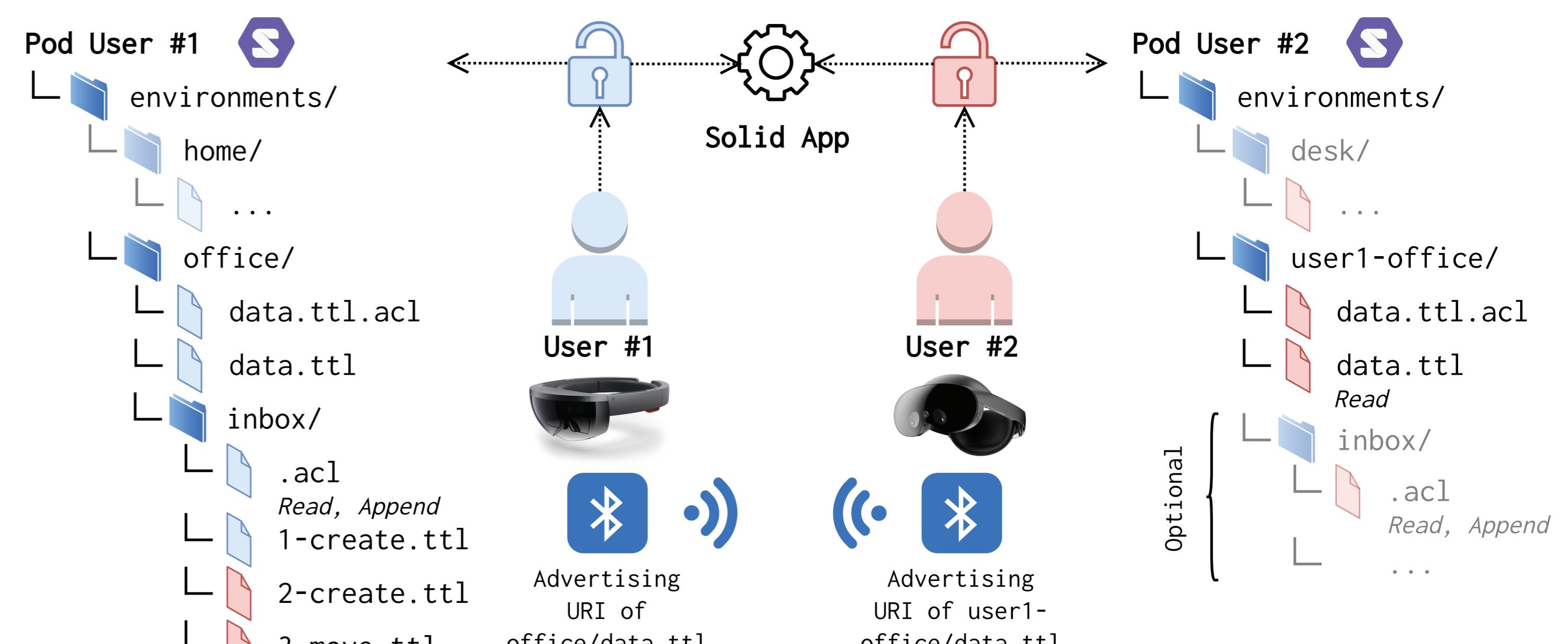


# Discoverable and Interoperable Augmented Reality Environments Through Solid Pods



Augmented Reality (AR) environments are physical environments with virtual objects superimposed through AR-enabled devices. These virtual objects can range from simple aesthetic objects such as pictures to superimposed contextual information about physical items. In most modern AR applications, these augmented spaces exist only for the user who created the environment or for proprietary applications that enable multi-user collaboration in the same environment. However, there is a lack of solutions that enable interoperable collaboration in these personal AR spaces, allowing users to share and contribute to an AR space. We propose a solution that enables users to create their personal AR space that can then be discovered by other users who are in physical proximity to this space, enabling them to view or contribute to the augmented space. In addition, we discuss a solution that utilises the same technique to create AR spaces that are bound to a specific room and can be discovered by users who are in close vicinity to these rooms.



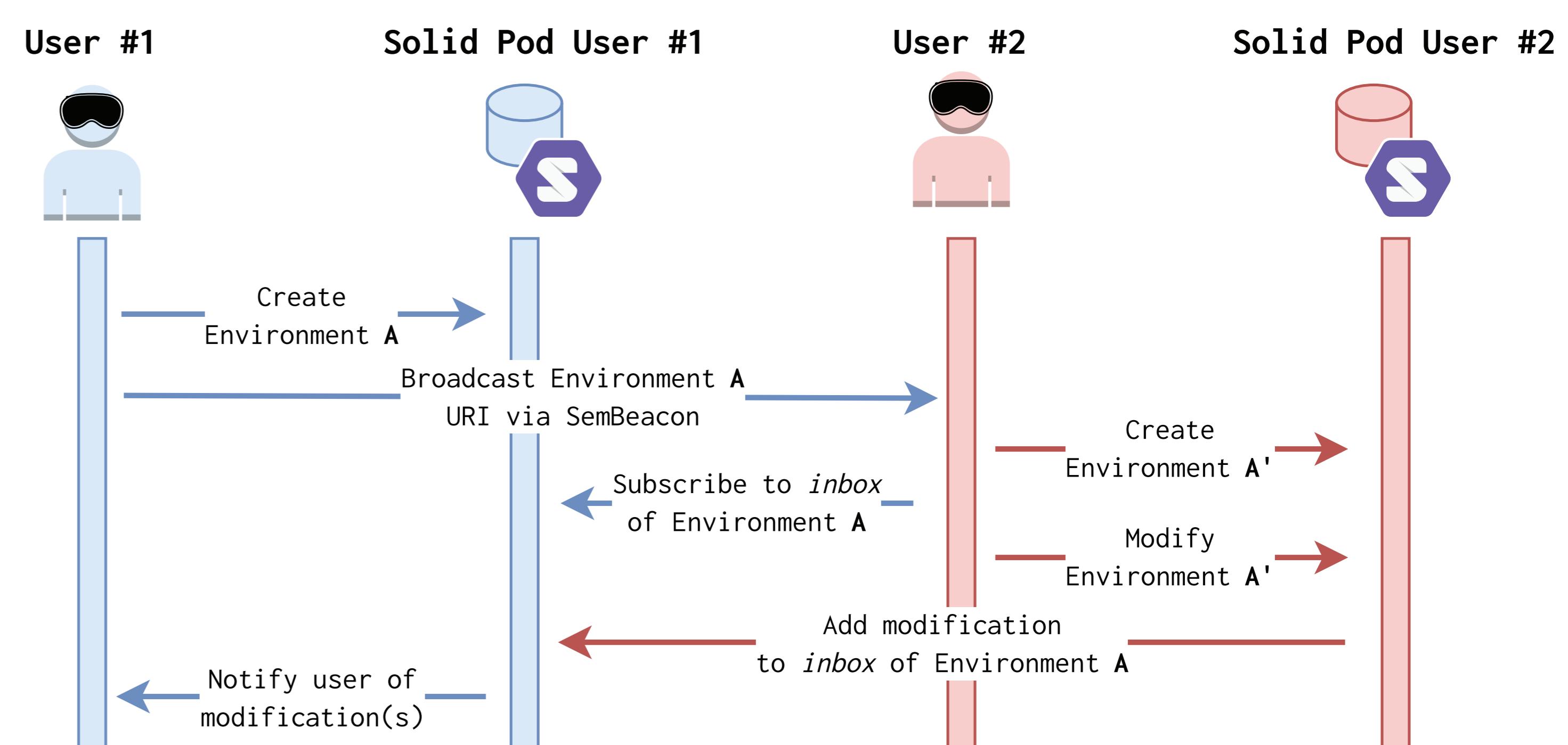
## Discovery via Semantic Beacons

SemBeacon Advertisement Data (Based on AltBeacon)									Bluetooth 4.0
Adv Flags	Len 1B	Type 1B	Company ID 2B	Beacon Code 2B	Namespace ID 16B	Instance ID 4B	TX @ 1m 1B	Flags 1B	
-	0x1B	0xFF	uint16	0xBEAC	128-bit UUID	32-bit UUID	int8	-	

SemBeacon Scan Response Data (Eddystone-URL compatible)									Bluetooth 4.0
Len 1B	Type 1B	UUID 2B	Frame 1B	TX @ 0m 1B	URI Prefix 1B	Encoded Short Resource URI 0B - 17B			
0x??	0x16	0xFEAA	0x10	int8	uint8	uint8[]			

M. Van de Wynckel and B. Signer, "SemBeacon: A Semantic Proximity Beacon Solution for Discovering and Detecting the Position of Physical Things," in Proceedings of the 13th International Conference on the Internet of Things, in IoT '23. New York, NY, USA: Association for Computing Machinery, 2024, pp. 9–16. doi: 10.1145/3627050.3627060.

## Interaction Flow



## Vocabularies and Usage

```

< a seas:Room ; rdfs:label "Our Lab"@en ;
  vcard:address [ ... ] .

:table_marker a fidmark:AruCo ;
  poso:hasPosition [ poso:isRelativeTo < > ] ;
  fidmark:hasDictionary fidmark:DICT_ARUCO_ORIGINAL ;
  fidmark:markerIdentifier 12 ;
  fidmark:hasOrigin fidmark:OriginCenter ;
  fidmark:hasHeight [ a qudt:QuantityValue;
    qudt:unit unit:MilliM; qudt:numericValue "150"^^xsd:double
  ] ;
  fidmark:hasWidth [ a qudt:QuantityValue;
    qudt:unit unit:MilliM; qudt:numericValue "150"^^xsd:double
  ] .

```

```

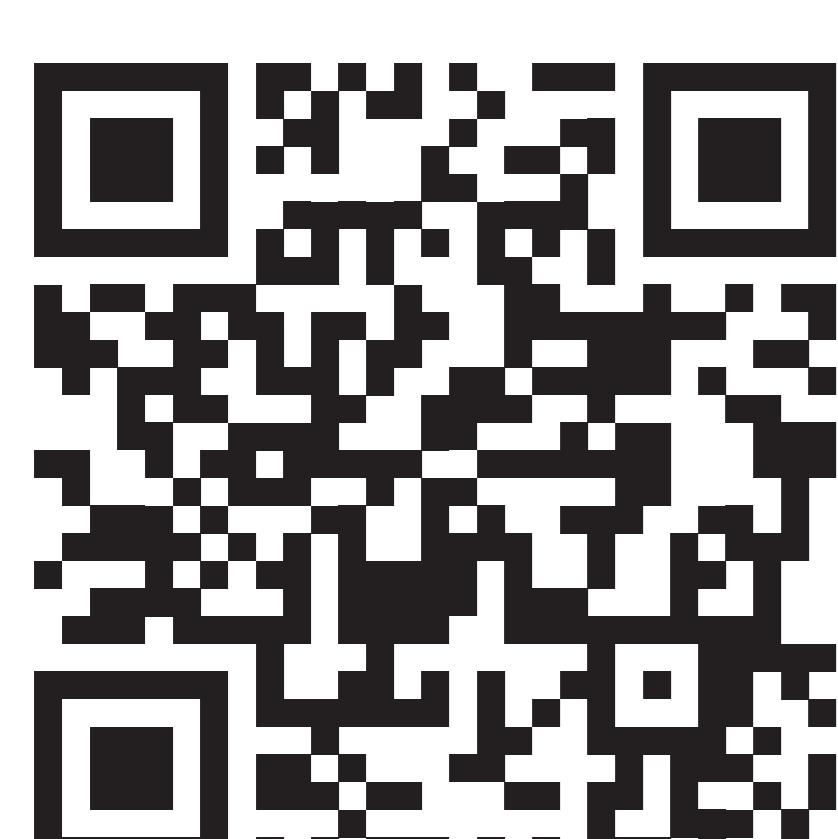
@prefix card: <https://{{user2}}/profile/card#> .
@prefix office: <https://{{user2}}/environments/user1-office/data.ttl#> .

< a schema:CreateAction ;
  schema:description "Created a new object 'painting'"@en ;
  schema:agent <https://ar-app.com/id> ;
  schema:creator card:me ;
  schema:object office:painting ; schema:result office:painting .

```



## Access Control and Versioning



VRIJE  
UNIVERSITEIT  
BRUSSEL

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<https://maximvdw.be>

Beat Signer  
bsigner@vub.be  
<https://beatsigner.com>