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Smart Service Efficiency: Evaluation of Cultural Trip Planning Service

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Introduction

- Various smart services in e-Tourism
  - New algorithms
  - New methods
  - New approaches
- Possible disadvantages by using smart services
  - Complexity
  - Development costs
  - High resource usage
  - Management limitations
- Open questions
  - How determine smart and regular service?
  - How do a smart service become fast?
  - How could manual work be decreased in a smart service?

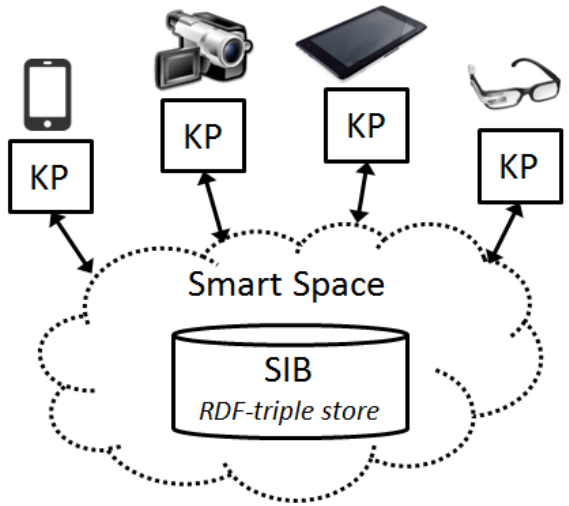
Smart service attributes

Attribute	Description
Multiple data sources	Service uses several third-party sources in the same request.
Composed services	Service uses several different services in the same request.
Personalized services	Service uses user info for clarification of the request, ordering lists and so on.
Human–computer interaction	Service provides user interface close to natural.
Self-learning	Service can detect and learn new material like facts, actions and so on.
Proactive automation	Service provide ability to perform actions without user intervention.
Collaborative work	Service provide ability to communication between users.

Cultural trip planning service

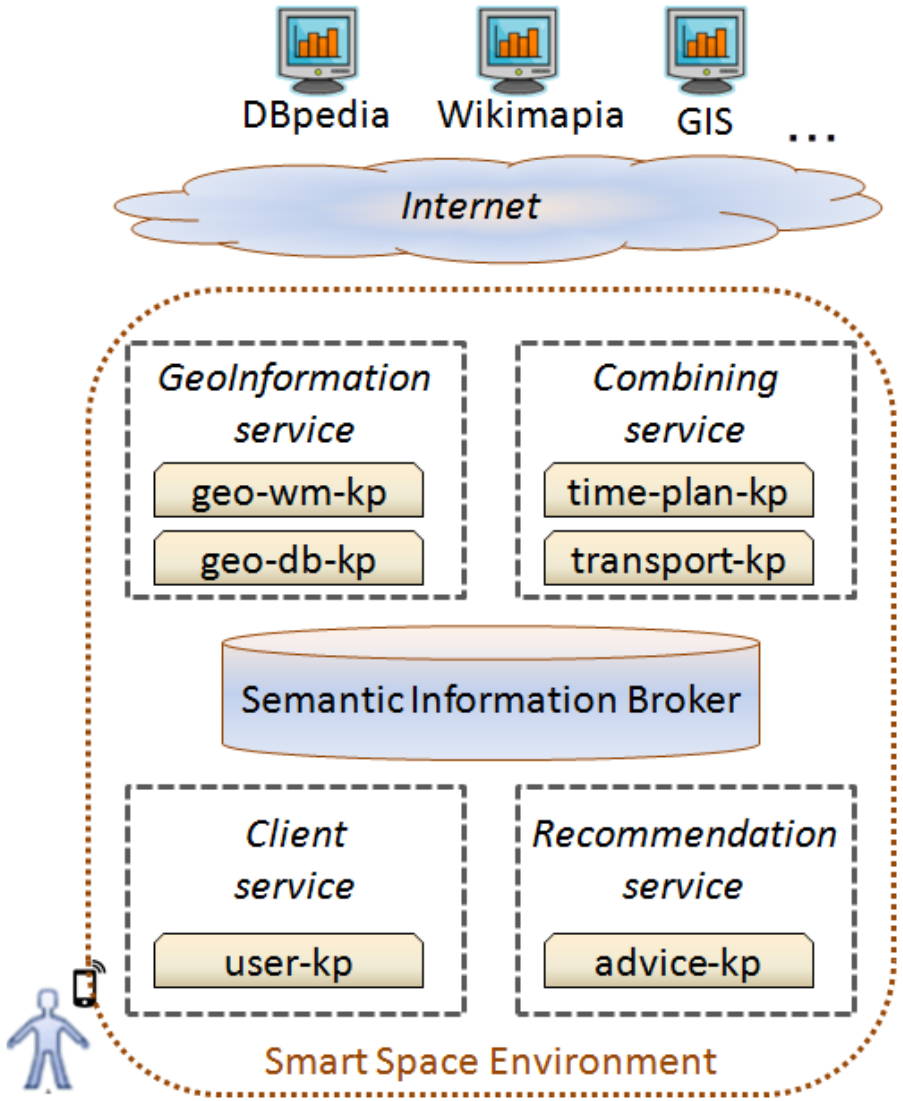
- Goal: create a trip plan based on tourist preference
- Abilities:
  - Search nearby attractions
  - View attractions on the map
  - Organize new trip by selecting a set of attractions to be visited
  - Calculate trip route as a result of solving traveling salesman problem
  - Create trip plan based on time delays and time costs

- Based on Smart Space technology
- Implementation uses Smart-M3 platform
- Tunable distributed architecture



High-level architecture of Cultural trip planning service

- **Client service** performs delivery, visualization and personalization of information for the user.
- **GeoInformation service** interacts with various external Internet services.
- **Recommendation service** provides a personalization.
- **Combining service** plans time and provides optimal route for attractions.



Smart service attribute presence in Cultural trip planning service

Attribute	Presence description
Multiple data sources	Service uses Wikimapia and DBpedia simultaneously. User KP shows combined result.
Composed services	Search action, route construction action and trip planning action. Actions can be used separately or coherently.
Personalized services	Service uses user data to personalize search requests and provide recommendations.
Human–computer interaction	Regular user interface, no ability to use natural input and output methods.
Self-learning	Each request are processed separately without any data accumulation.
Proactive automation	The User KP requires user intervention in all actions. Service provides recommendations in semiautomatic mode which is not fully proactive.
Collaborative work	Service does not provide communication between users.

Common approach

Goal: estimate total resource usage and human work by comparing smart and regular services

Common work scenario for information service

1. Service open
2. Input request
3. Wait result
4. Result analyze

- Work time: $T = \frac{T_s}{T_{ns}}$

$$T_s = T_s^{open} + T_s^{input} + T_s^{wait} + T_s^{analyze} \quad (1)$$

$$T_{ns} = T_{ns}^{open} + T_{ns}^{input} + T_{ns}^{wait} + T_{ns}^{analyze} \quad (2)$$

- Handwork automation: $A = \frac{A_s}{A_{ns}}$

$$A_s = T_s^{input} + T_s^{analyze} \quad (3)$$

$$A_{ns} = T_{ns}^{input} + T_{ns}^{analyze} \quad (4)$$

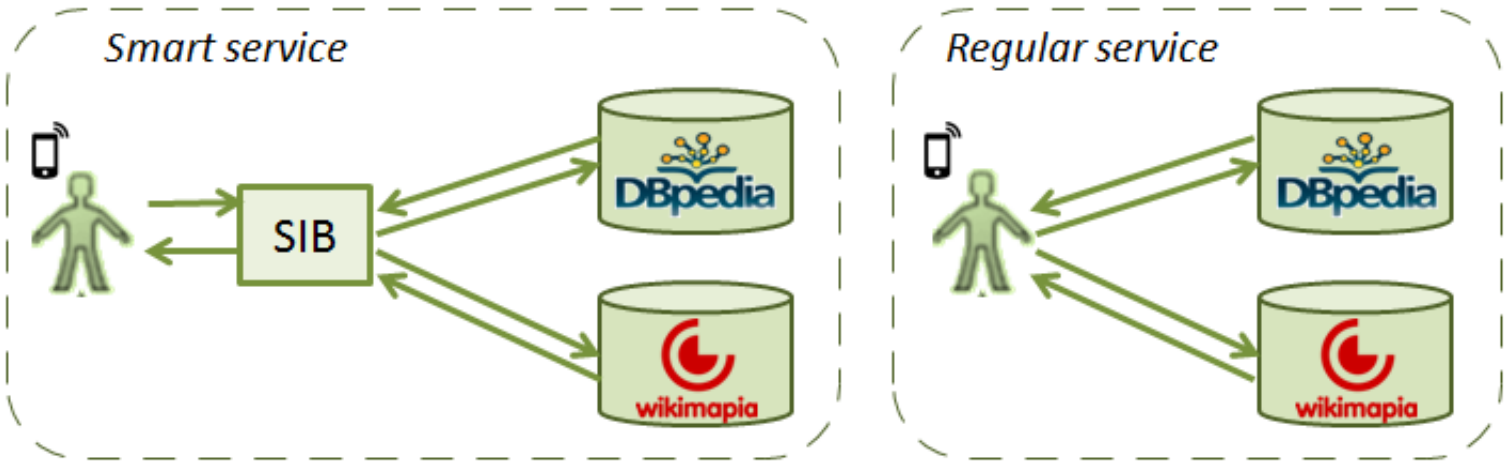
Input rate (mobile device) [Source: Soukoreff and Mackenzie, 1995]:

- “novice users”: 9 words per minute
- “regular users”: 15 words per minute
- “advanced users”: 30 words per minute

Multiple data sources

Description

- Smart service: automatically combine results from a set of third-party data sources
- Regular service: set of small services and each service provides access to a single third-party data source



Multiple data sources

Calculation

- "Work time" estimation:

$$T_{\mathrm{s}} = T_{\mathrm{s}}^{\mathrm{open}} + T_{\mathrm{s}}^{\mathrm{input}} + T_{\mathrm{s}}^{\mathrm{wait}},$$

$$T_{\mathrm{ns}} = \sum_{i \in I} \left(T_i^{\mathrm{open}} + T_i^{\mathrm{input}} + T_i^{\mathrm{wait}} \right) + T_{\mathrm{ns}}^{\mathrm{combine}}$$

  - I – a set of data sources
  - T_i^{open} – a time to open a data source i
  - T_i^{input} – a time to input request into a data source i
  - T_i^{wait} – a time to wait from data source i
  - $T_{\mathrm{ns}}^{\mathrm{combine}}$ – a time to combine results from multiple data sources

- "Handwork automation" estimation:

$$A_s = T_{\mathrm{s}}^{\mathrm{input}}, \quad A_{\mathrm{ns}} = \sum_{i \in I} \left(T_i^{\mathrm{input}} \right) + T_{\mathrm{ns}}^{\mathrm{combine}}$$

Multiple data sources

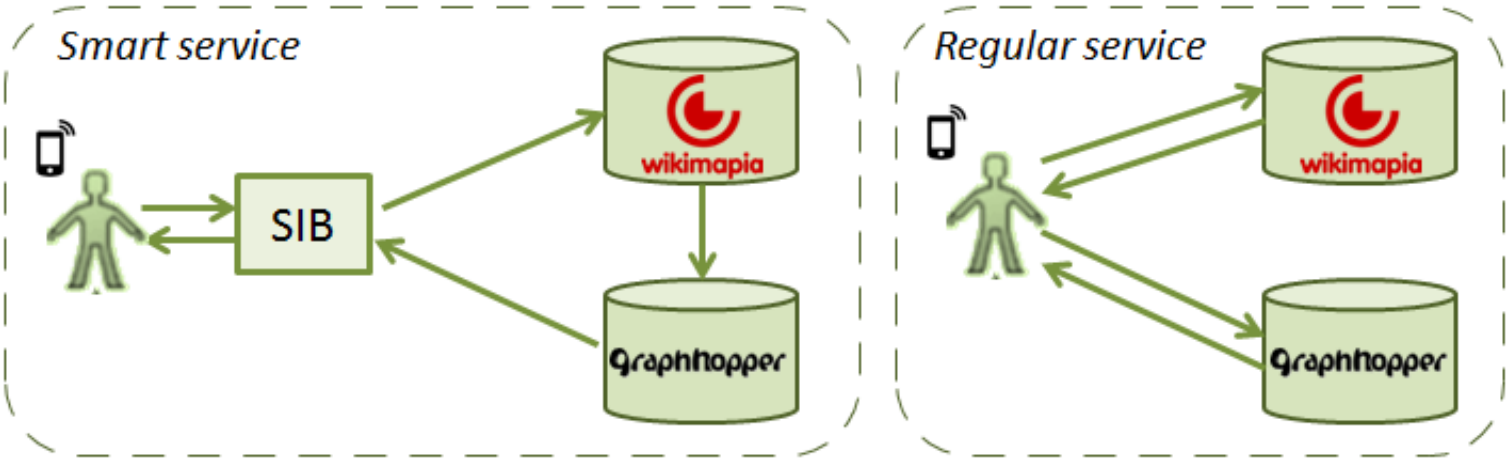
Results of experiments

Service	Novice users	Regular users	Advanced users
Smart service	$T_s = 11.30$, $A_s = 6.67$	$T_s = 8.63$, $A_s = 4.00$	$T_s = 6.63$, $A_s = 2.00$
Regular service	$T_{ns} = 66,22$, $A_{ns} = 60.00$	$T_{ns} = 42,22$, $A_{ns} = 36.00$	$T_{ns} = 24,22$, $A_{ns} = 18.00$

Composed services

Description

- Smart service: coherently uses actions (search action, route construction action and trip planning action)
- Regular service: manual data transformation from output result of one service to input of another service, manual run separate services



Composed services

Calculation

- “Work time” estimation:

$$T_{\text{s}} = T_{\text{s}}^{\text{open}} + T_{\text{s}}^{\text{input}} + T_{\text{s}}^{\text{wait}},$$

$$T_{\text{ns}} = \sum_{i \in I} \left(T_i^{\text{open}} + T_i^{\text{input}} + T_i^{\text{wait}} + T_i^{\text{transform}} \right)$$

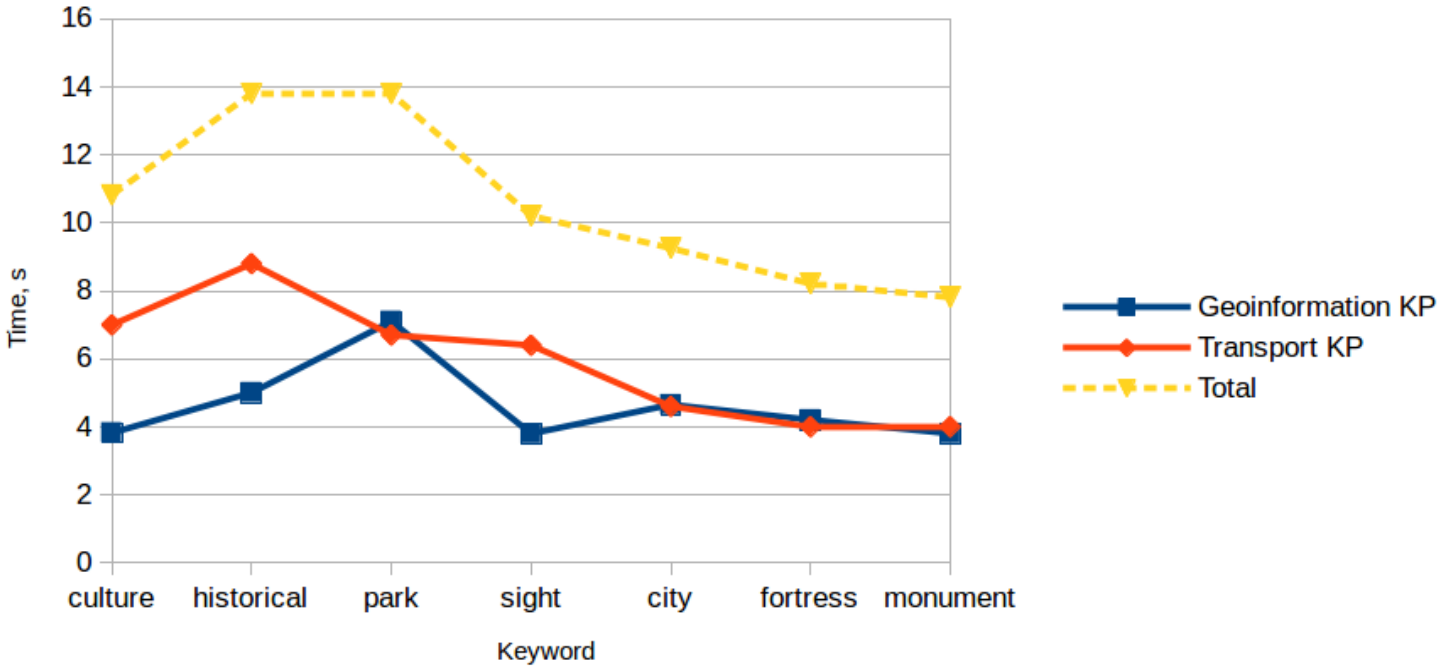
  - $T_i^{\text{transform}}$ is a time of manual data transformation to input for service i

- “Handwork automation” estimation:

$$A_{\text{s}} = T_{\text{s}}^{\text{input}}, \quad A_{\text{ns}} = \sum_{i \in I} \left(T_i^{\text{input}} + T_i^{\text{transform}} \right).$$

Composed services

Results

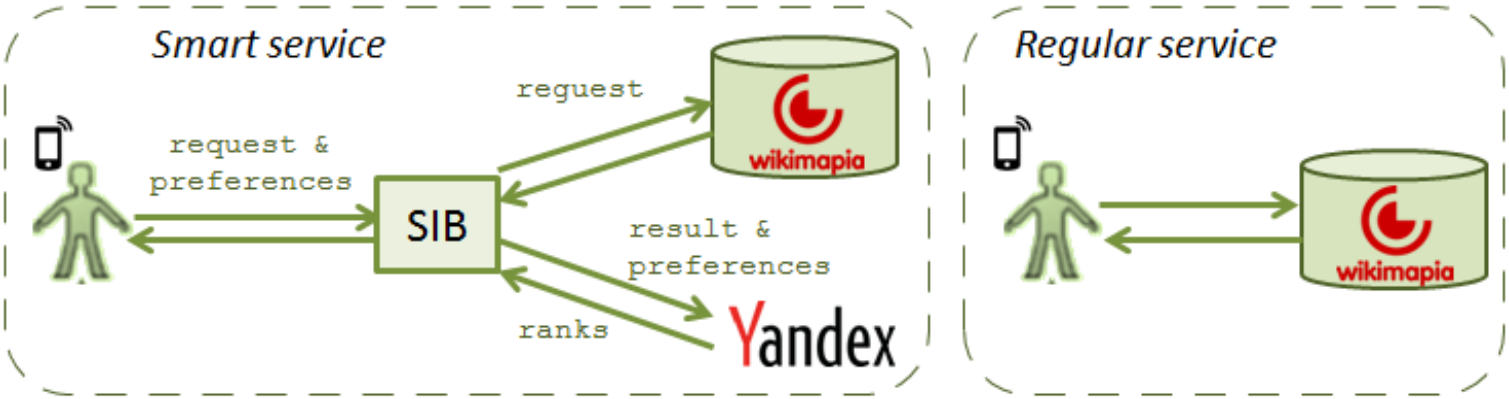


Service	Novice users	Regular users	Advanced users
Smart service	$T_s = 17.23$, $A_s = 6.67$	$T_s = 14.56$, $A_s = 4.00$	$T_s = 12.57$, $A_s = 2.00$
Regular service	$T_{ns} = 243,90$, $A_{ns} = 233.00$	$T_{ns} = 150,56$, $A_{ns} = 140.00$	$T_{ns} = 80,57$, $A_{ns} = 70.00$

Personalized services

Description

- Smart service: personalize search request by using additional data (preferences)
- Regular service: the same result for different users if they use the same request



Personalized services

calculation

- “Work time” estimation:

$$T_{\text{s}} = T_{\text{s}}^{\text{open}} + T_{\text{s}}^{\text{context}} + T_{\text{s}}^{\text{query}} + T_{\text{s}}^{\text{wait}},$$

$$T_{\text{ns}} = T_{\text{ns}}^{\text{open}} + T_{\text{ns}}^{\text{input}} + T_{\text{ns}}^{\text{wait}}$$

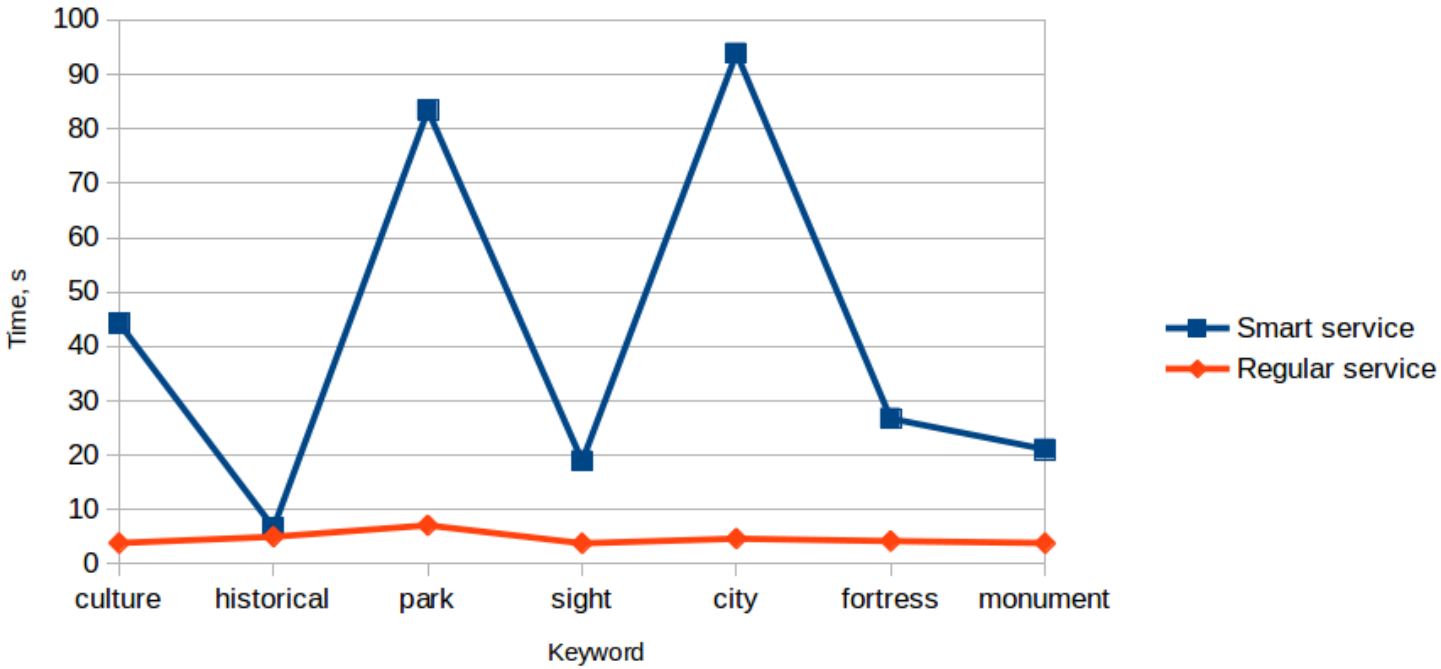
  - $T_{\text{s}}^{\text{context}}$ – a time to create and fill user context
  - $T_{\text{s}}^{\text{query}}$ – a time to input query

- “Handwork automation” estimation:

$$A_{\text{s}} = T_{\text{s}}^{\text{context}} + T_{\text{s}}^{\text{query}}, \quad A_{\text{ns}} = T_{\text{ns}}^{\text{input}}$$

Personalized services

results



Service	Novice users	Regular users	Advanced users
Smart service	$T_s = 48.86$, $A_s = 6.67$	$T_s = 46.14$, $A_s = 4.00$	$T_s = 44.14$, $A_s = 2.00$
Regular service	$T_{ns} = 37.97$, $A_{ns} = 33.33$	$T_{ns} = 24.63$, $A_{ns} = 20.00$	$T_{ns} = 14.63$, $A_{ns} = 10.00$

Conclusion

- Presented results of several experiments for efficiency evaluation of a Cultural trip planning service.
- Evaluation was based on introduced list of smart attributes which includes “multiple data sources”, “composed services” and “personalized services” smart attributes.
- “Work time” and “handwork automation” estimates showed increasing of speed and reducing of manual work.
- The results of evaluation for “personalized services” smart attribute shows advantage of smart service for manual work but regular service works faster.

Thank you for attention

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