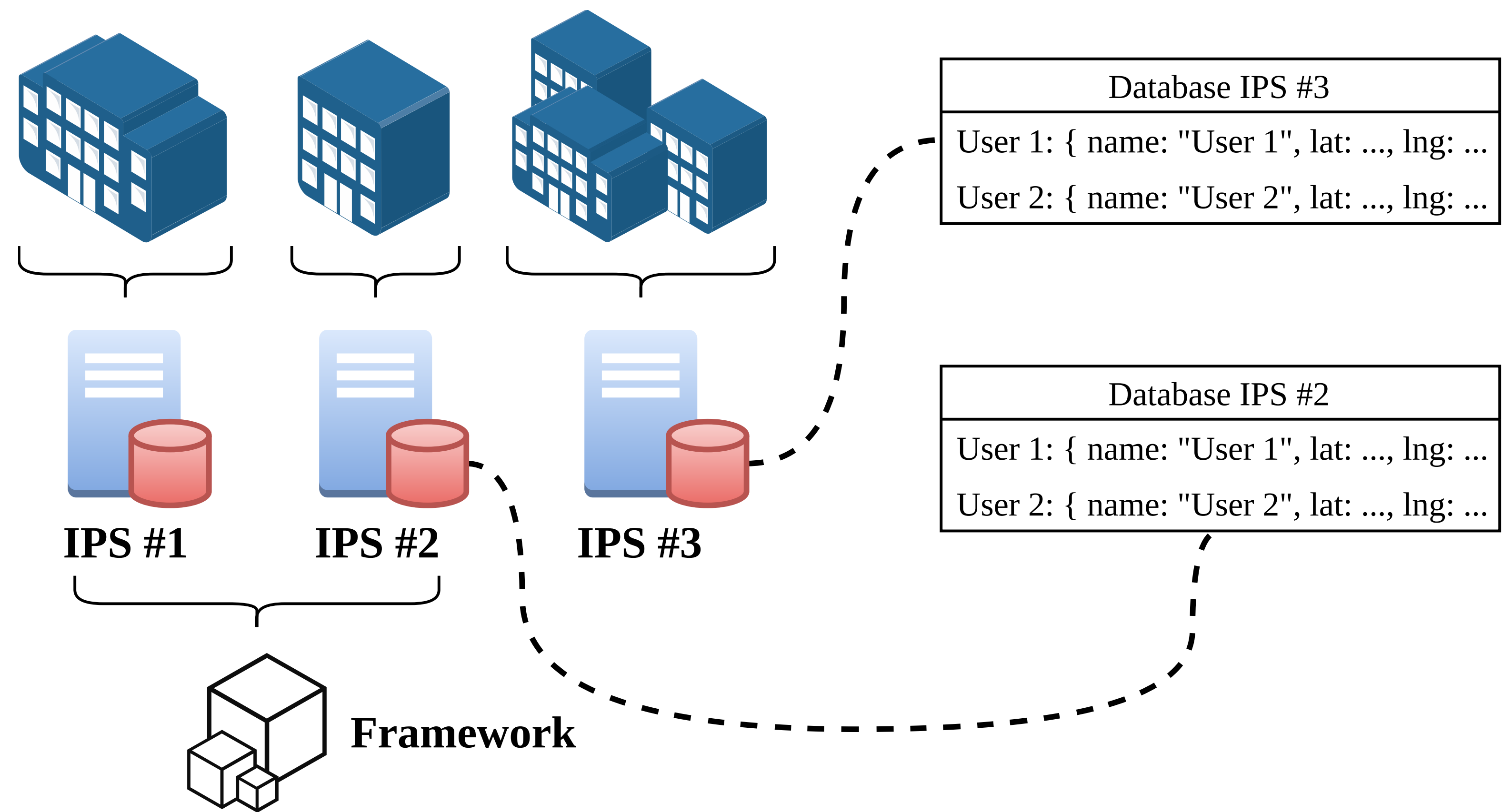
# A Solid-based Architecture for Decentralised Interoperable Location Data

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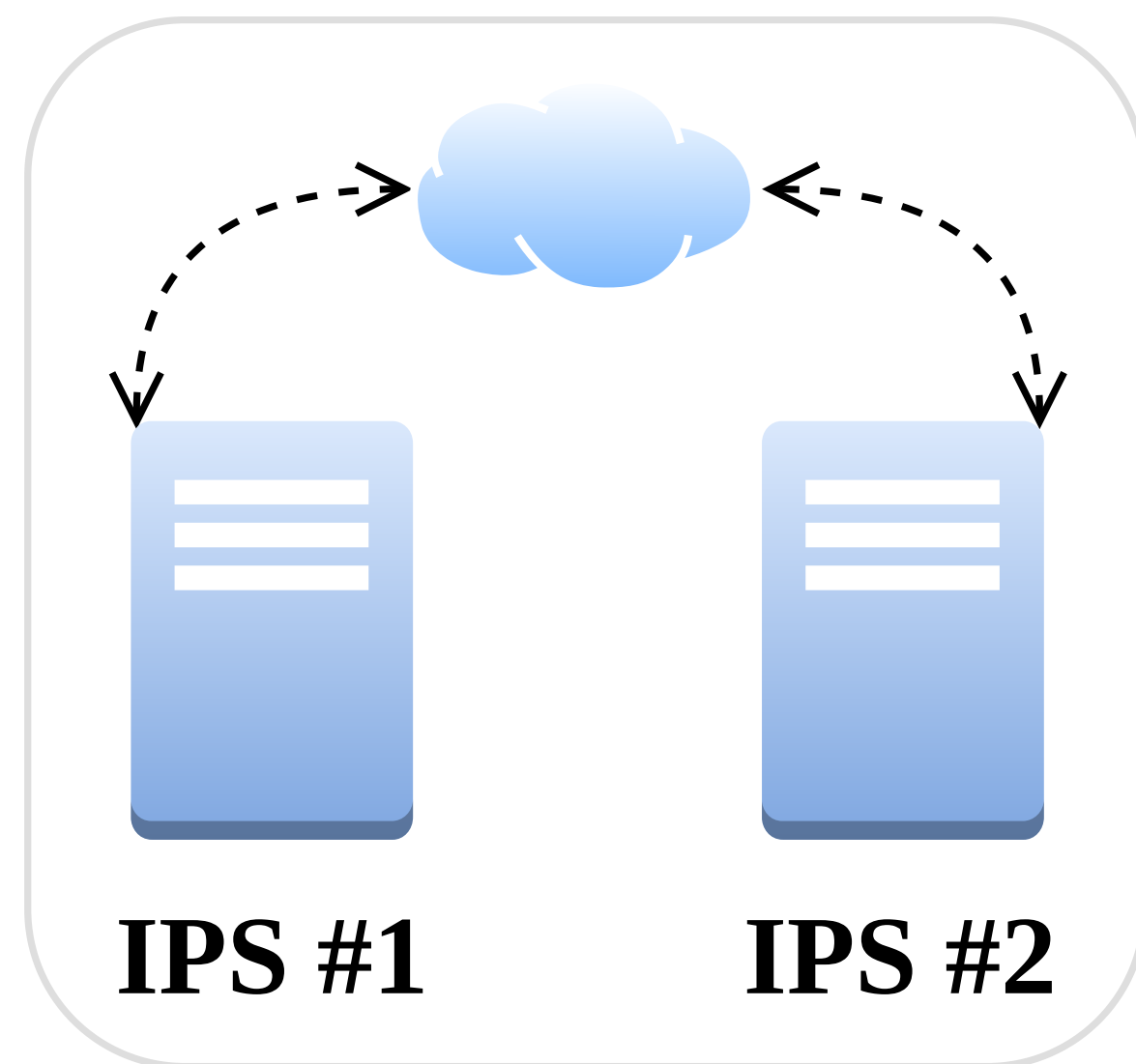
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Vrije Universiteit Brussel*

# Current indoor positioning systems (IPS)



# 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**

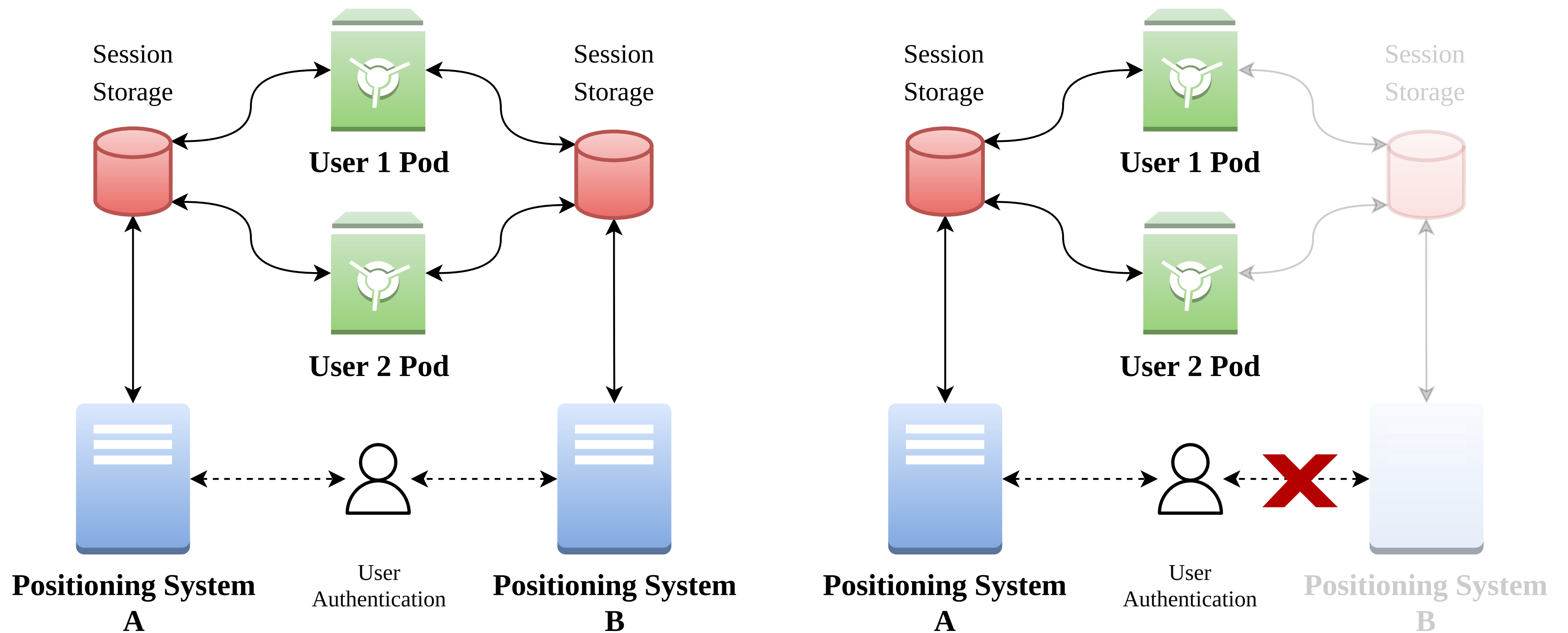


**Readability**



**Understandability**

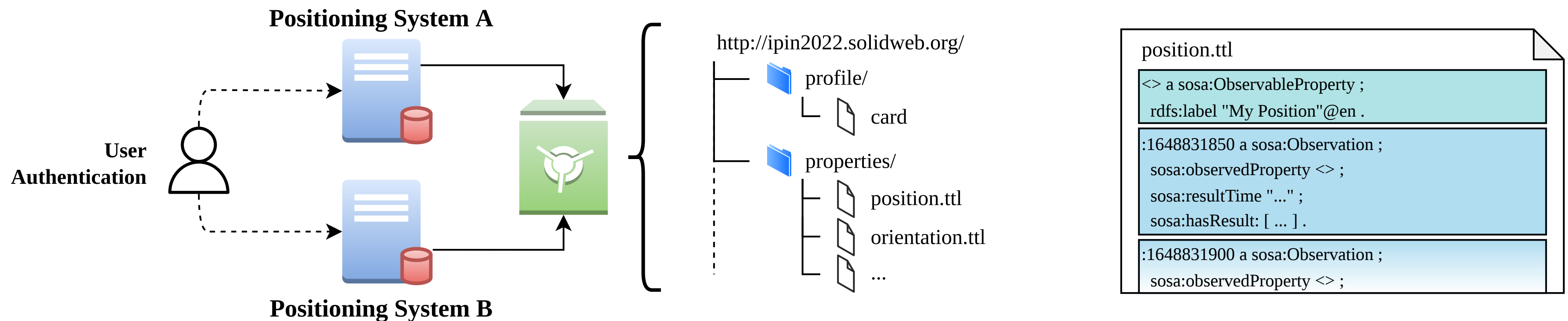
# Decentralised interoperable architecture



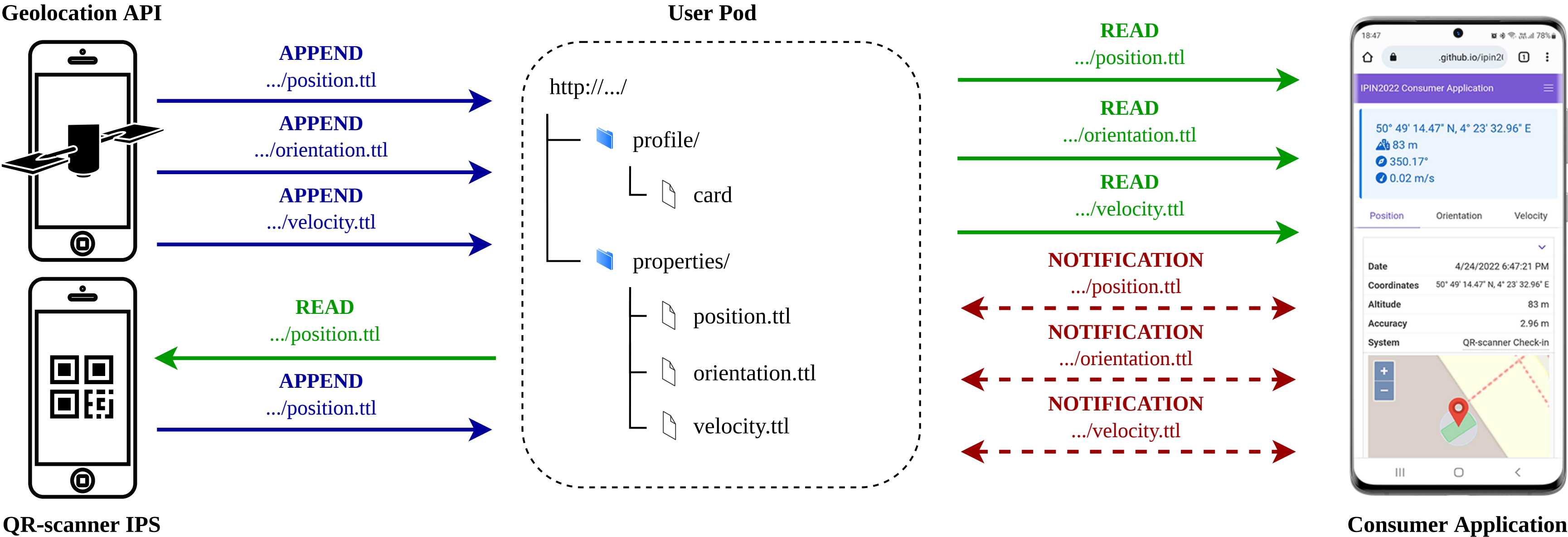
# Decentralised interoperable architecture

**Core vocabularies:** SOSA, SSN (W3C®)

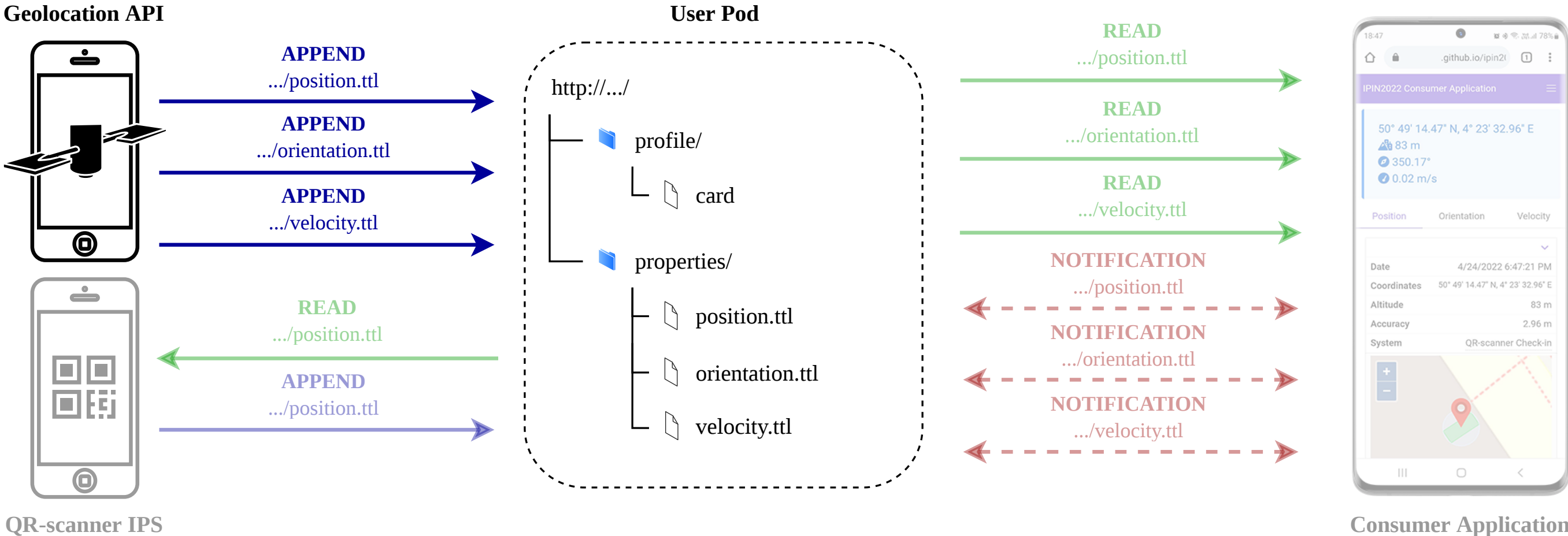
**Alignment vocabularies:** GeoSPARQL (Open Geospatial Consortium®), QUDT



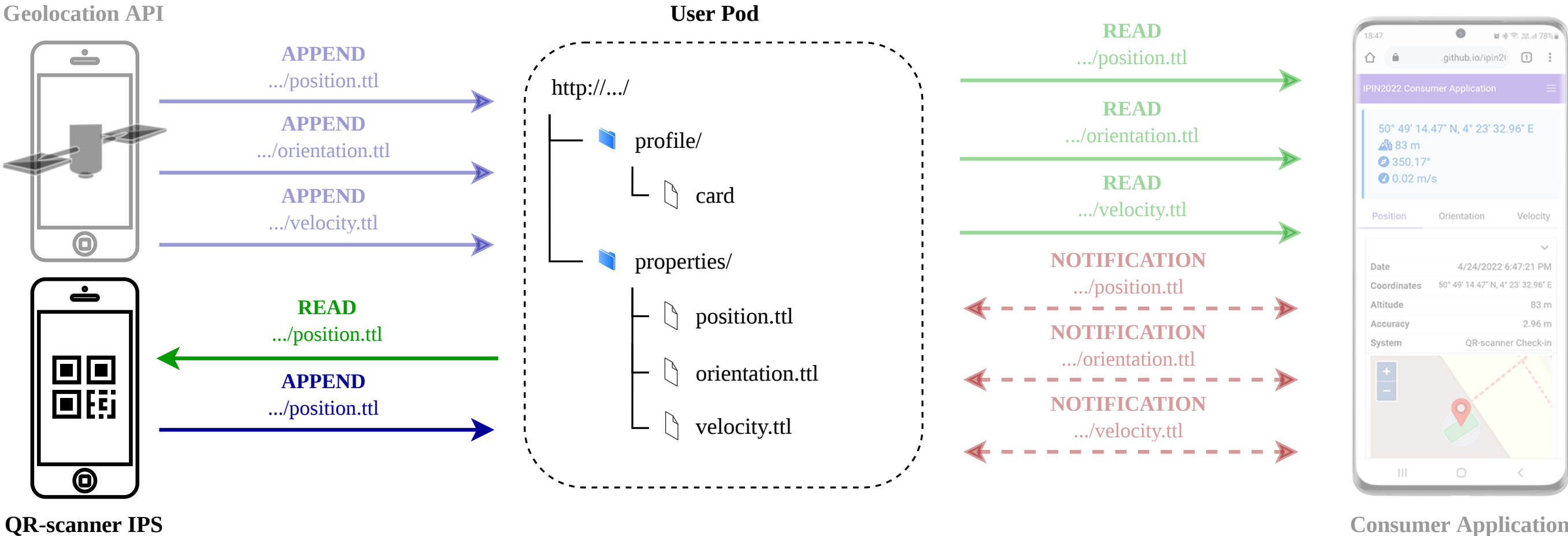
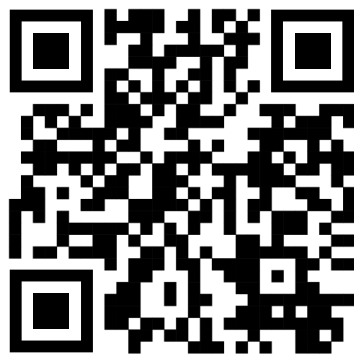
# PoC demonstrator



# PoC demonstrator ...

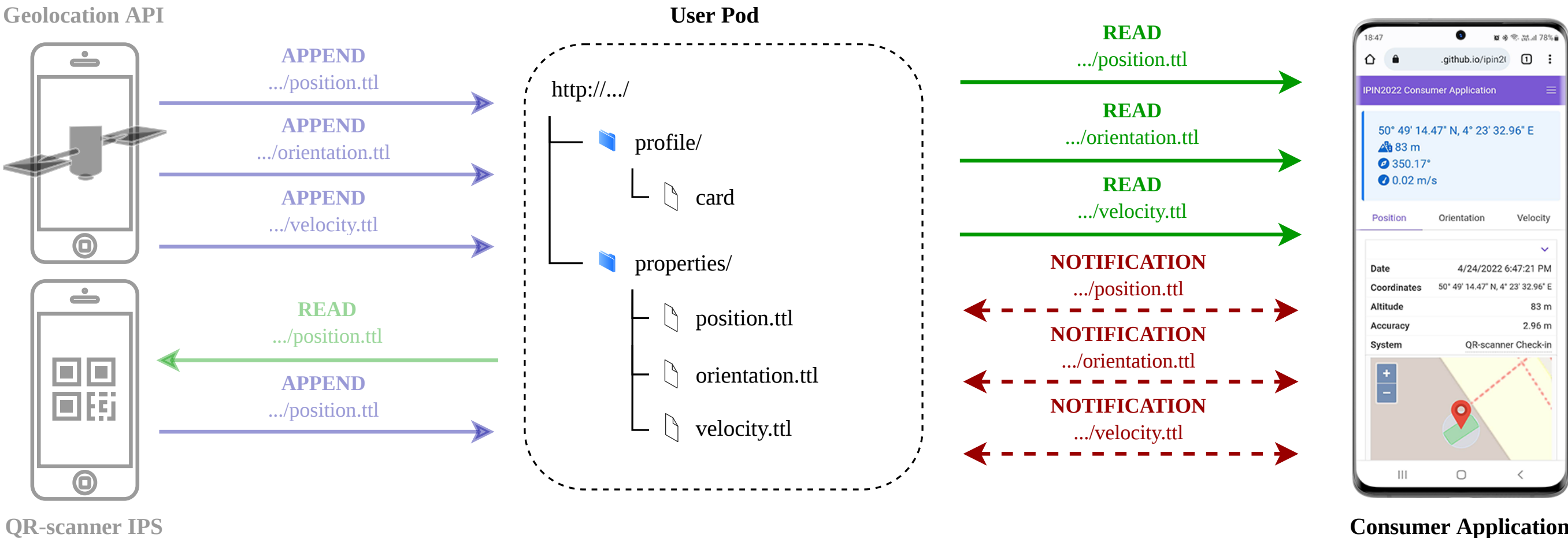


# PoC demonstrator ...

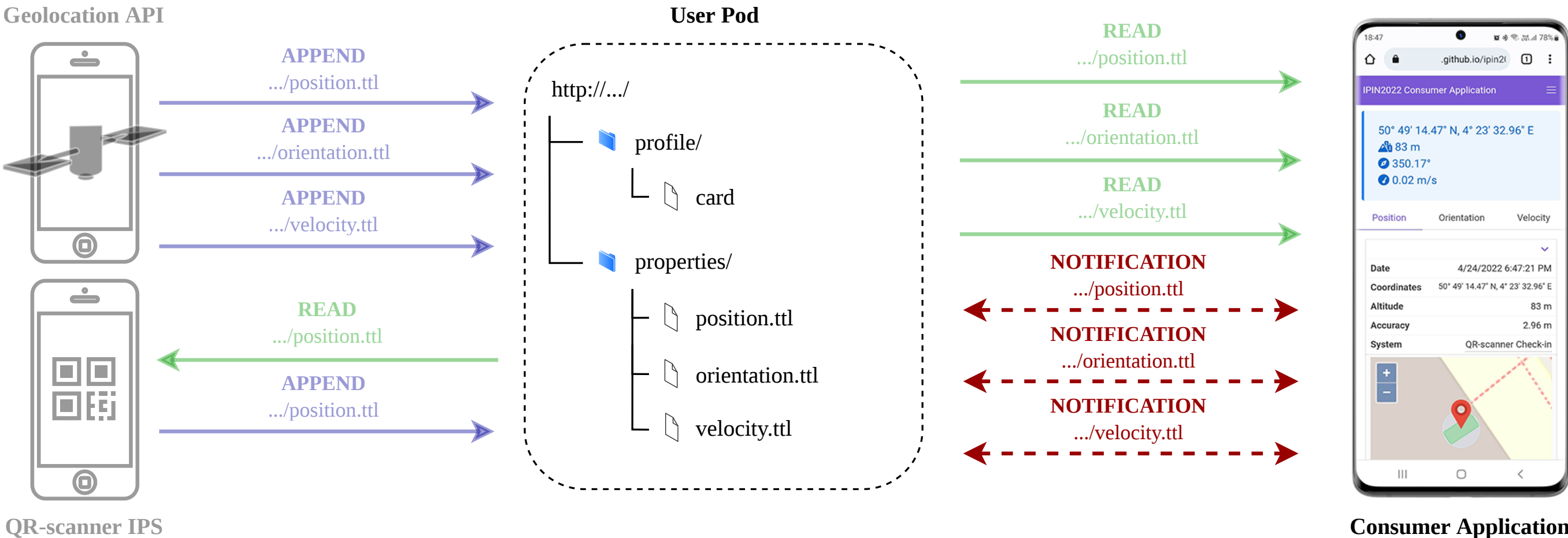




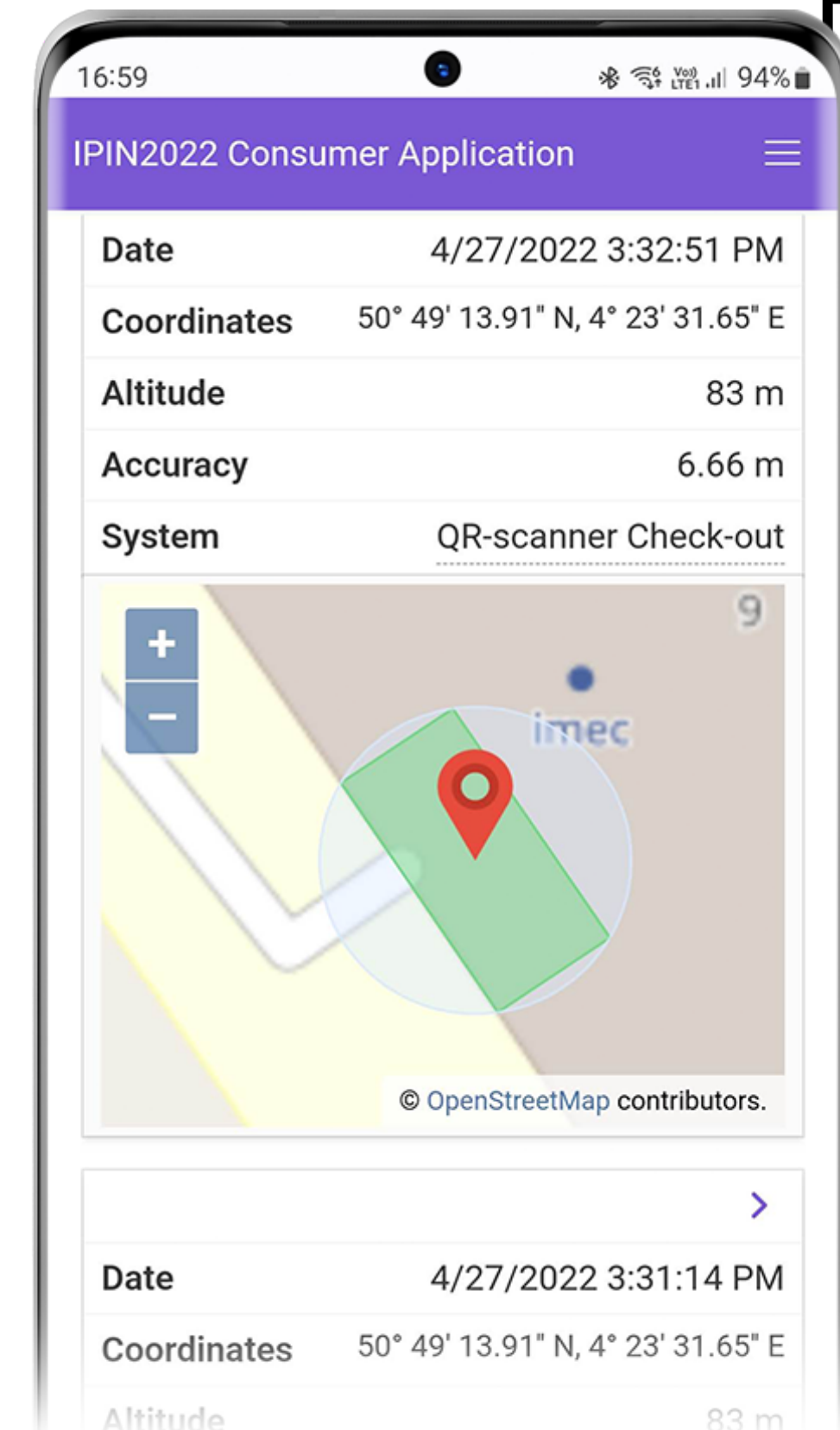
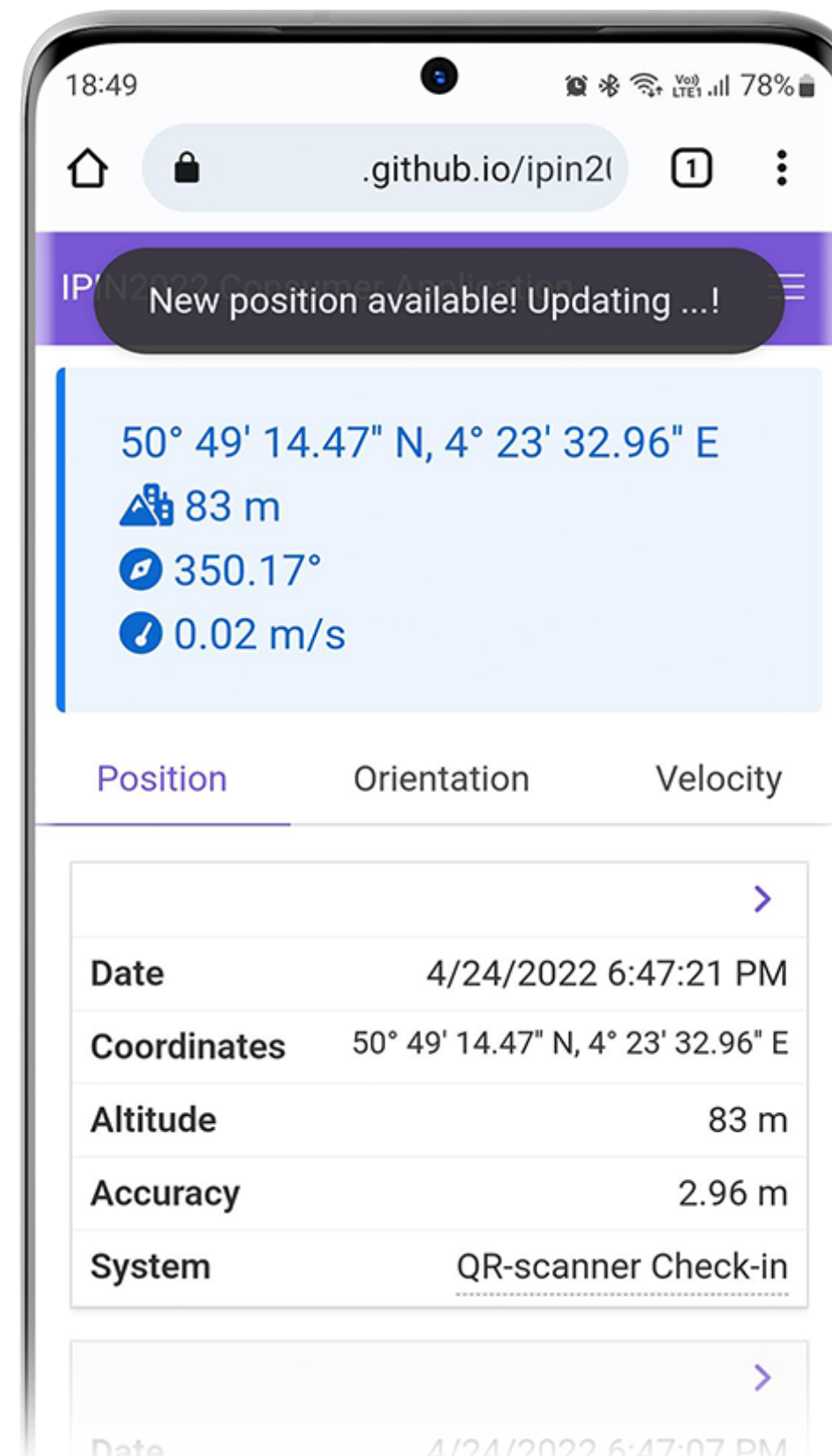
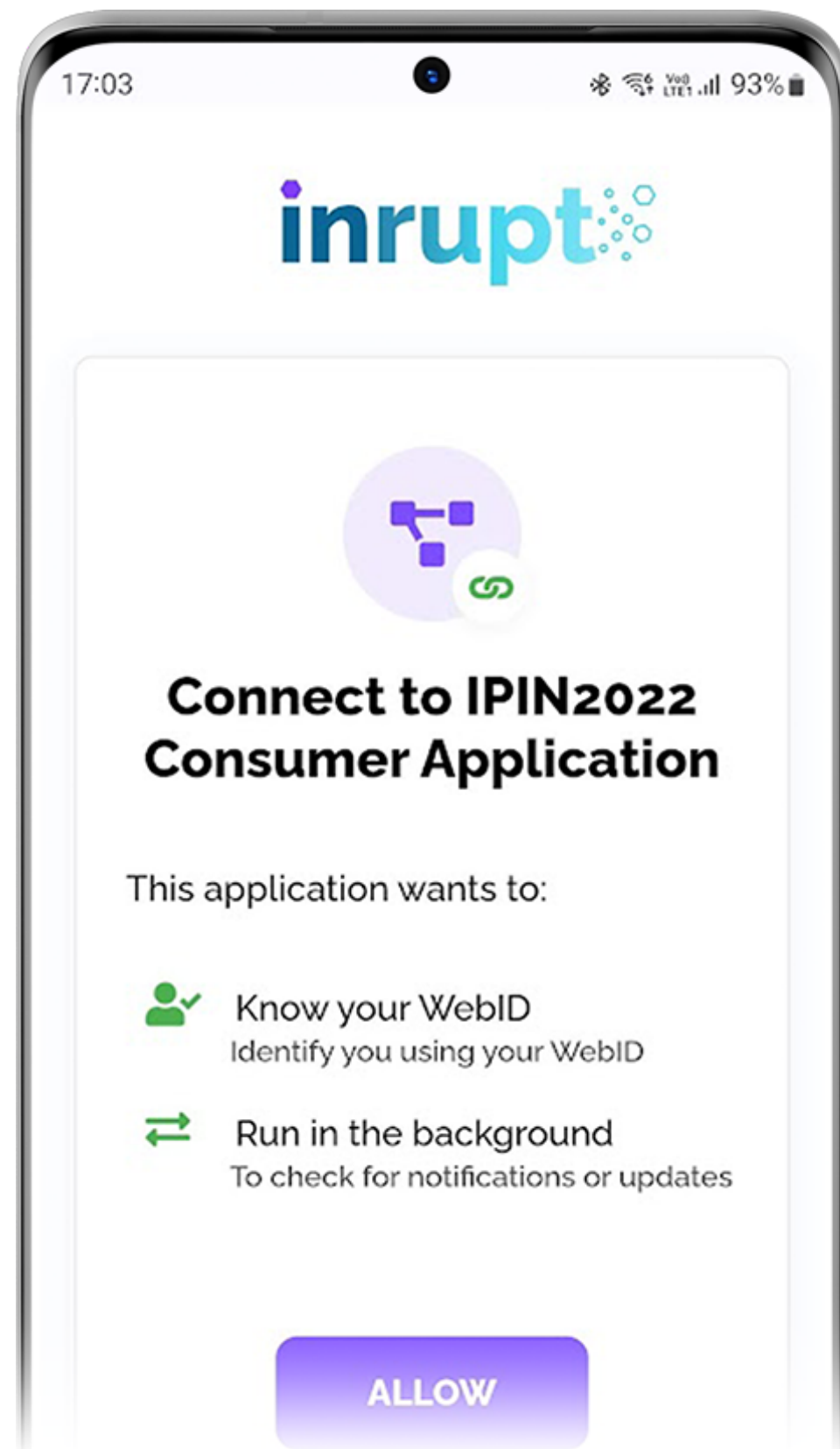
# PoC demonstrator ...



# PoC demonstrator ...



# 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

- ▶ Novel architecture for **decentralising** location **data**
  - **User** remains **in control** of their data
- ▶ **Interoperability** between systems and applications
  - High level decision fusion
  - Single **navigation** application
  - **Handover** of tracking between systems
- ▶ **Scalable** to raw sensor data

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