



Policies as Blockchain Smart Contracts for Ensuring Compliance and Provenance: A Healthcare Industry Perspective



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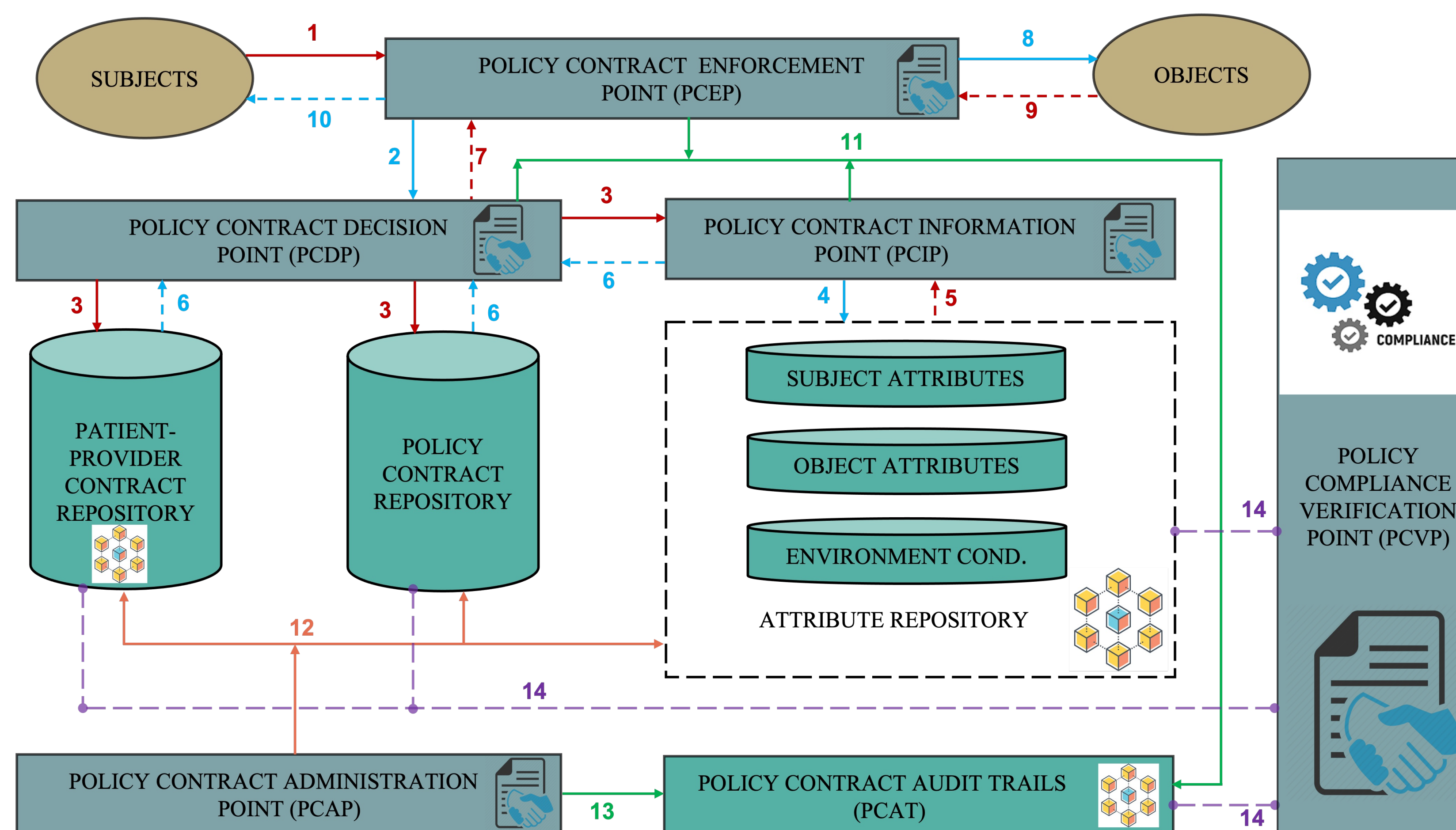
Problem Statement

- For stronger security guarantees, demonstrating / proving policy compliance is must
- Policy compliance is challenging since policies can range from national level policies to state-level, city-level, organization-level policies, and also individual user level policies
- Problems in policy specification and implementation remain unidentified until a breach
- Organizational subcultures often lead to (overlooked) policy violations

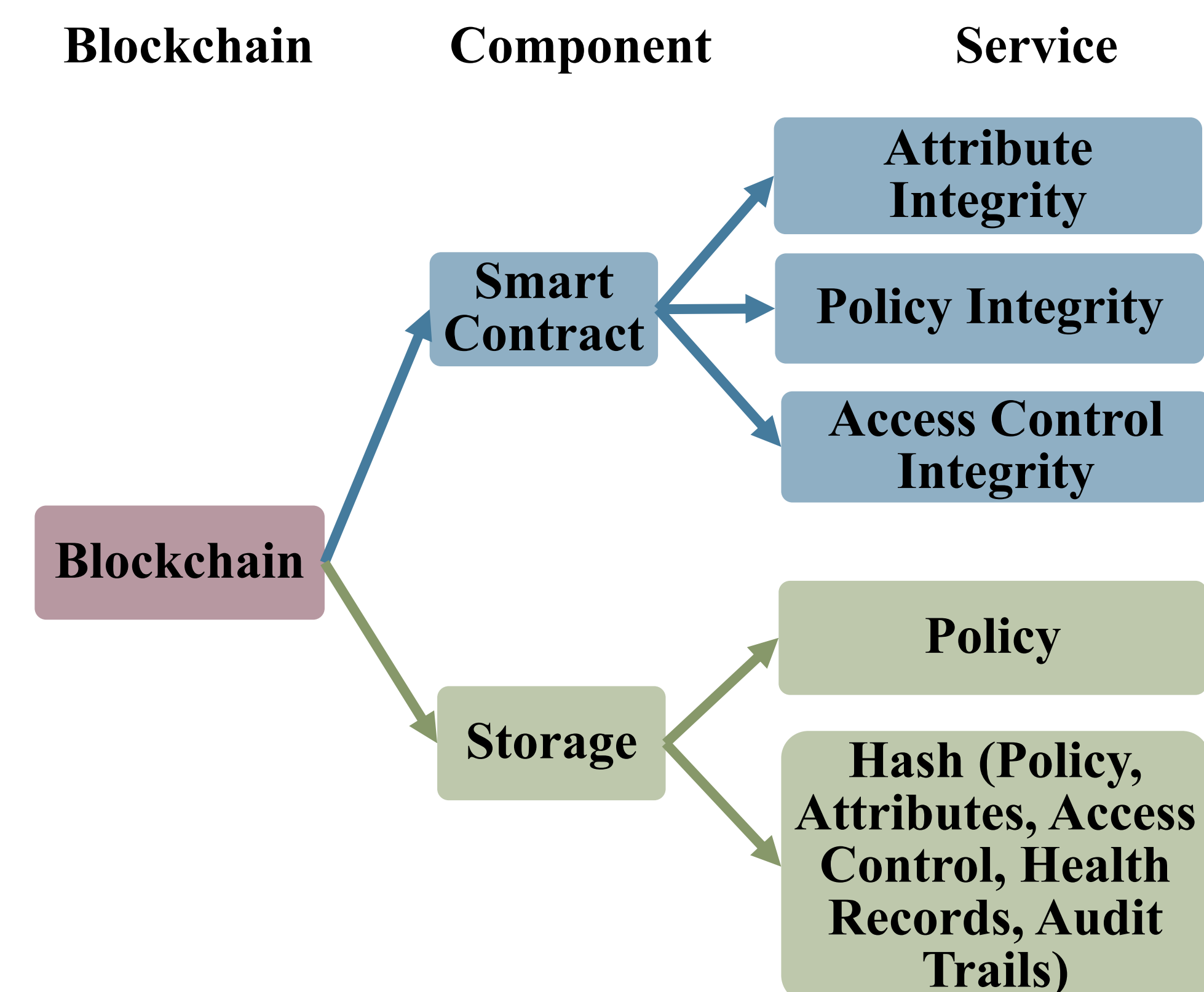
Proposed Approach

- A blockchain's decentralized consensus mechanism and immutable, integrity verified storage helps provenance by maintaining better audit trail
- Implementing policies as smart contracts ensures compliance via auto triggering and consensus mechanism doubles as strong reference monitor

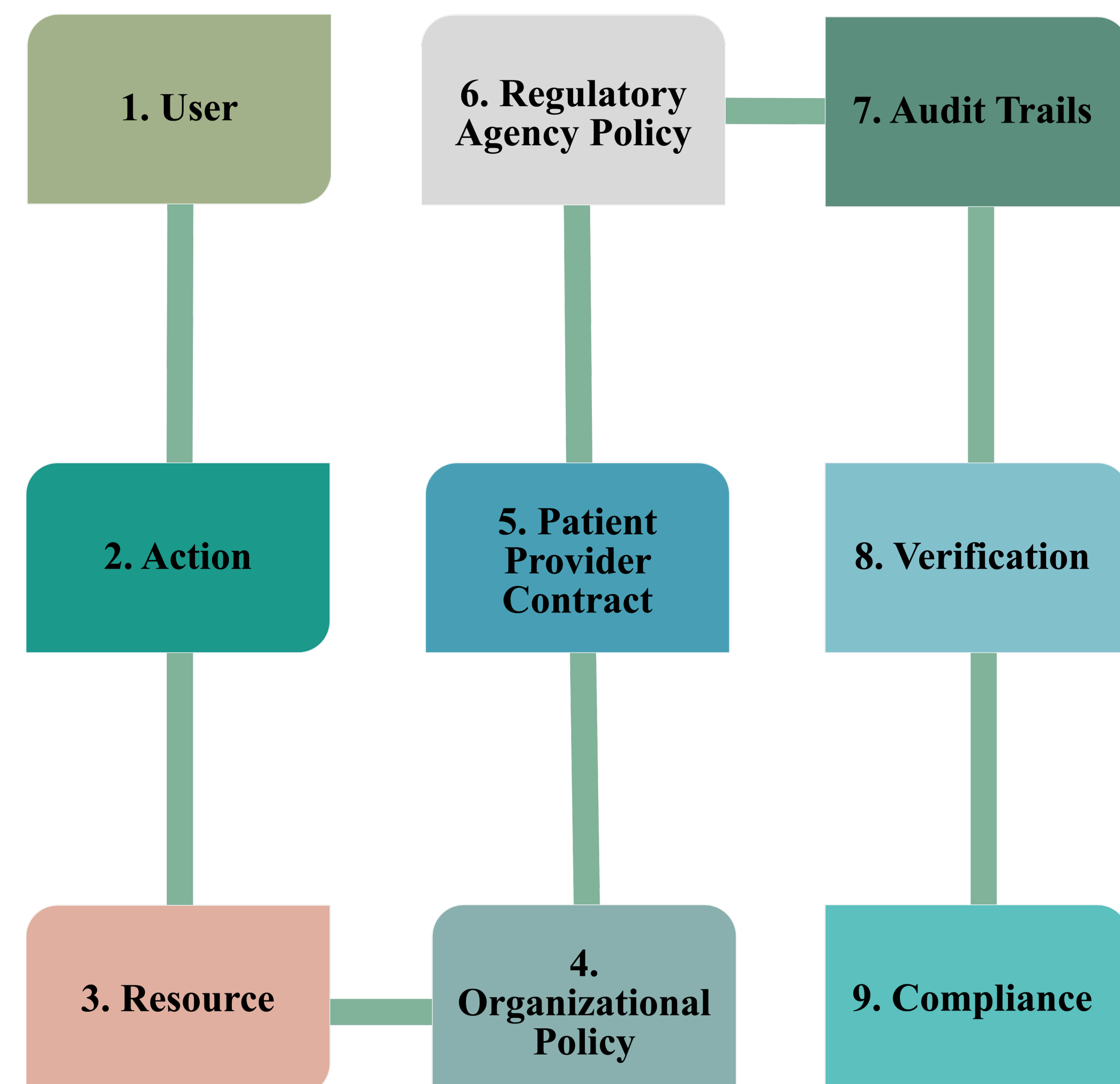
Contract Based Policy Enforcement



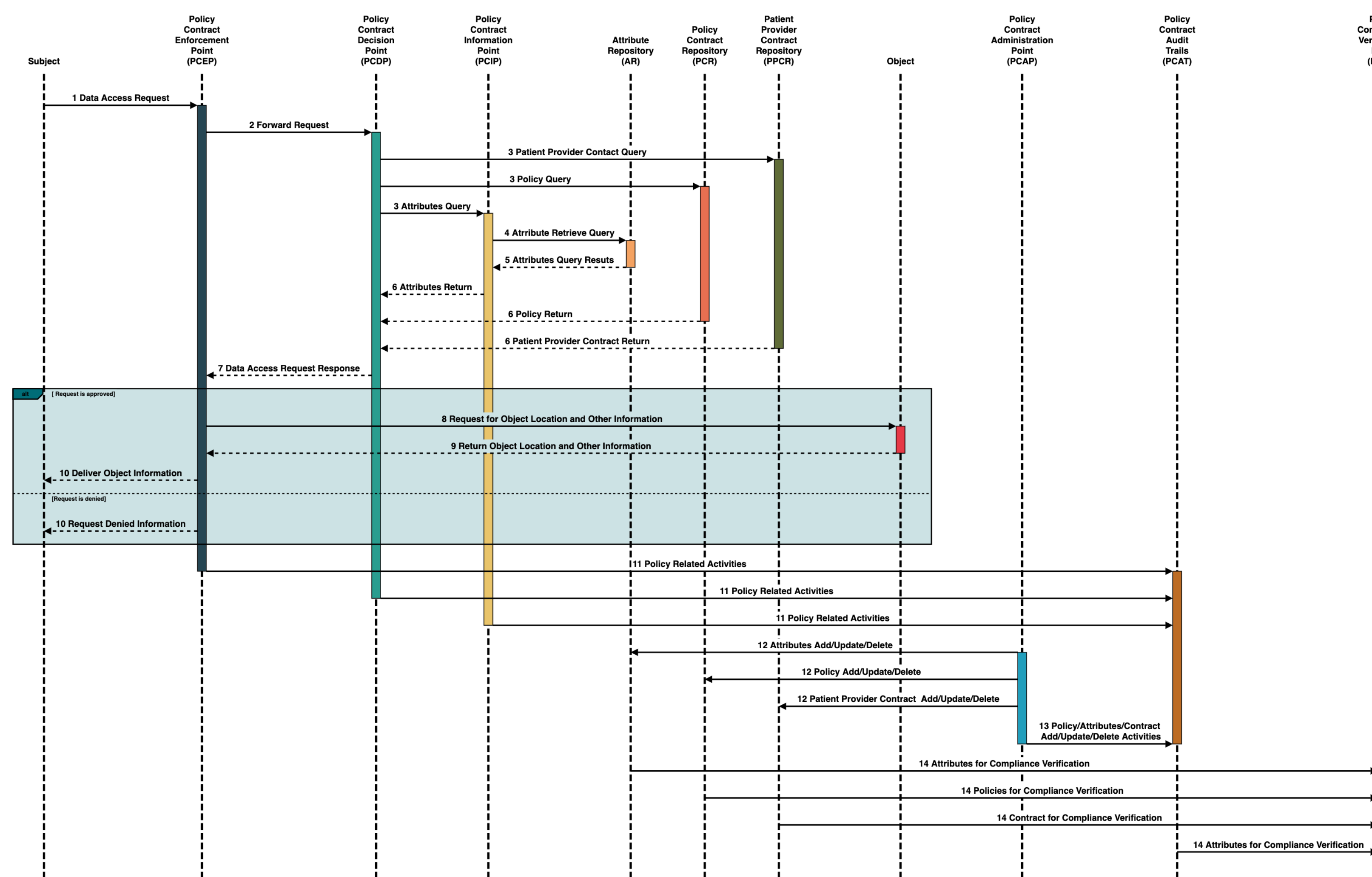
Provenance via Blockchain



Healthcare Policy Compliance



Policy Compliance Sequence Diagram



Future Directions

- Implementing prototype of the proposed model
- Providing verification process of deployed policies and attributes
- Integrating blockchain API with access control model to interact with blockchain network
- Developing mechanism for audit trails verification for a certain user to confirm policy compliance
- Building query API for performing different queries regarding policy compliance for a user or a policy or an object

References

[1] Y. Piao, K. Ye, and X. Cui, "A Data Sharing Scheme for GDPR-Compliance Based on Consortium Blockchain," *Future Internet*, vol. 13, no. 8, Art. no. 8, Aug. 2021, doi: 10.3390/fi13080217.

[2] A. Singh Chouhan, M. Sanaullah Qasem, Q. Mohammed Abdul Basheer, and Ms. Asma Mehdiya, "Blockchain based EHR system architecture and the need of blockchain in healthcare," *Mater. Today Proc.*, Jul. 2021, doi: 10.1016/j.matpr.2021.06.114.

[3] W. Charles, N. Marler, L. Long, and S. Manion, "Blockchain compliance by design: Regulatory considerations for blockchain in clinical research," *Front. Blockchain*, p. 18, 2019.

[4] M. Shuaib, S. Alam, M. Shabbir Alam, and M. Shah Nawaz Nasir, "Compliance with HIPAA and GDPR in blockchain-based electronic health record," *Mater. Today Proc.*, Mar. 2021, doi: 10.1016/j.matpr.2021.03.059.

[5] A. Hasselgren, P. K. Wan, M. Horn, K. Kravetska, D. Gligoroski, and A. Faxvaag, "GDPR Compliance for Blockchain Applications in Healthcare," *ArXiv Prepr. ArXiv200912913*, 2020.