

QuanTM Architecture for Web Services

Insup Lee

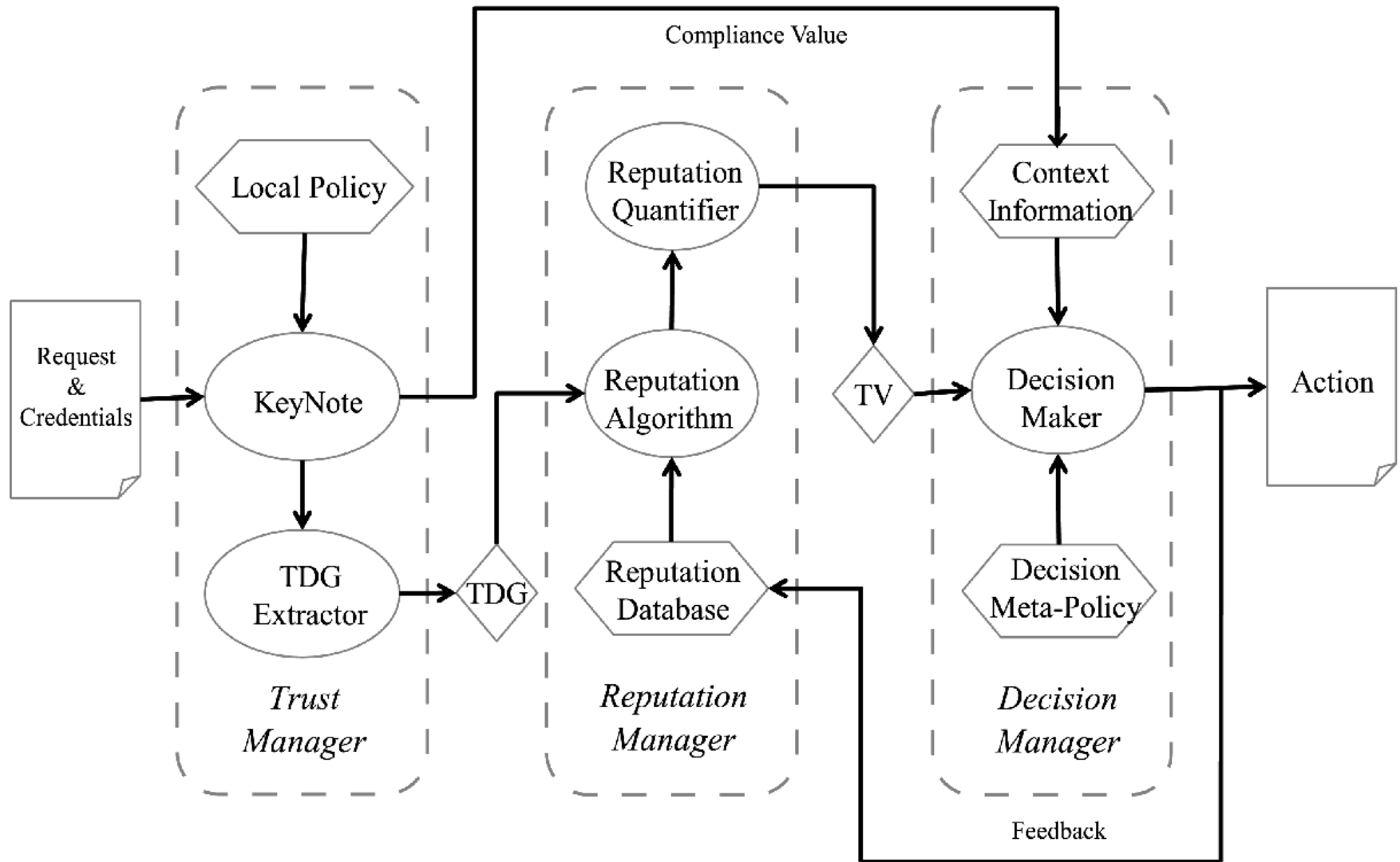
Computer and Information Science
University of Pennsylvania

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QuanTM Architecture

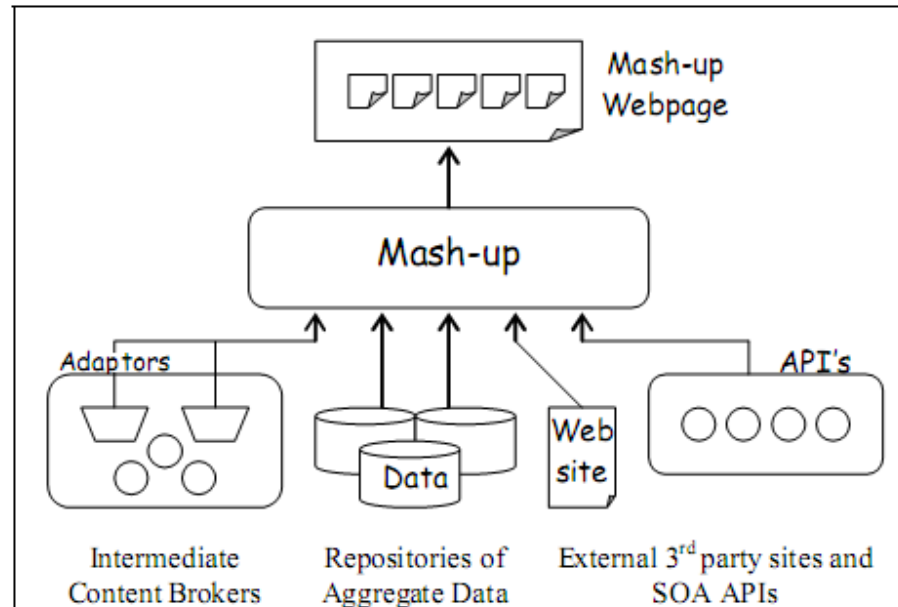


Application Area: Service Mashups

- What is Mashup:
 - Wikipedia definition
 - A mashup is a web page or application that uses or combines data or functionality from **two or many more** external sources to create a new service.
 - Definition from academia literature
 - A mashup is a website or web application that seamlessly combines content from **more than one** source into an integrated experience.
- Key aspect:
 - It involves multiple administrative/trust domains

Service Mashup

- Mashup Architecture



- For example, the content may be drawn from local data repositories, from existing local and external web pages, accessed via SOA based APIs, and from intermediate content brokers.

More on Mashup (cont.)

- Mashup Types:
 - Data mashups
 - combine **similar types** of media and information from multiple sources into a single representation
 - Consumer mashups
 - combines **different data types**. Generally visual elements and data from multiple sources
 - Business mashups
 - generally define applications that combine own resources, application and data, with other external web services, allowing for collaborative action among businesses and developers

Data Mashup Example

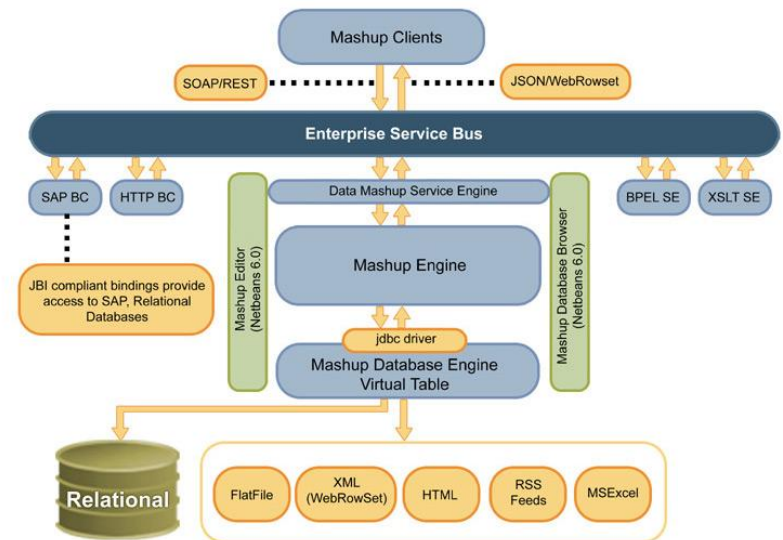
- RSS Feed

- Integrate new post on from various blogs, websites using Google Reader

- Integrate headline news from various news source, such as: NY-Times.com, CNN.com, and BBC.com

- Enterprise Data Mashup

- aggregate relational datastores represented as federated query server



Client Mashup Example

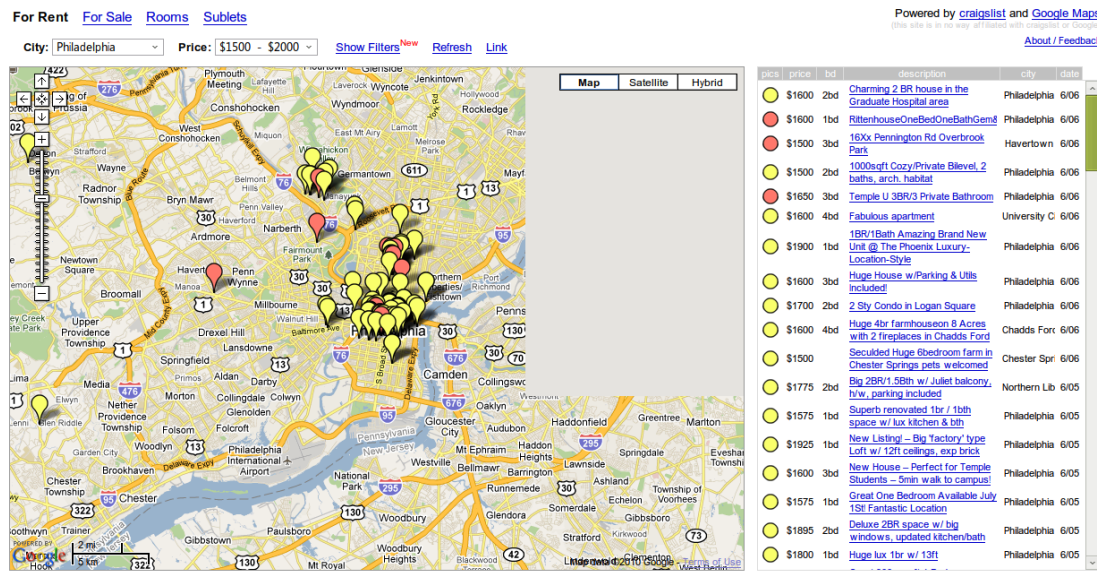
- One widely-cited example of web mashup:
 - www.housingmaps.com combines Google Maps data with Craigslist's housing data and presents an integrated view of the prices of the houses at various locations on the Google map.

For Rent For Sale Rooms Sublets

City: Philadelphia Price: \$1500 - \$2000 Show Filters Refresh Link

Powered by [craigslist](#) and [Google Maps](#)
(This site is in no way affiliated with craigslist or Google)

Map Satellite Hybrid

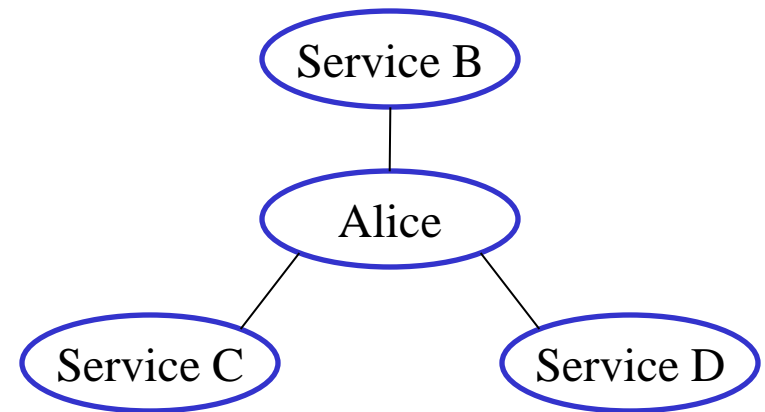


pic	price	bd	description	city	date
	\$1600	2bd	Charming 2 BR house in the Graduate Hospital area	Philadelphia	6/06
	\$1600	1bd	RittenhouseOneBedOneBathGem	Philadelphia	6/06
	\$1500	3bd	16Xx Pennington Rd Overbrook Park	Havertown	6/06
	\$1500	2bd	1000sqft Cozy/Private Bilevel, 2 baths, arch. habitat	Philadelphia	6/06
	\$1650	3bd	Temple U 3BR/3 Private Bathroom	Philadelphia	6/06
	\$1600	4bd	Fabulous apartment	University C	6/06
	\$1900	1bd	1BR/1Bath Amazing Brand New Unit @ The Phoenix Luxury- Location-Style	Philadelphia	6/06
	\$1600	3bd	Huge House w/Parking & Utills included!	Philadelphia	6/06
	\$1700	2bd	2 Sty Condo in Logan Square	Philadelphia	6/06
	\$1600	4bd	Huge 4br farmhouse 8 Acres with 2 Trappices in Charles Ford Seculed Huge 6bedroom farm in Chester Springs pets welcomed	Chadds For	6/06
	\$1500			Chester Spi	6/06
	\$1775	2bd	Big 2BR/1.5Bth w/ Juliet balcony, h/w, parking included	Northern Lb	6/05
	\$1575	1bd	Superb renovated 1br / 1bth space w/ lux kitchen & bth	Philadelphia	6/05
	\$1925	1bd	New Listing - Big Factory type Loft w/ 12ft ceilings, exp brick	Philadelphia	6/05
	\$1600	3bd	New House - Perfect for Temple Students - 5min walk to campus!	Philadelphia	6/05
	\$1575	1bd	Great One Bedroom Available July 1st! Fantastic Location	Philadelphia	6/05
	\$1895	2bd	Deluxe 2BR space w/ big windows, updated kitchen/bath	Philadelphia	6/05
	\$1800	1bd	Huge lux 1br w/ 13ft	Philadelphia	6/05

Business Mashup Example

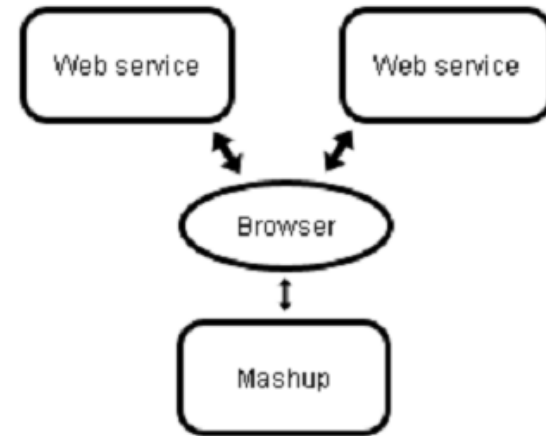
- E-trading mashup is a trading platform to allow their customers to trade globally.
- For a particular trading transaction:
 - Customer Alice initiates the trade request with Service B.
 - This is based on the pricing chart provided by Service C's charting service, with real-time price input from Service D.

Identity	Role
Alice	Trade Requestor
Service B	Trade Provider
Service C	Charting Service Provider
Service D	Real-time Price Provider



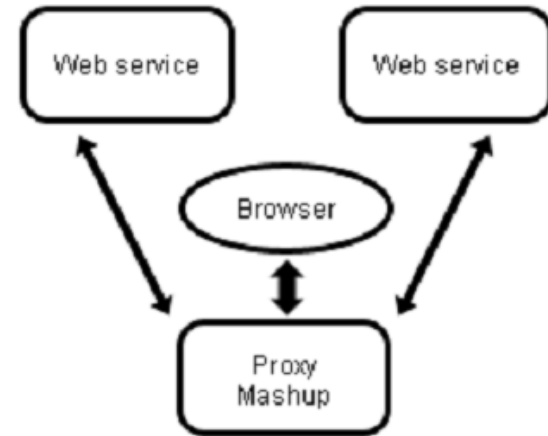
Web-based Mashup (WbM)

- Definition:
 - mashup typically use the user's Web browser to combine and reformat the data
- Challenges:
 - Need to transfer/share information cross multiple trust domains
- Limitations:
 - The current security model used by web browsers, the Same Origin Policy (SOP), does not support secure cross-domain communication desired by web mashup developers.
 - The developers need to choose between:
 - **no trust**: where no cross-site communication is allowed
 - **full trust**: where third-party content runs with the full privilege of the integrator (mashup provider), after explicit user consent

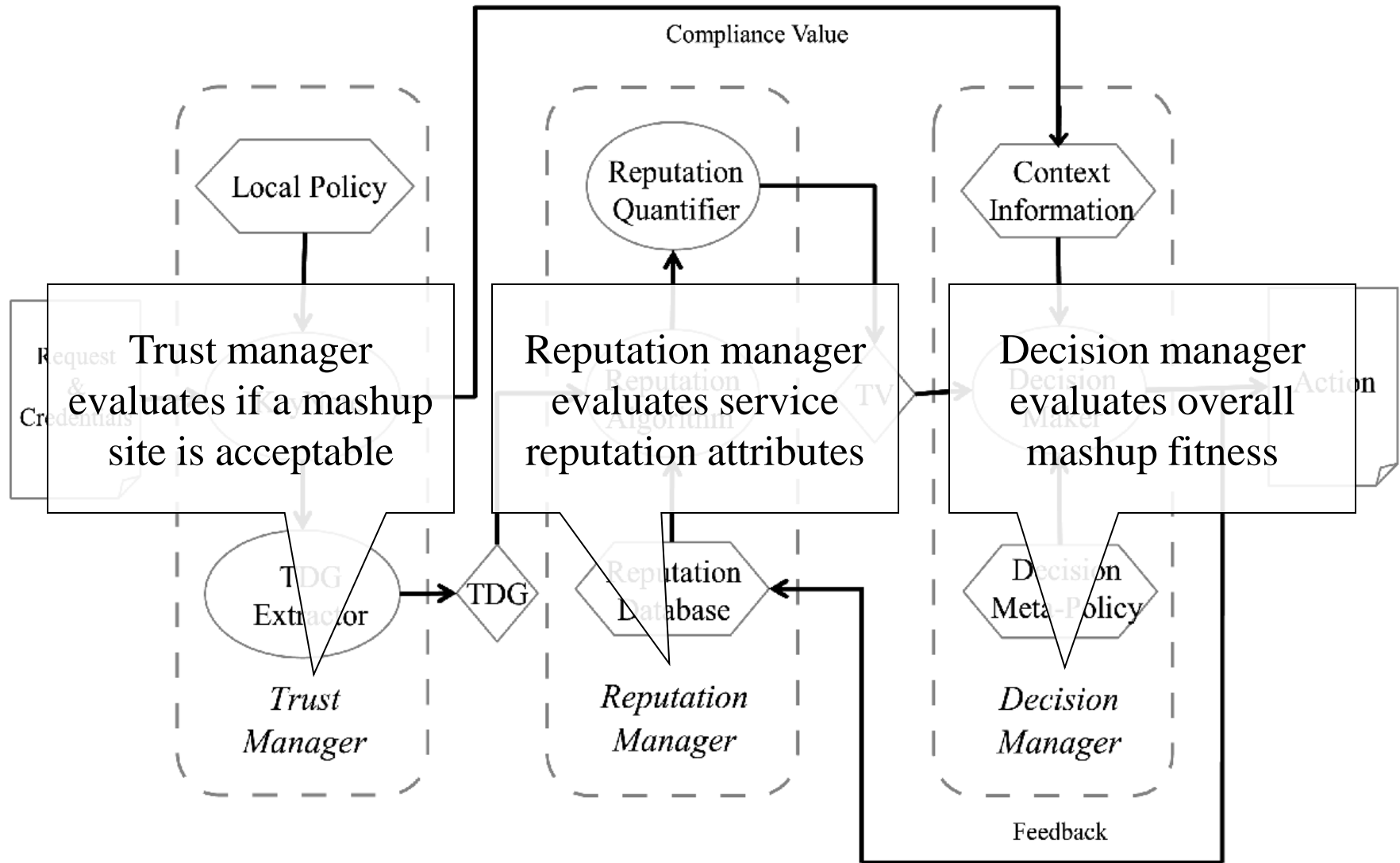


Server-based Mashup (SbM)

- Definition:
 - analyze and reformat the data on a remote server and transmit the data to the user's browser in its final form
- Features:
 - It does not suffer from the SOP limitation
 - Security issues can be addressed using corresponding security protocols/standards, such as: OAuth authentication technique
- Limitations:
 - Requires user to **give complete trust** to mashup providers on accessing his/her private data
 - Need a **proxy mashup service** instead of using client-side computation resource.



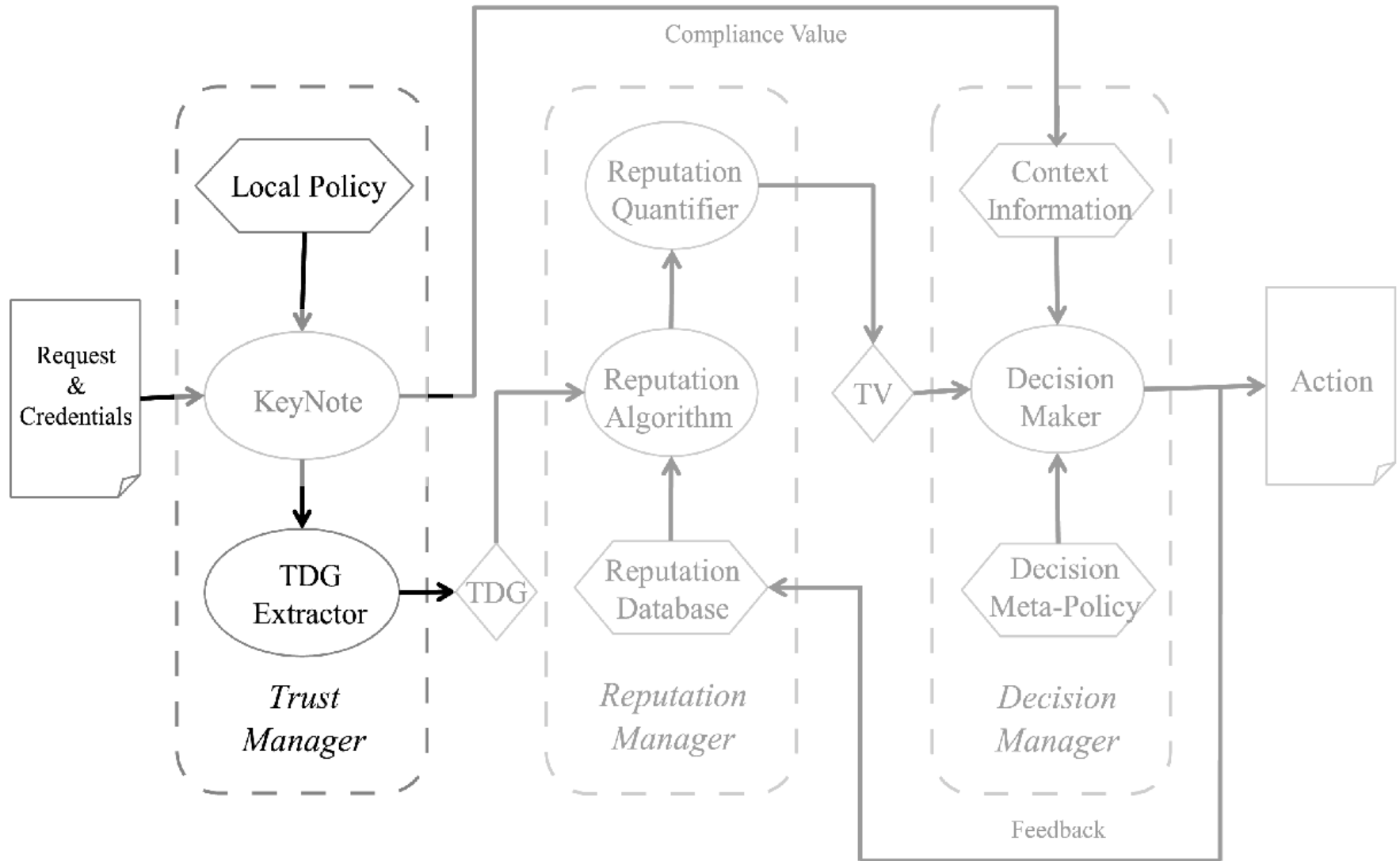
QuanTM to the rescue!



Which mashup to use/trust?

- QuanTM can be applied as a powerful trust framework, replacing current SOP
- Some mashups may be ruled out by *local policy*.
 - *E.g.,: no mashup is allowed to execute, if:*
 - some service components do not support secure connections
 - it needs third-party service to read user email contacts
- Acceptable mashup according to static local policy may have various trust-levels:
 - *E.g., one service component is known to leak user information to third-party violating privacy requirement*
- *Decision policy* used to make the final decision
 - Different from the aforementioned local policy above

Trust Manager

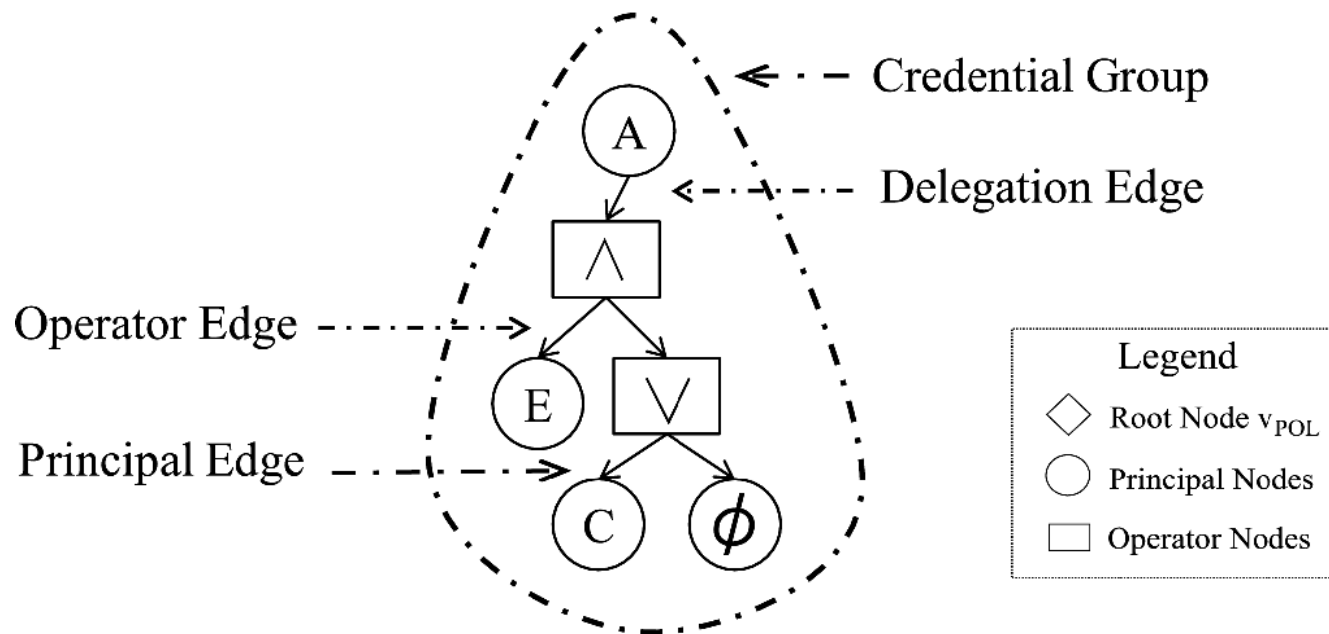


Trust Manager

- Identify service components of mashup
 - DNS name as identifier
- Use local policy to evaluate mashup compliance
 - Qualitative value representing compliance with the policy
- Construct trust dependency graph (TDG)
 - Based on mashup dataflow and workflow
 - May require analyzing underlying javascript code

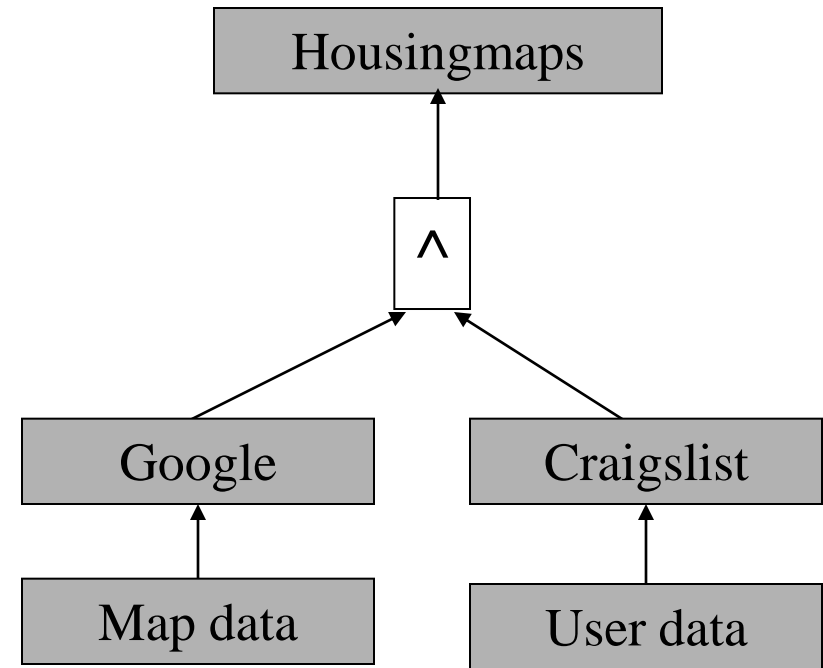
Trust Dependency Graph (TDG)

- An encoding of mashup workflow/dataflow
- Reflect trust in principals and trust relations
- Edges represent trust dependencies
- Reputations are assigned to TDG elements

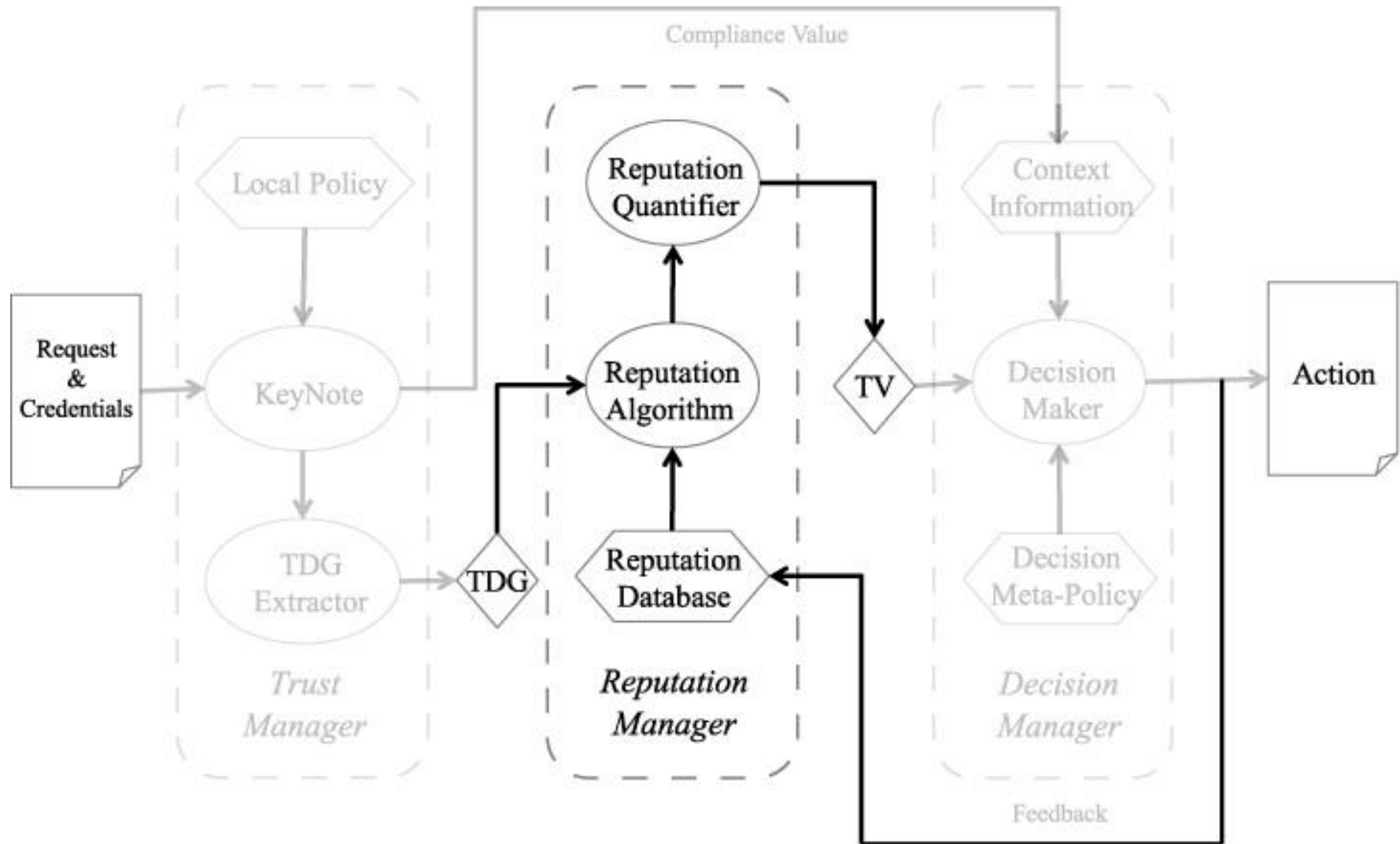


TDG for Housingmaps

- Data sources:
 - map data
 - house listings
- Services:
 - Google
 - overlay data on maps
 - Craigslist
 - deliver user data
 - Housingmaps
 - parse and filter data from Craigslist
 - send to Google
 - arrange results



Reputation Manager

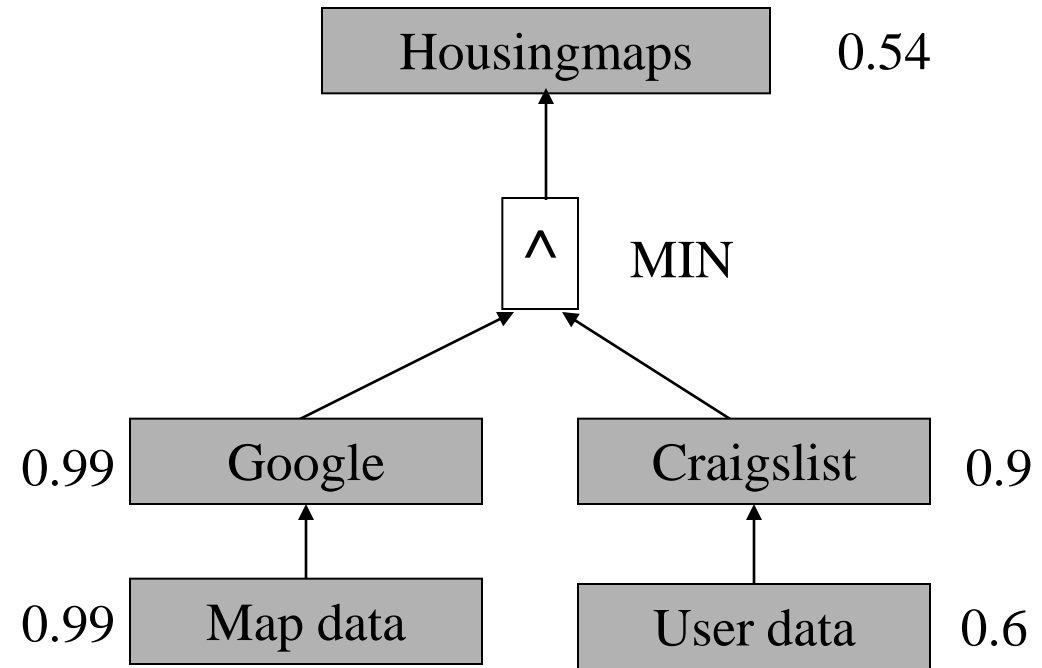


Reputation Manager

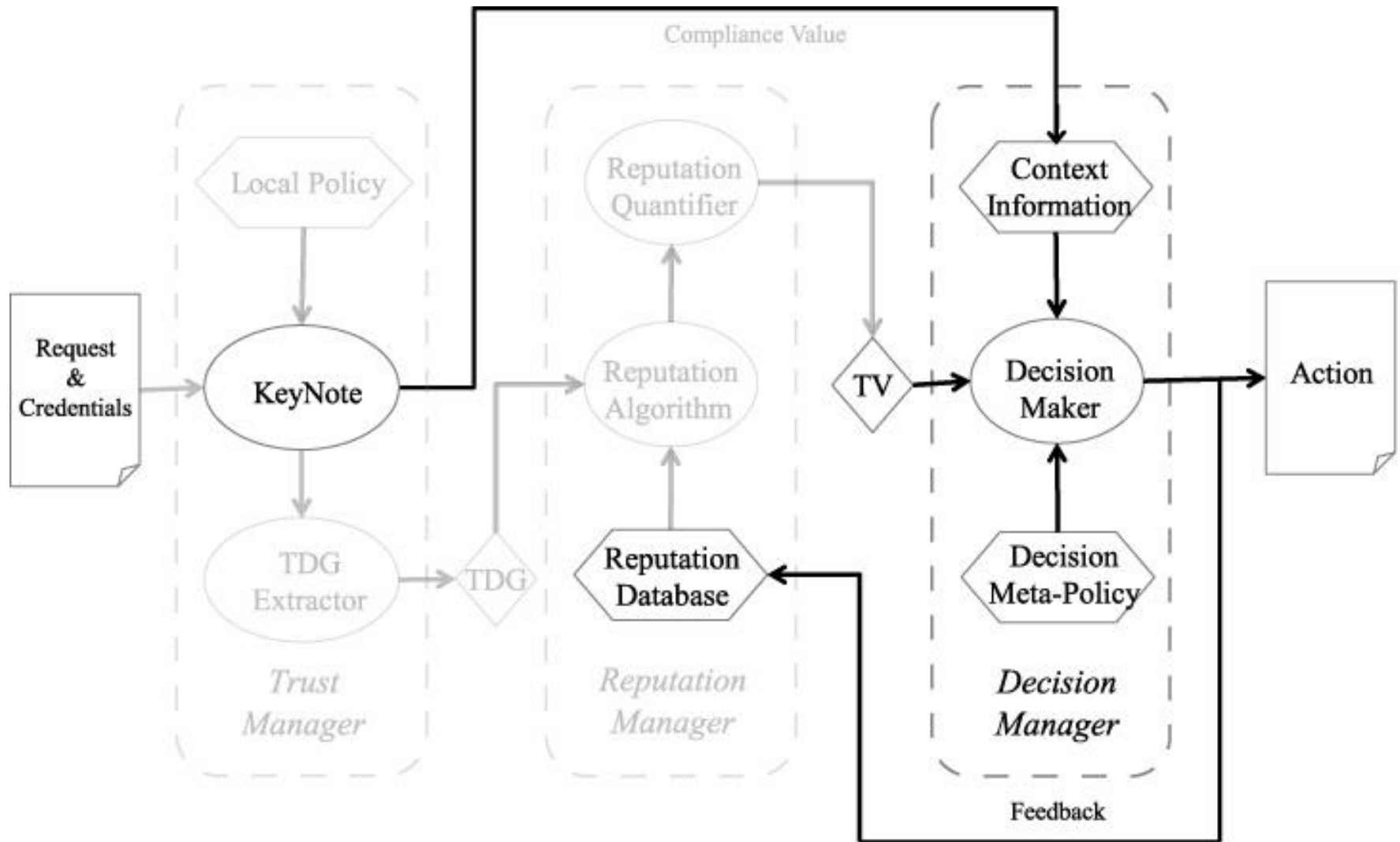
- Calculate trust value
 - Assign reputations to TDG edges using reputation values
 - “push” reputation values up the graph
- Build reputation using existing databases, e.g.,
 - General DNS reputation DB
 - Google PageRank
 - Trust-of-Web reputation DB
- Update reputation based on feedback
 - Past performance of the service
 - Experiences from other mashups and direct uses

TDG for Housingmaps with reputation

- Data sources:
 - map data
 - house listings
- Services:
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Decision Manager



Decision Manager

- Uses an user-specific meta-policy
 - Context monitors
 - Cost-benefit analysis
 - Game-theoretic formalization
- Simple example: Threshold policy
 - If $CV='maybe'$ and $TV > 0.5$ -> Fulfill request
 - If $CV='true'$ always fulfill request
 - In general, thresholds can be adaptive

Current and Future Work

- Design local policy language for WbM
 - Allow user to specify their static trust requirement
- Technique to construct TDG for WbM based on code (e.g., javascript) analysis
- Integrate available service reputation
 - E.g., DNS reputation, PageRank, Trust-of-Web Score
- Design Decision policy language for WbM
 - Allow user to specify their dynamic trust requirement
- Implementation of QuanTM WbM as extension for real-world application (e.g., Firefox web browser)
- TDG-carrying services

End

Applying QTM to Mashup

- Evaluation and selection of services to use
- Differences from access control:
 - “request” is now an entry for consideration
 - Services may be evaluated initially and/or re-evaluated periodically
 - “delegation” is one service using another as part of its operation
 - “policy” describes rules for selecting and comparing services
- Similarities:
 - Trust in an entity depends on dependencies and past performance
- Issues
 - **Accountability**
 - Authentication (access control) and non-repudiation guarantees need to be provided.
 - **Service Selection**
 - Need to understand the QoS of available service components, and choose the most suitable/trustworthy ones to build mashup