Chair of Network Architectures and Services
Department of Informatics
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Secure Multiparty Computation in the Internet of Things

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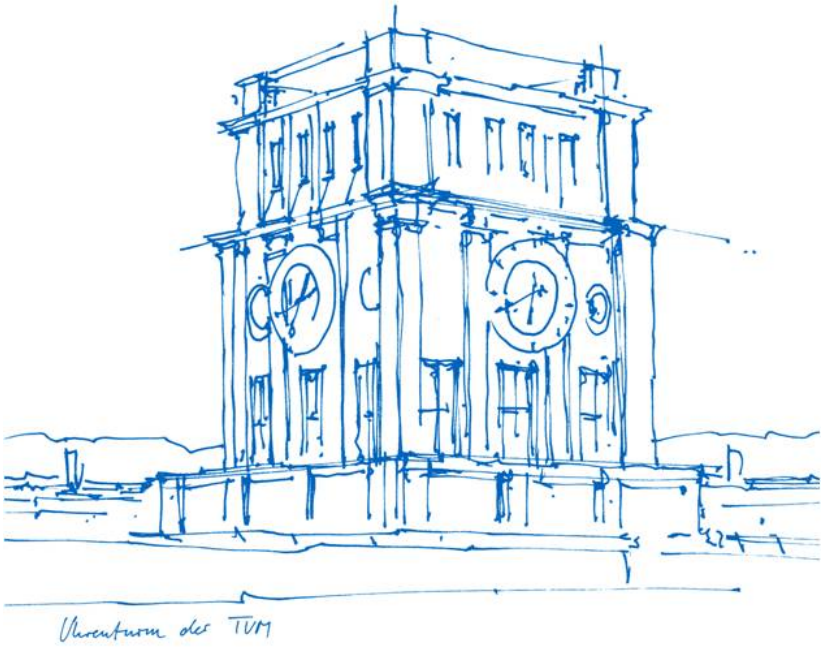

Focus: Smart Building / Smart Homes / Smart Offices

A Siemens building management system in Vienna, which can access some 10,000 sensors, provides extremely energy-efficient lighting, as well as temperature and ventilation optimization.

Focus: Smart Building / Smart Homes / Smart Offices

©Siemens

HVAC	Power Consumption	Fire Safety
Lighting	Presence Detection	Guidance Systems
Elevators	Environment Sensing	Energy Management

Abstraction

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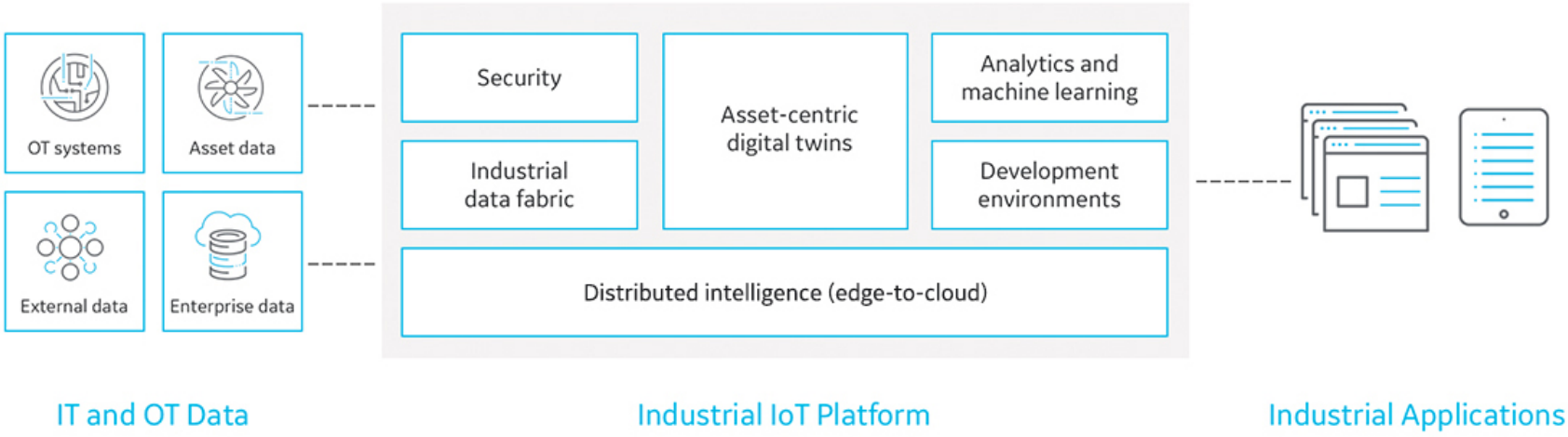
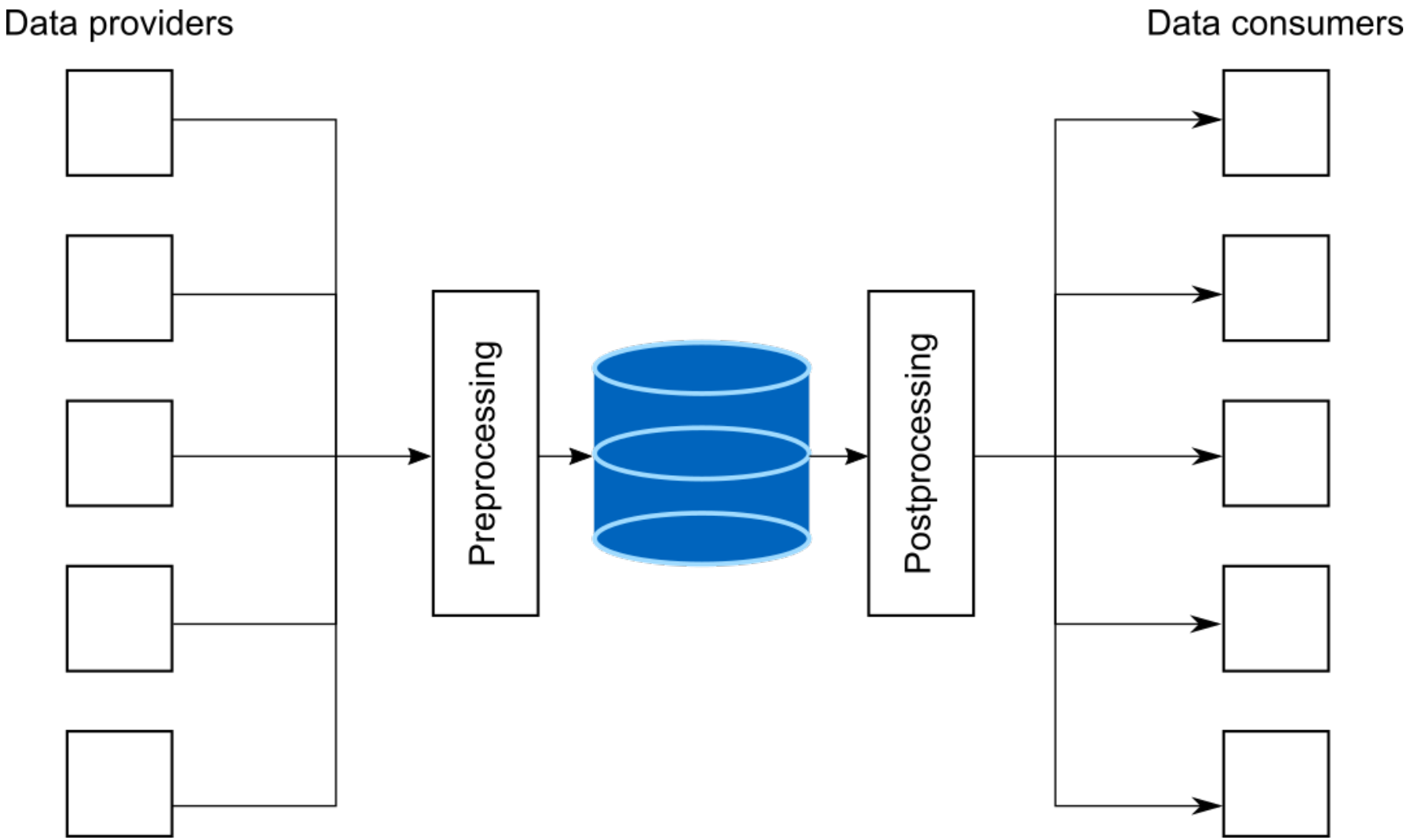


© General Electrics: Predix Platform

Abstraction



Problems

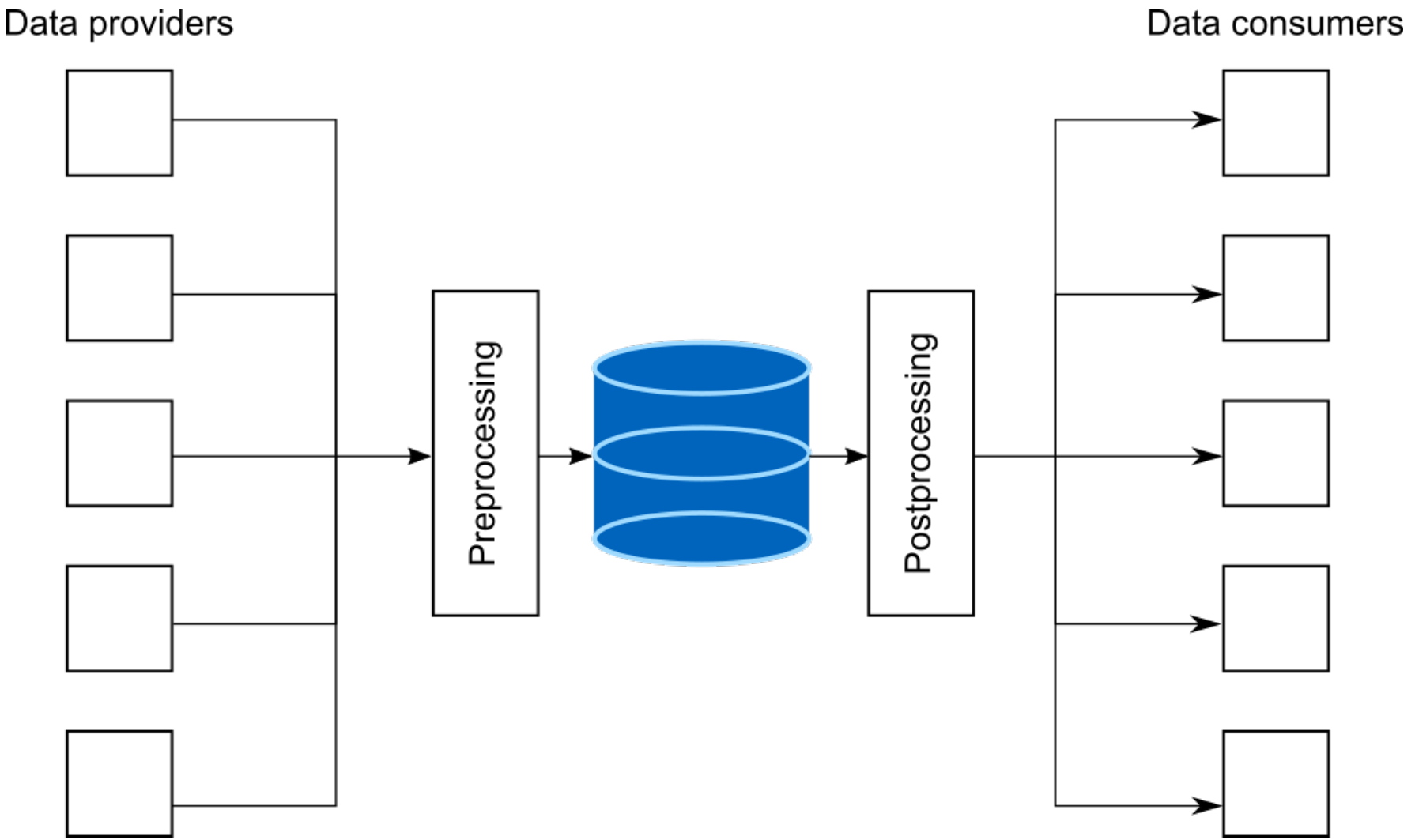
Security

- Collection of raw data
- History of previously collected data
- → Single point of attack, High value target

Privacy / Data Protection

- Personally identifiable/relatable information
- Collection and usage intransparent
- Lost of control
- Observation / Tracking / Surveillance
- → Threats to privacy
- → User acceptance?
- → Legal conformity?

Abstraction



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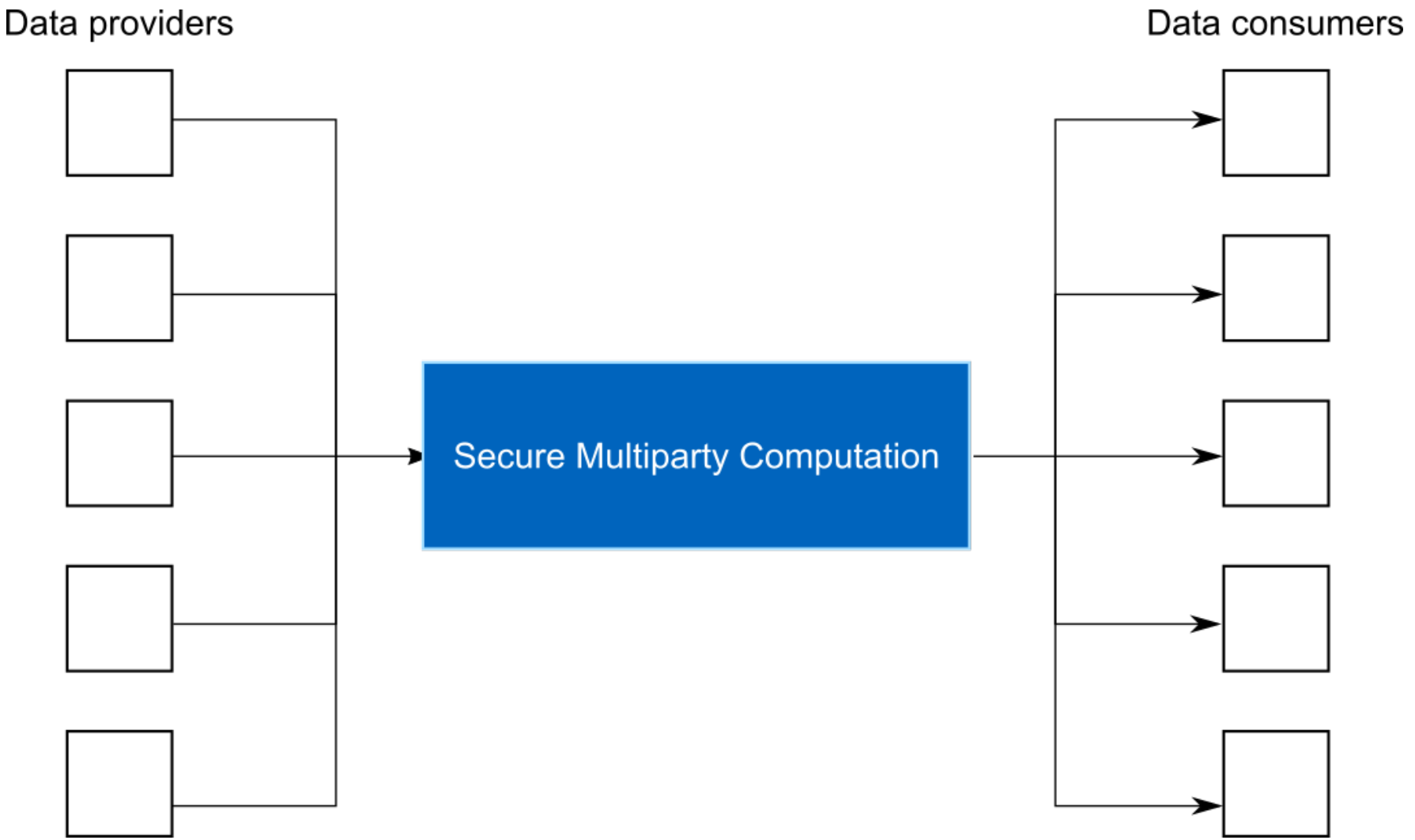
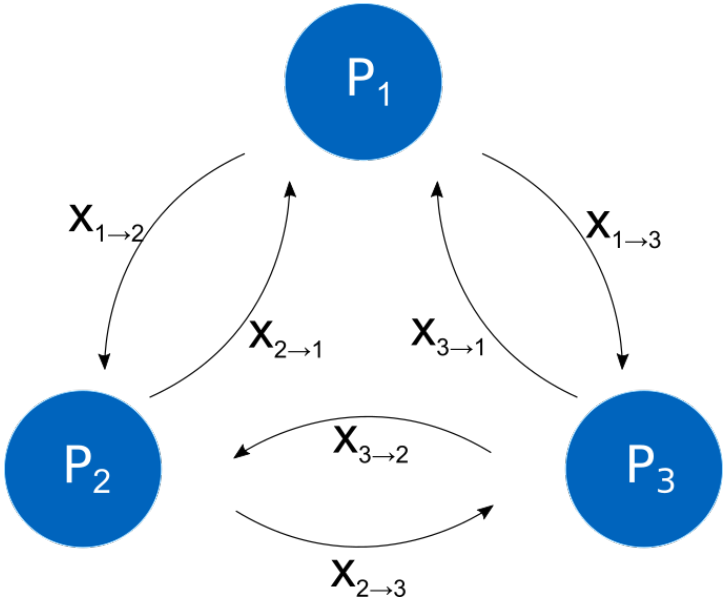


Background: Secure Multiparty Computation

There are n parties P_1, …, P_n. Each party P_i holds a secret value x_i. *Secure Computation* of $y = f(x_1, \ldots, x_n)$ is performed if two conditions are satisfied:

- Correctness: the correct value of *y* is computed
- Privacy: *y* is the *only* new information that is released



Example: Addition

Party	x_i	Share P_1	Share P_2	Share P_3
P_1	10	3	2	5
P_2	5	1	2	2
P_3	7	4	1	2
Result	22	8	5	9

Benefits

Confidentiality

- Raw input data only on collecting device

Unlinkability

- Results give no insights in input data
- Illegitimate combination of information from same device harder

Transparency

- Purpose of computation known due to participation
- Trustworthy accountability by individual parties

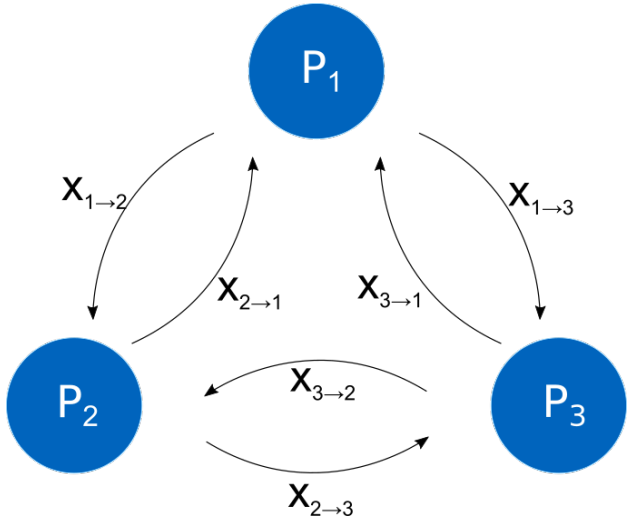
Intervenability

- Parties can refrain from participation → Veto-Mechanism

Challenges

Dynamic Environment

- Parties previously unknown
- Subsets of Parties
- Different input data
- Computations previously unknown



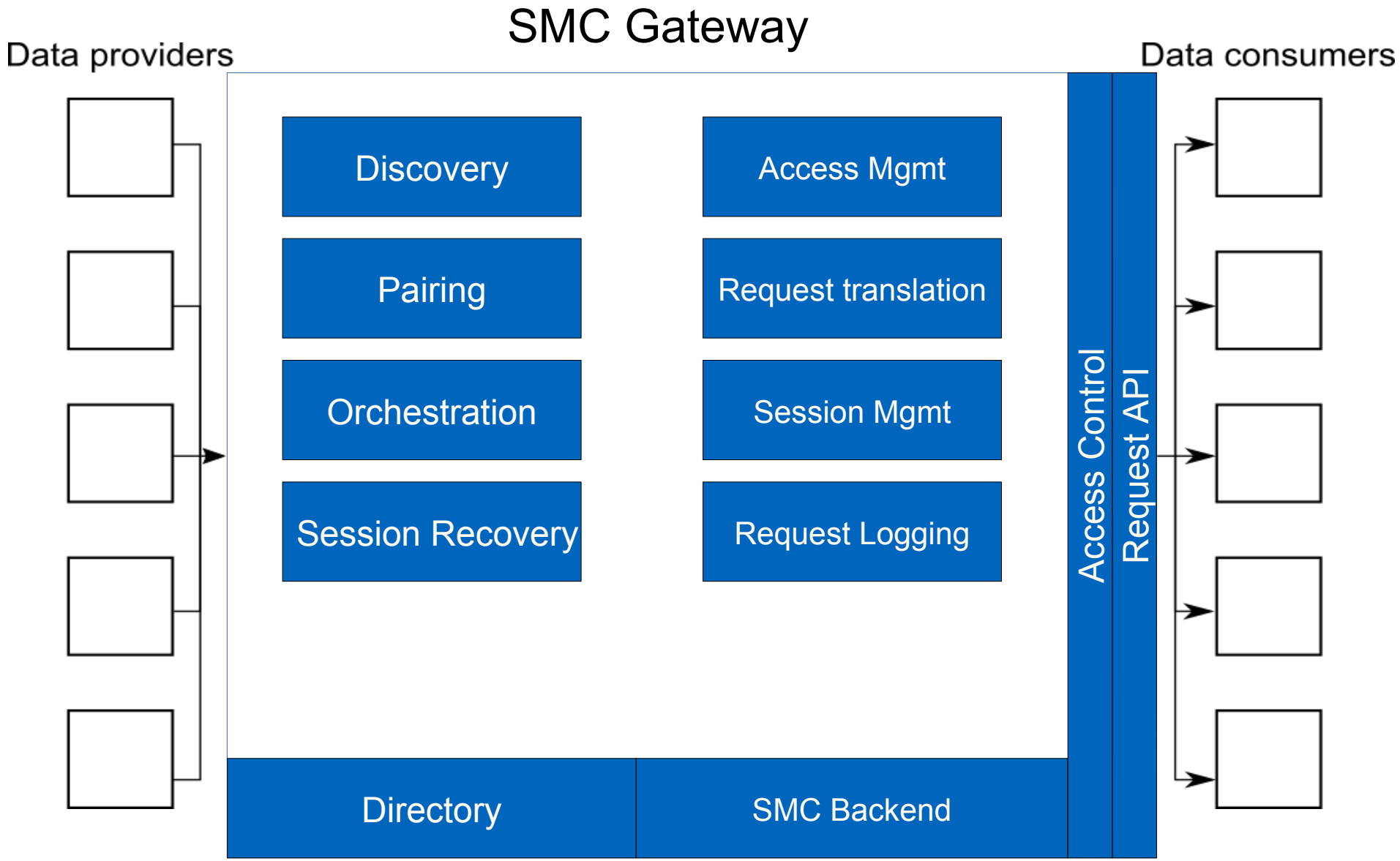
Orchestration of Computations

- Synchronized communication
- No error handling
- Only parties obtain result

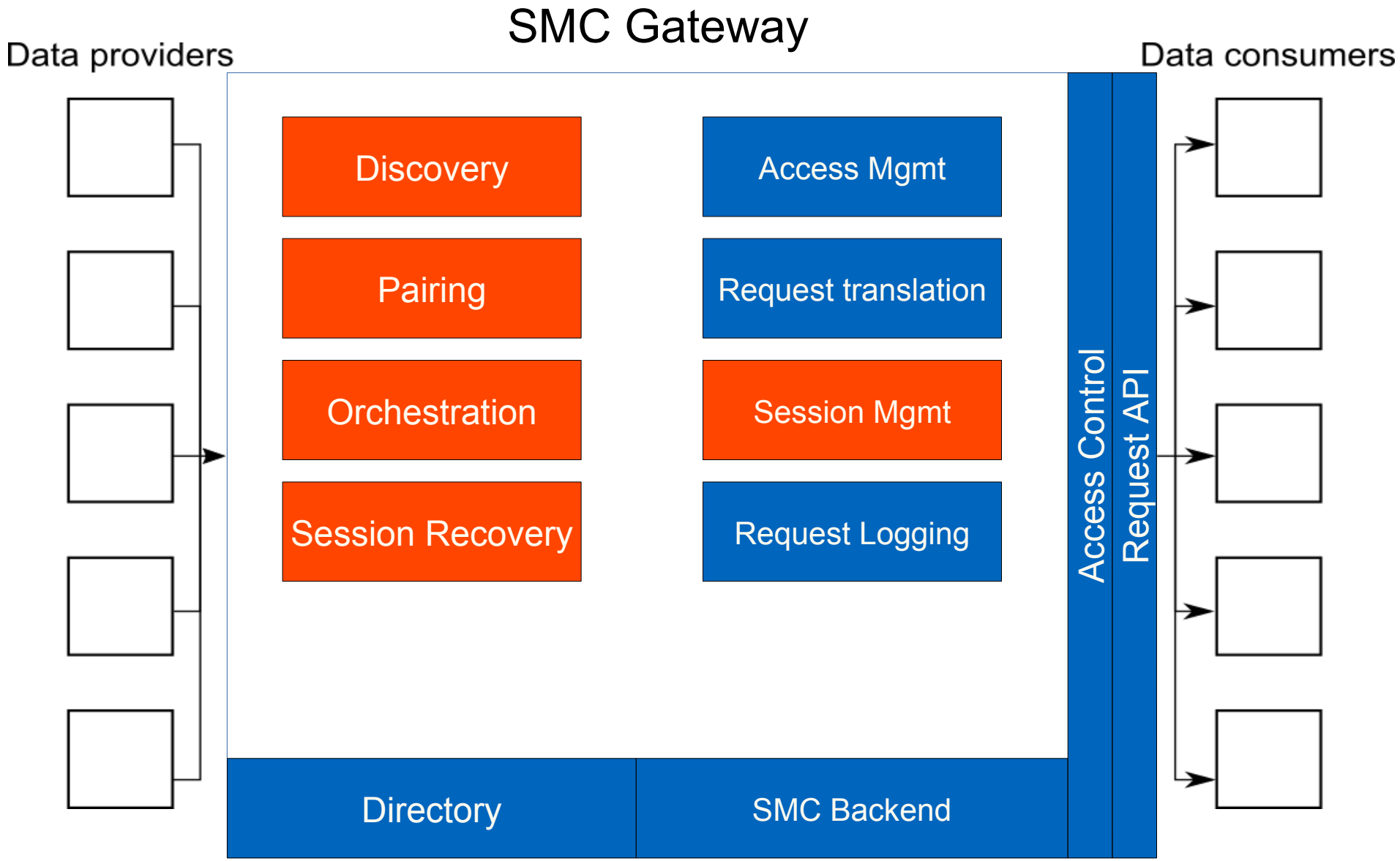
Service character

- Access for data consumers
- Metadata about available information
- Access control

Approach


SMC Gateway
Data providers
Data consumers
Discovery
Pairing
Orchestration
Session Recovery
Access Mgmt
Request translation
Session Mgmt
Request Logging
Access Control
Request API
Directory
SMC Backend

Approach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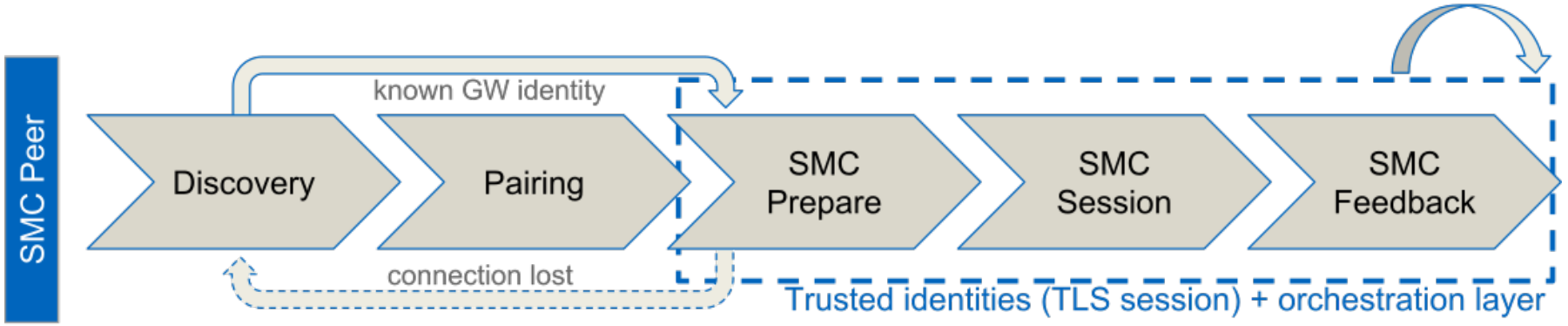
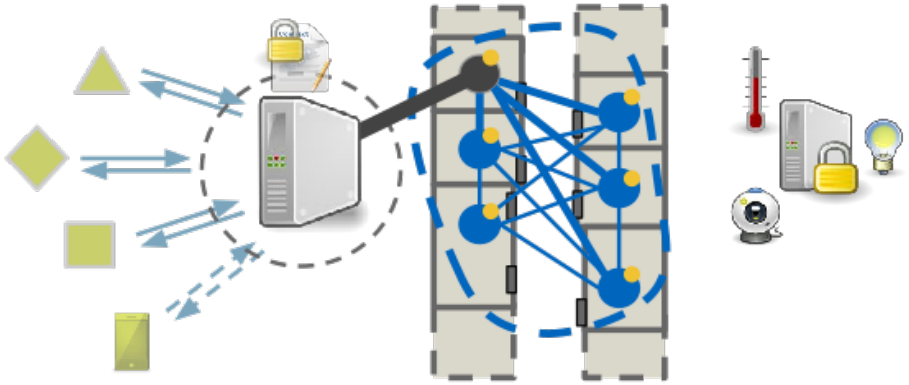
Approach: Self-organizing Parties

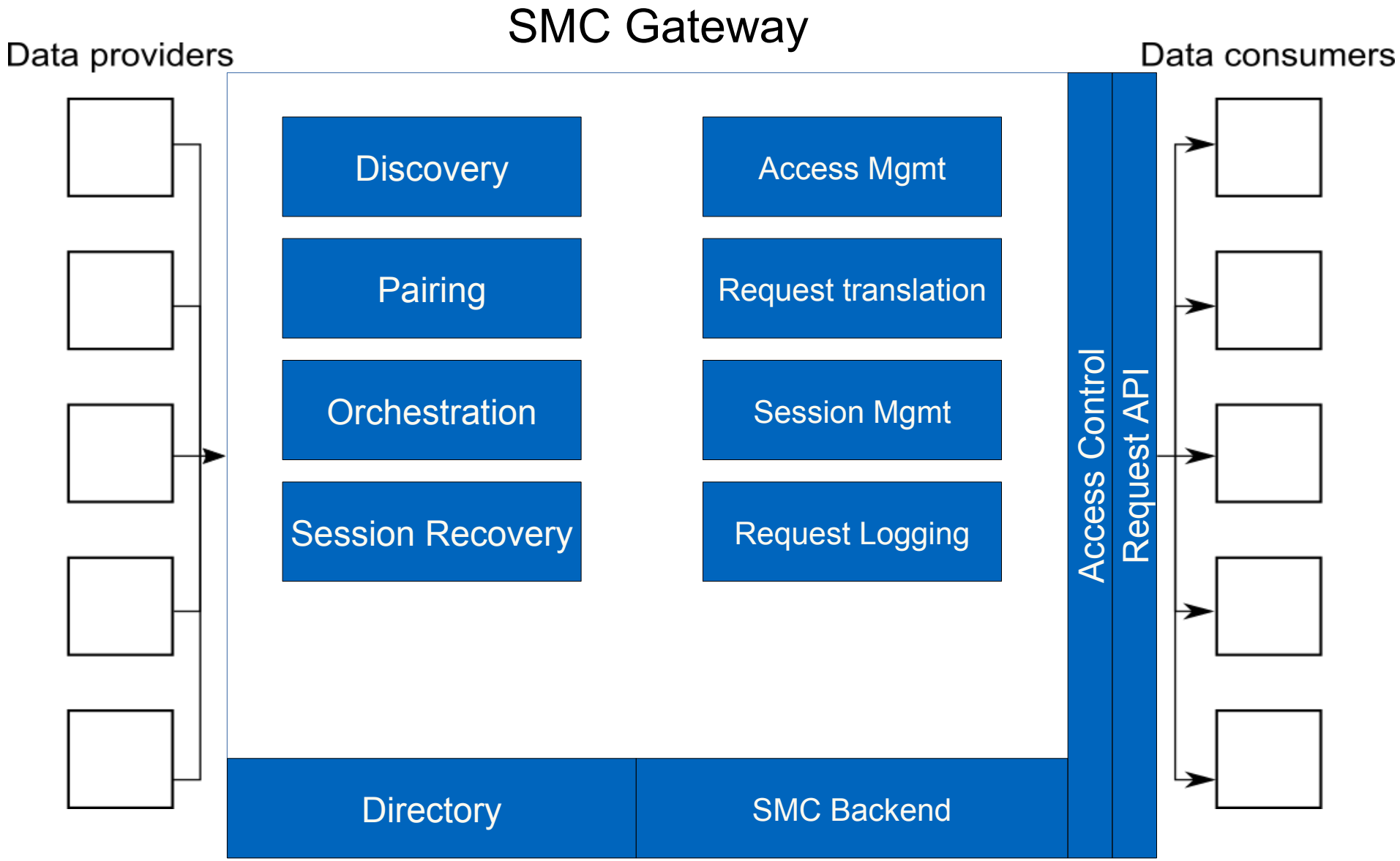


- Bonjour / Zeroconf
- Find GW with matching properties / responsibility
- Match capabilities
- x509 certs commissioning
- Out-of-bound verification
- Request verification
- Preprocessing with selectors
- Synchronized start of SMC
- Check for problems
- (Signed) result sent to GW



von Maltitz, M., Smarzly, S., Kinkelin, H., & Carle, G. (2018). A Management Framework for Secure Multiparty Computation in Dynamic Environments. To appear in Proceedings of NOMS 2018 -- IEEE/IFIP DOMINOS Workshop. Taipei, Taiwan.

Approach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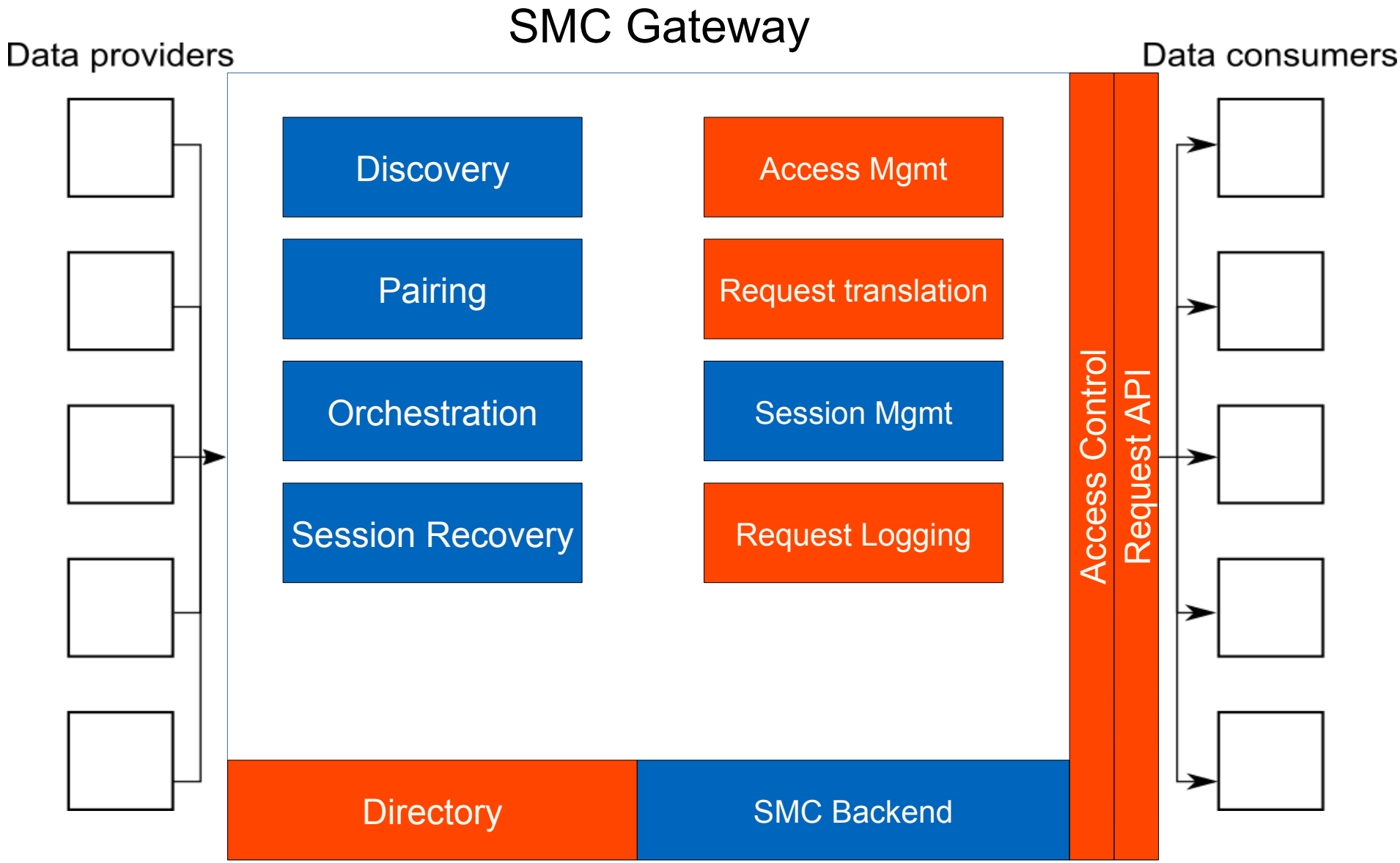
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Conclusion

Secure Multiparty Computation in the Internet of Things

- Promising approach
- Solves/mitigates several security and privacy problems in systems handling sensor data
- Challenges emerge from mismatch between SMC premises and properties of dynamic environments
- Convergence possible

Questions?