SATP Stage-0 Challenges

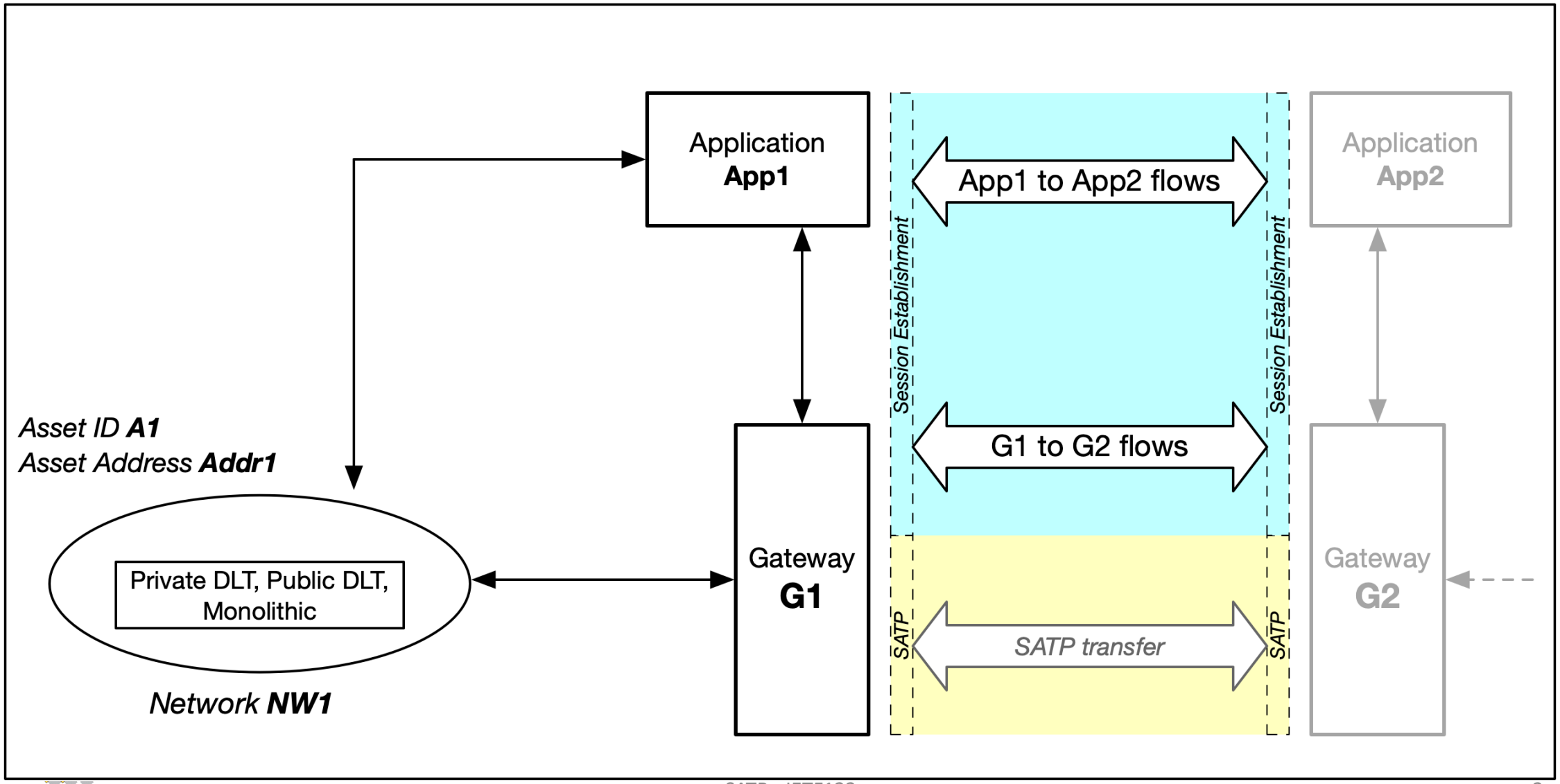
SATP Working Group Meeting

IETF122

19 March 2025

Thomas Hardjono (MIT), Denis Avrilionis (Compellio) & Venkatraman Ramakrishna (IBM)

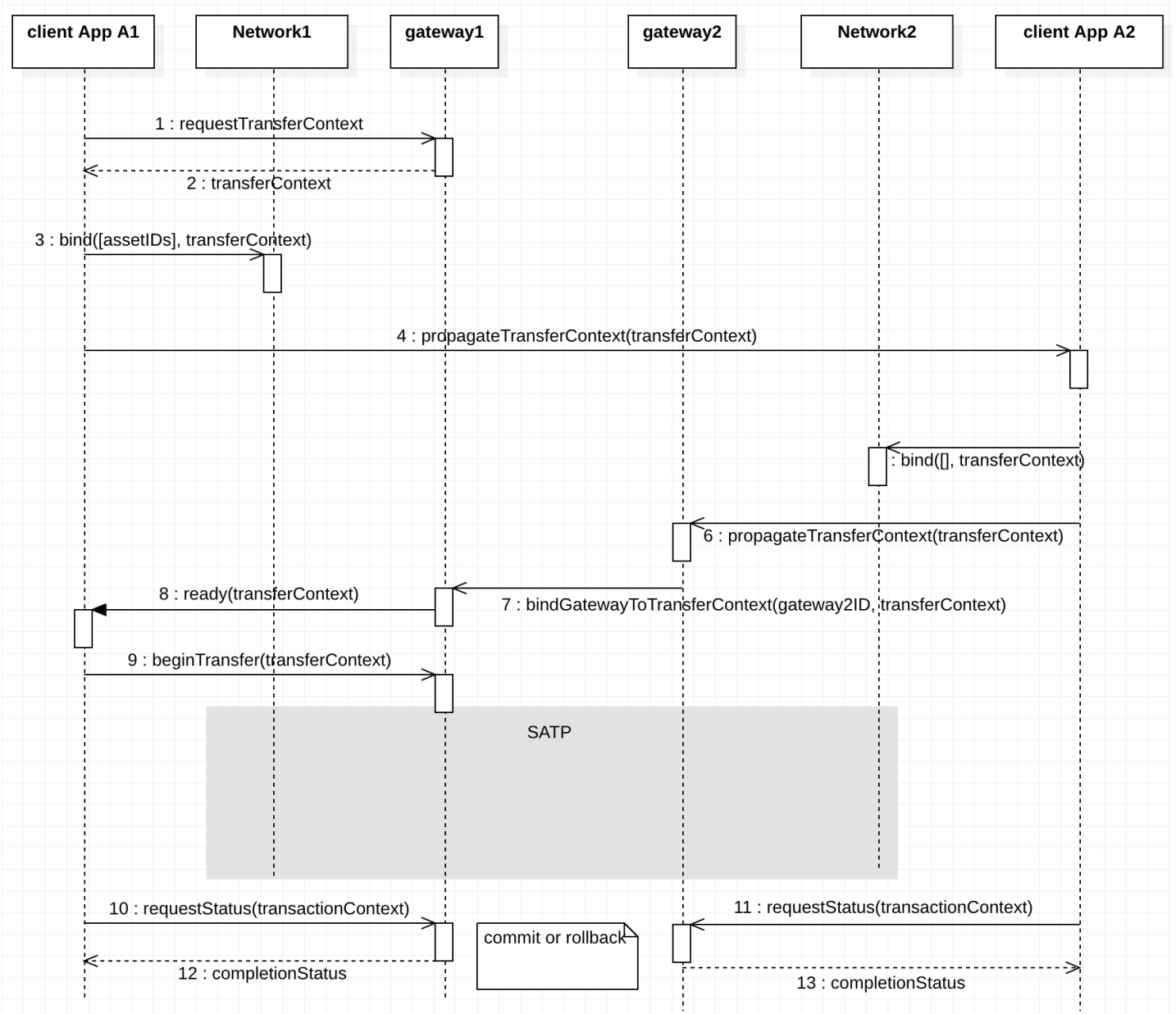
Overview of “Stage-0” (setup stage - blue)



Some Open Challenges

- Establishment of ContextID between App1 and App2
- Globally unique Asset-ID of asset A1 on network NW1
  - Need globally unique network-address for asset networks
- Provable “disablement” of asset A1 in network NW1
- Standardizing APIs

General Interaction Flows in Stage-0



ContextID: some open questions

- App1 and App2 must establish a common context regarding the asset to be transferred
- What information should be placed inside the ContextID data structure? (see example)
- How to communicate the ContextID from Apps to the gateways?
- How to “bind” ContextID (incl. AssetID) to the network?
- Does asset obtain new ID when transferred to NW2?

Transfer Context: Example


```
{
   "transferContextID": "urn:satp:transferContext:0xf3beac30c498d9e26865f34fcaa57dbb935b0d74",
   "transferStatus": "inProgress",
   "activeSessionID": "urn:satp:session:0x06012c8cf97BEaD5deAe237070F9587f8E7A266d",
   "sessionHistory": [
      "urn:satp:session:0x06012c8cf97BEaD5deAe237070F9587f8E7A2777",
      "urn:satp:session:0x06012c8cf97BEaD5deAe237070F9587f8E7A2888"
   ],
   "egress": {
      "gw1ID": "urn:satp:gateway:0x517BBF0c9B71f64b5807f644E1F1bacD3Afb3ec2",
      "nw1ID": "urn:satp:network:0xa9c28ce2141b56c474f1dc504bee9b01000000890000000000000000000012",
      "nw1EndPoint": "0x6e329e9c3653a0ab99e806e2267e8e4dff4d3fbb",
      "assets": [
         {
            "assetID": "urn:satp:tar:0xa9c28ce2141b56c474f1dc504bee9b01000000890000000000000000000012
:0x897374acc81080d4fb818ee8c5f8822d937d8912",
            "transferExpiration": "2025-03-19T08:04:40Z"
         }
      ]
   },
   "ingress": {
      "gw2ID": "urn:satp:gateway:0xc24854b8457710f98ca254308b65e18b12ca0504",
      "nw2ID": " urn:satp:network:0xa9c28ce2141b56c474f1dc504bee9b01000000010000000000000000000012",
      "nw2EndPoint": "0x0debadd980c7eec904cf57e105e3993688107aaf"
   }
}
```

What should be achieved at the end of Stage-0

At Sender side (gateway G1):

- The Client App1 (i.e. Alice) has obtained a “transfer context”, namely the information that unambiguously defines a specific asset transfer instance related to sending the asset.
- The network NW1 is aware that the asset is going to be transferred for the given transfer context
- Gateway G1 is bound to gateway G2 for the given transfer context

At the Receiver side (gateway G2):

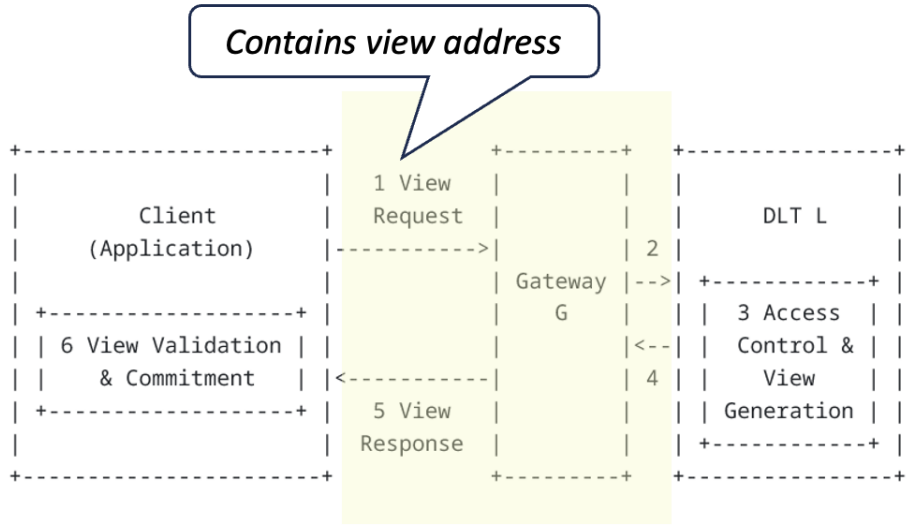
- The Client App2 (i.e. Bob) knows that it will receive a well-defined set of assets for the given transfer context
- Network NW2 is aware that assets will be received for the given transfer context
- Gateway G2 is bound to gateway G1 for the given transfer context

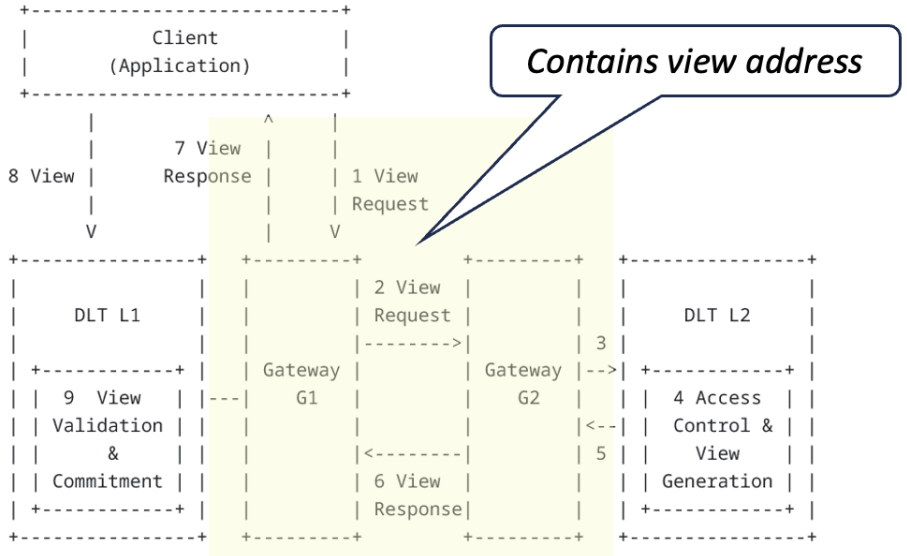
Proof of “disablement” of asset on network

- Once App1 and App2 agree on the ContextID for the asset A1 on network NW1, the *asset state* must be temporarily prevented from being modified (i.e. “locked”)
- Whose job is this?
  - Application App1 or gateway GW1?
- Is there a network-agnostics mechanism to obtain proof regarding the state of the asset?
  - Who is taking-on liability? (Gateway operator?)
  - Can App1 independently check the state of asset A1 in NW1?

Asset State Discovery & Verification

- Applications, as the drivers of asset transfers, need to discover state of assets in either network participating in a SATP instance
  - Especially in State-0 where the transfer context is created
  - Also in later stages if the session is stuck following a crash
- Need a universal communication format and mechanism for applications, relying on gateways only for message routing and network action triggers and not for decision-making
  - Addressing asset states through a hierarchy of gateways, networks, and procedures/contracts (with optional verification policy)
  - Structured way to describe state (with optional authenticity proofs) that is agnostic of network or asset types
  - General-purpose request-response protocol
- Candidate drafts:
  - Views as structured asset states with URL-like view addresses: https://datatracker.ietf.org/doc/draft-ramakrishna-satp-views-addresses/
  - Data sharing protocol triggered by client-to-gateway request: https://datatracker.ietf.org/doc/draft-ramakrishna-satp-data-sharing/
- Peer-reviewed publication
  - Enabling Enterprise Blockchain Interoperability with Trusted Data Transfer, Middleware 2019 - Industry Track: https://arxiv.org/abs/1911.01064
- Implementation in the Hyperledger Cacti project in the Linux Foundation Decentralized Trust (LFDT) organization: https://github.com/hyperledger-cacti/cacti/blob/main/weaver/rfcs/protocols/data-sharing/generic.md





Thank You and Q&A