Egyptian E-Learning University (EELU)
Faculty of Computers and Information Technology

The Web Engineering 3

Introduction to Semantic Web

Lecture 1

Introduction to Semantic Web

Presented by

Prof. Khaled Wassif

Course Topics

- Introduction to the semantic web.
- Semantic web technologies and layered approach.
- Structured web documents in XML.
- Describing web resources in basic elements of Resource Description Framework (RDF).
- Web Ontology Language: OWL.
- Ontologies Applications.

Course References

1. Grigoris Antoniou, Paul Groth, Frank van Harmelen, Rinke Hoekstra, "A Semantic Web Primer", 2012.

2. John Domingue, Dieter Fensel, James A. Hendler, "Introduction to the Semantic Web Technologies", 2011.

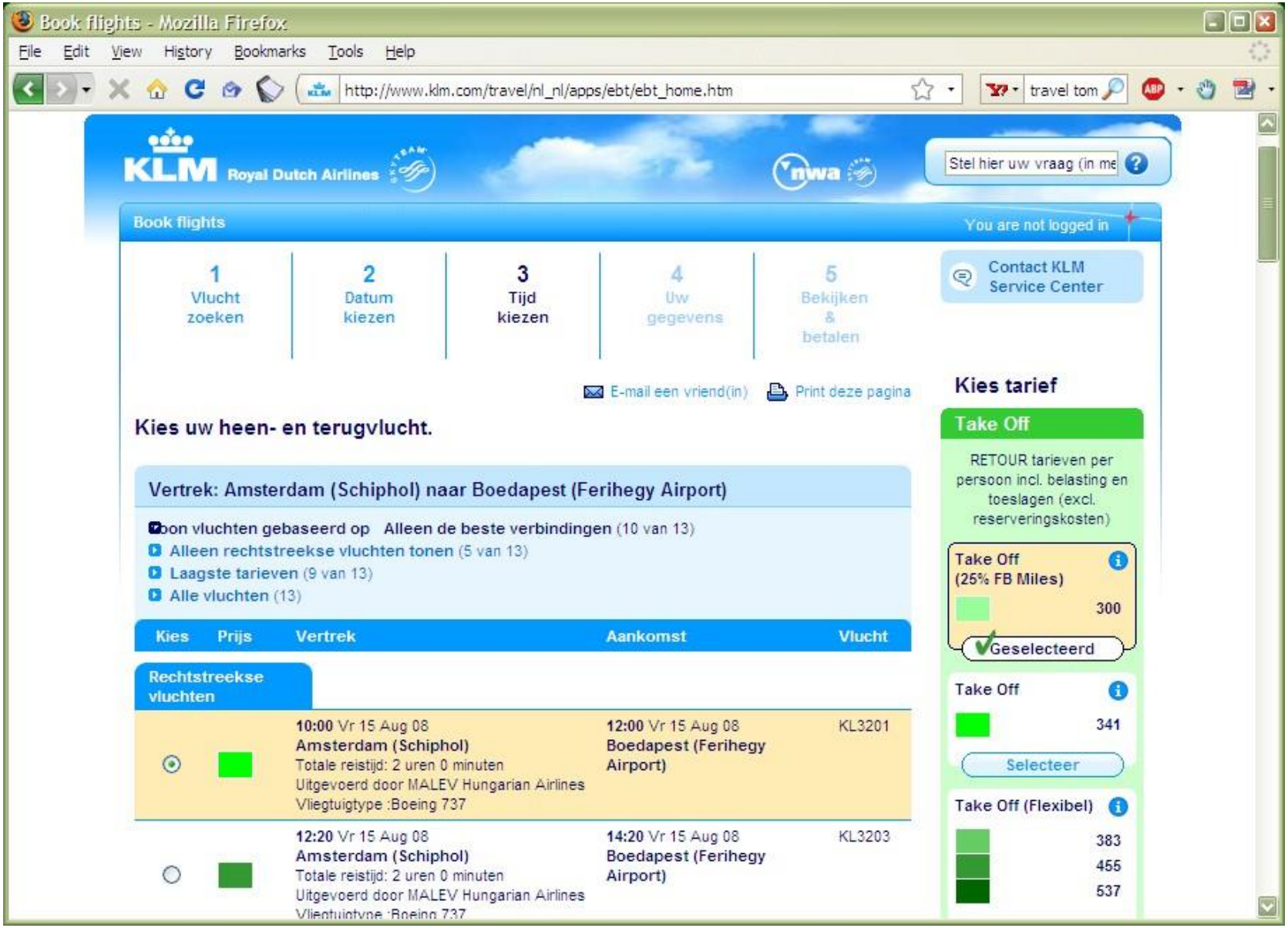
Lecture 1 Outline

- Practical example showing the current web data management.
- What are the problems with the web?
- What is the semantic web?
- Knowledge Management (KM)

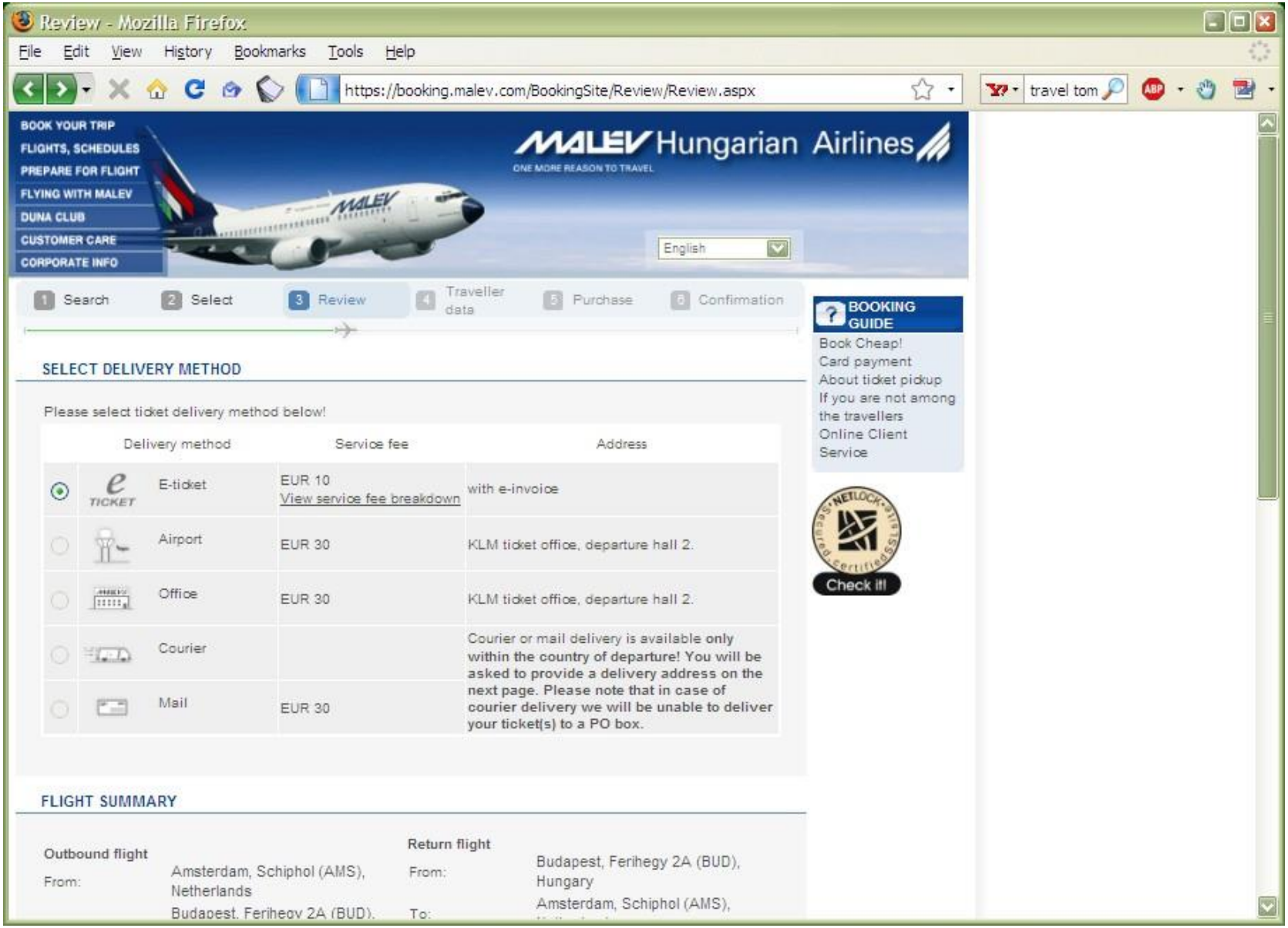
Let’s organize a trip to Budapest using the Web!

Step 1: You try to find a proper flight with …

… a big, reputable airline, or …



… a big, reputable airline, or …



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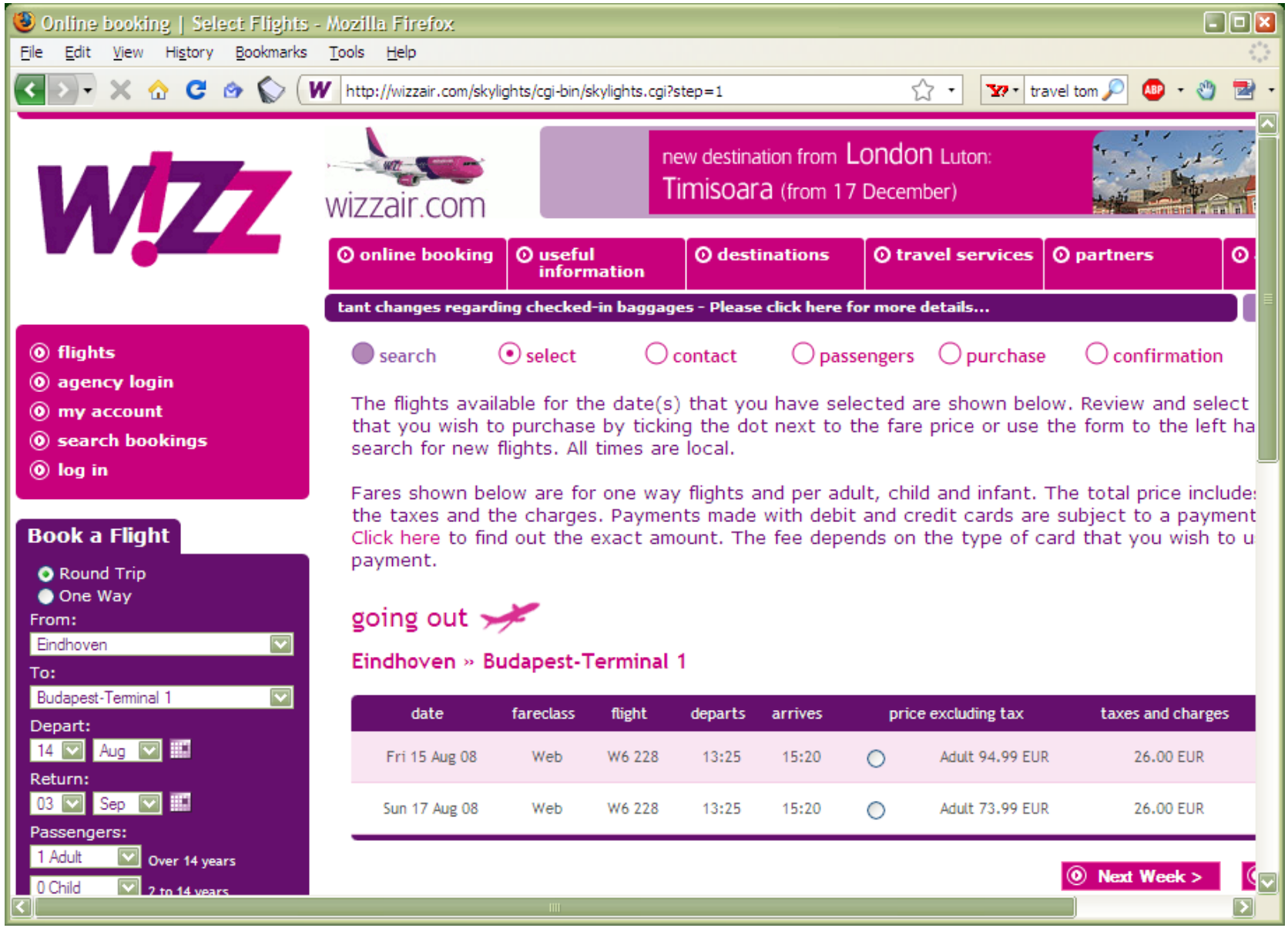
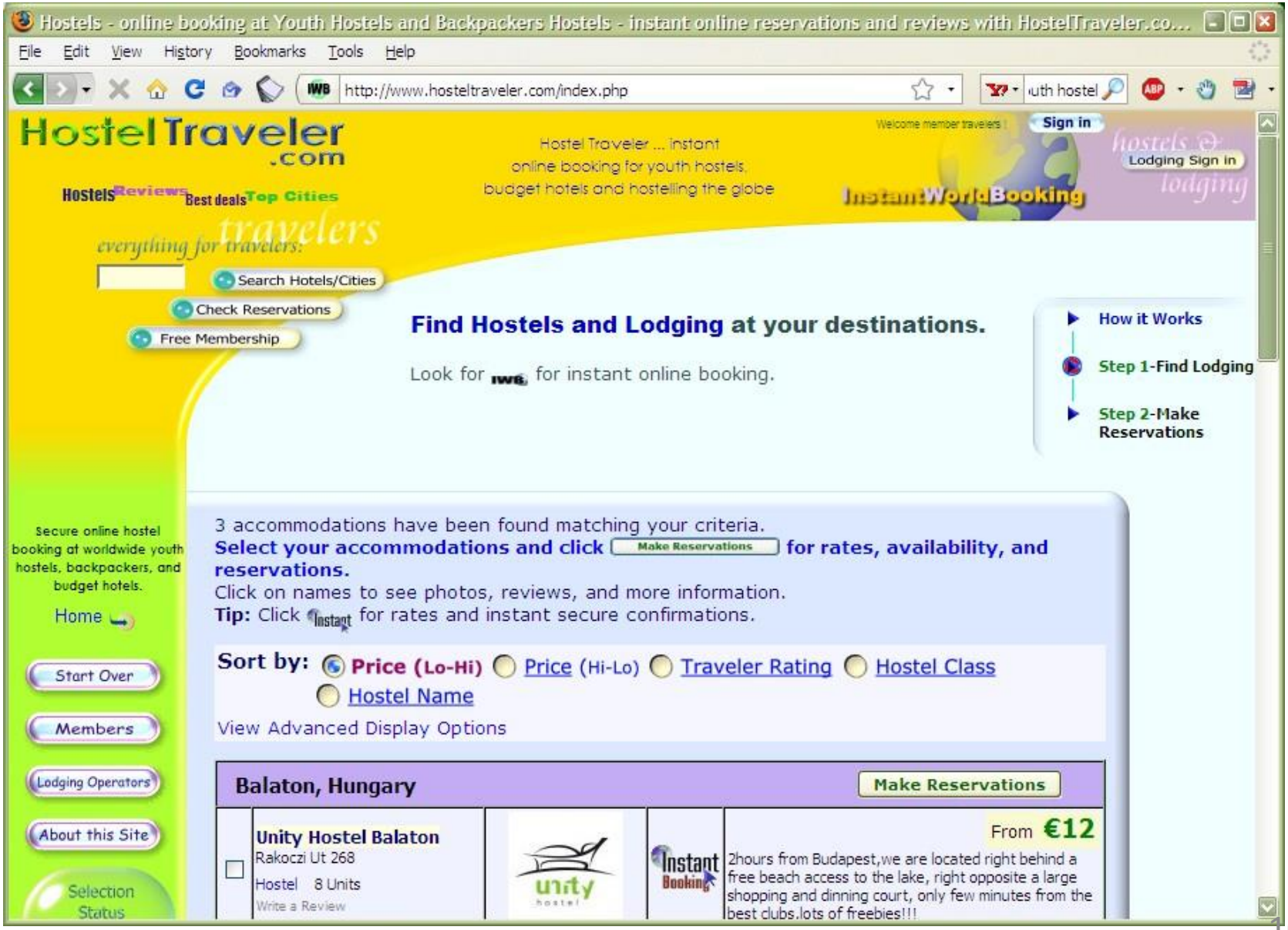


Let’s organize a trip to Budapest using the Web!

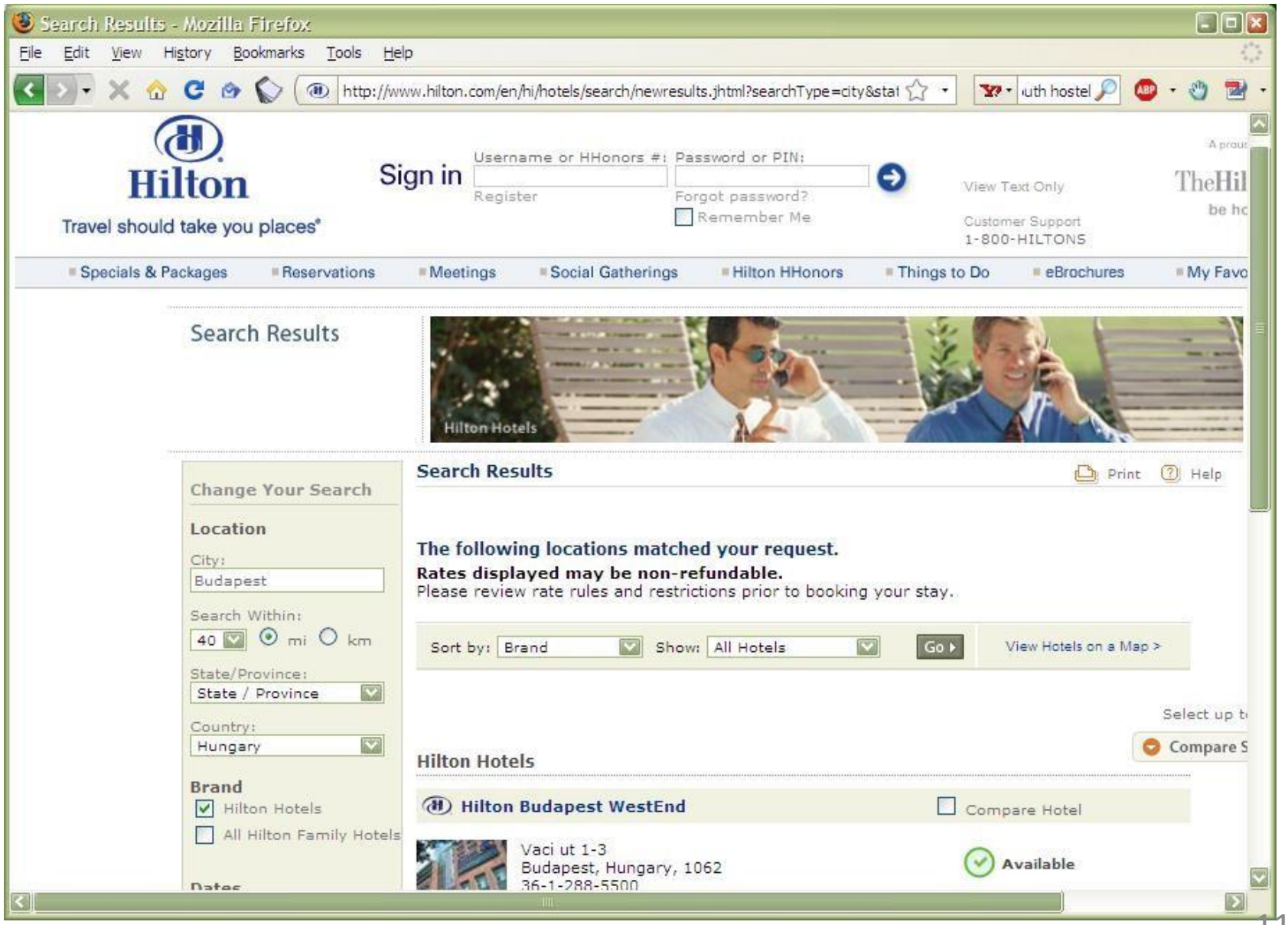
Step 1: You try to find a proper flight with …

Step 2: You have to find a hotel, so you look for…

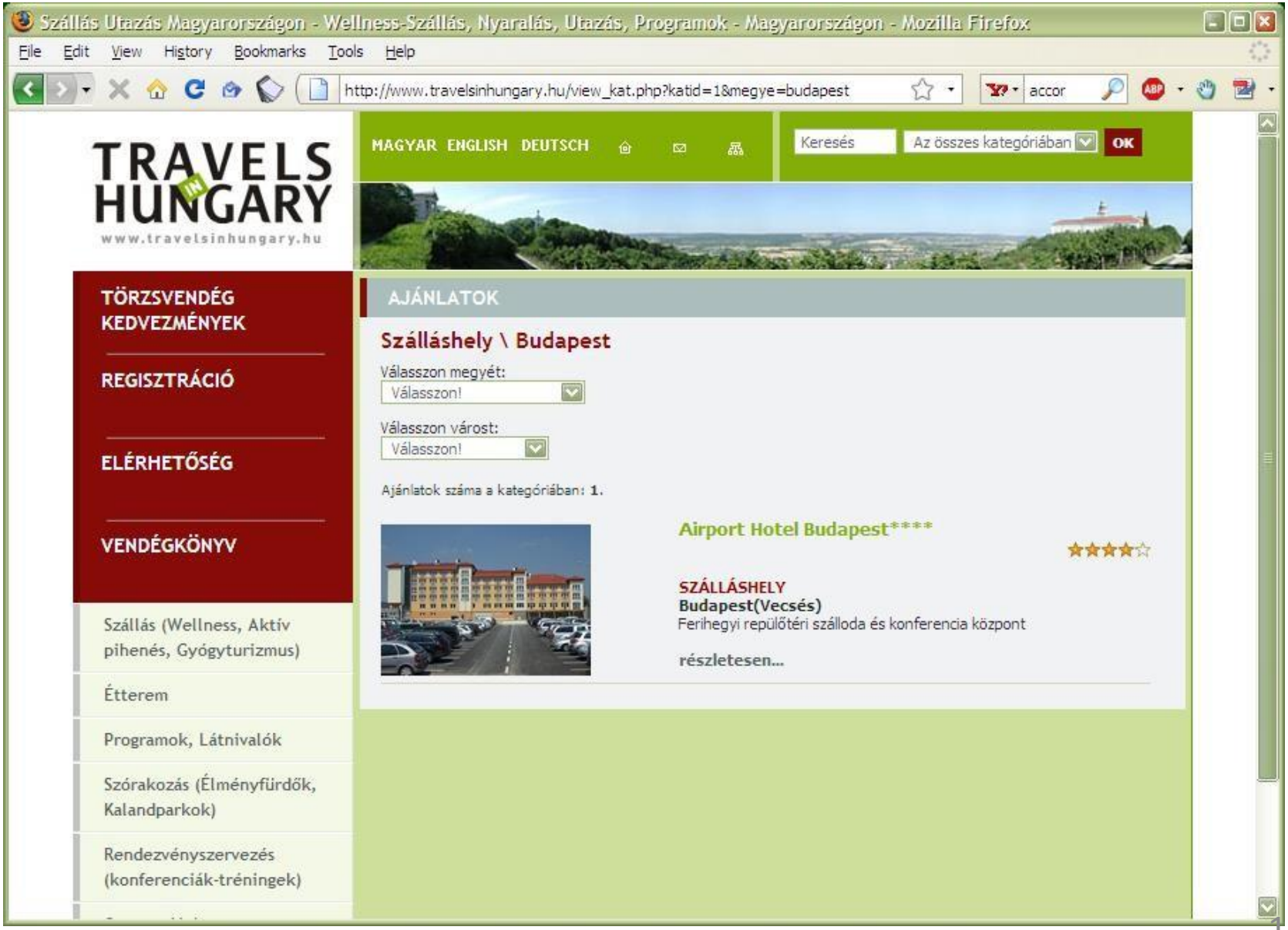
… a really cheap accommodation, or …



… or a really luxurious one, or …



… an intermediate one …



Let’s organize a trip to Budapest using the Web!

Step 1: You try to find a proper flight with …

Step 2: You have to find a hotel, so you look for…

- oops, that is a problem, the page is in Hungarian that almost nobody understands, but…

Let’s organize a trip to Budapest using the Web!

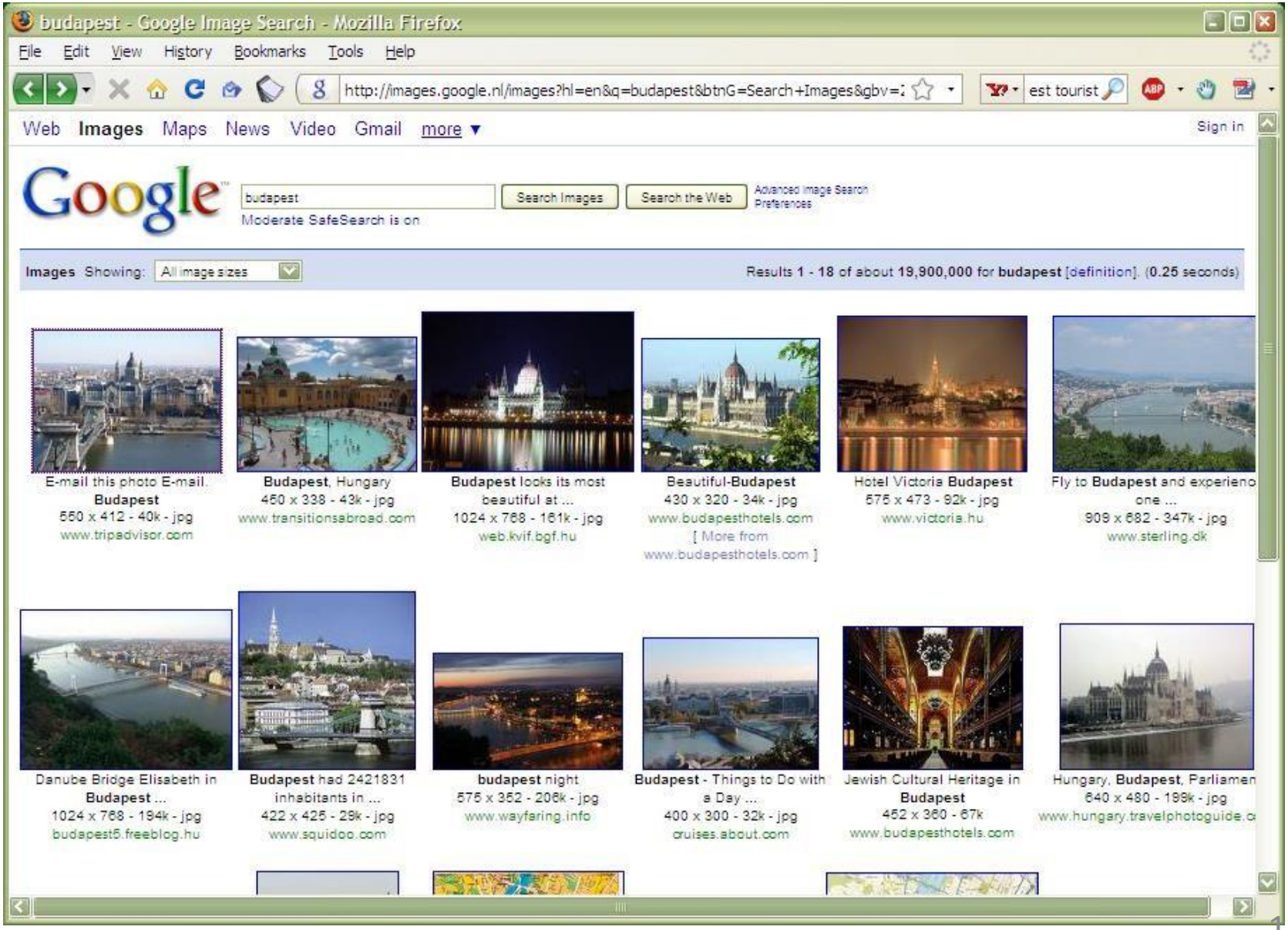
Step 1: You try to find a proper flight with …

Step 2: You have to find a hotel, so you look for…

- oops, that is no good, the page is in Hungarian that almost nobody understands, but…

Step 3: You may want to watch some photos about the city you will visit…

… on Google …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budapest night
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www.wayfaring.info
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Jewish Cultural Heritage in Budapest
452 x 360 - 67k
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640 x 480 - 199k - jpg
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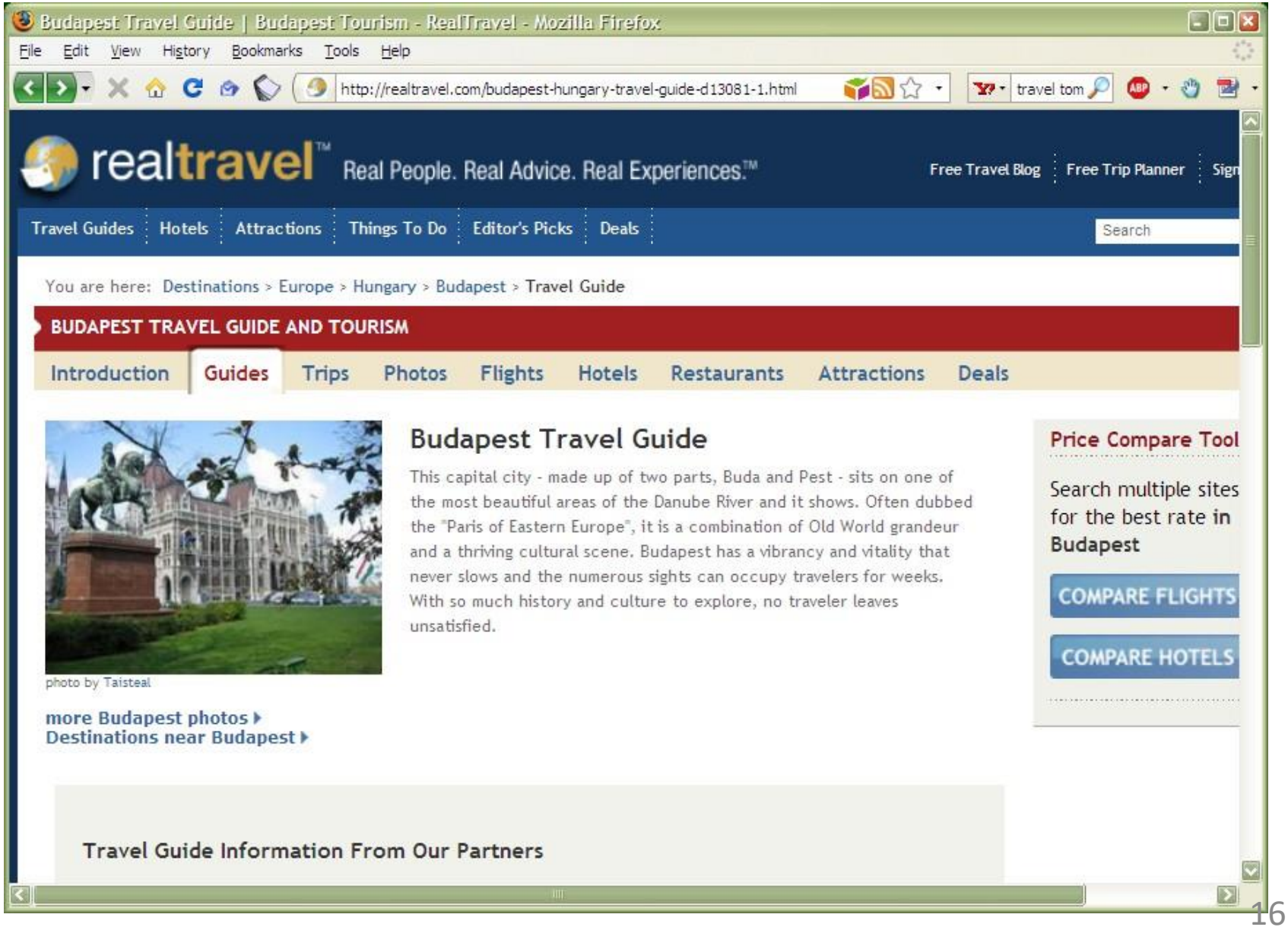
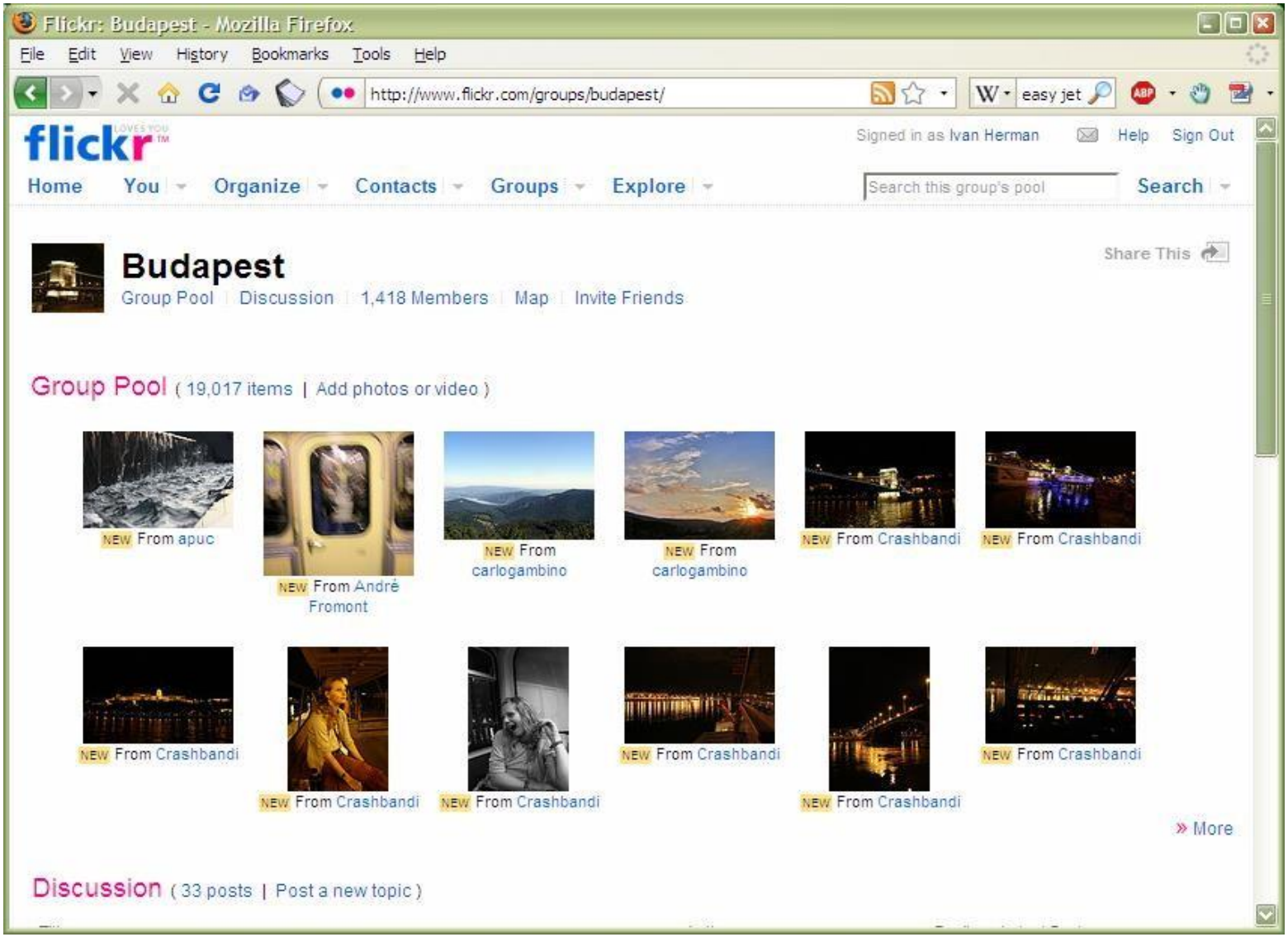
… or a (social) travel site



… on Flickr …



Flickr community: home to tens of billions of photos and 2 million groups.

What happened here?

1. You had to consult a large number of sites, all different in style, purpose, possibly language…
2. You had to mentally integrate all those information to achieve your goals
3. We all know that, sometimes, this is a long and complex process!

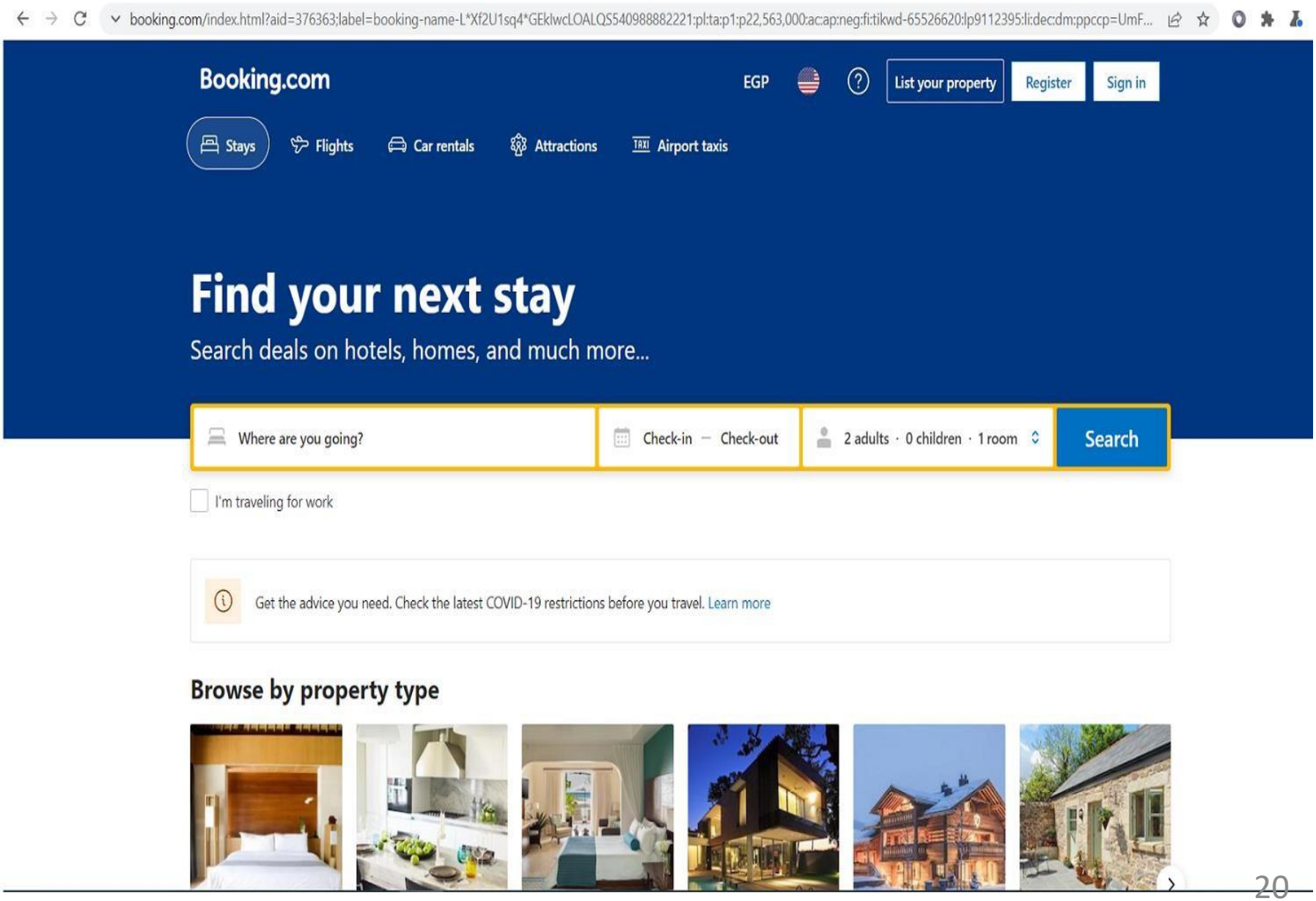
- All those pages are only the user interface that displays on the sites: (there are two main issues)
  - The real *data* is hidden somewhere in databases, XML files, Excel sheets, …
  - You have only access to what the Web page designers allow you to see in the interface.

What happened here?

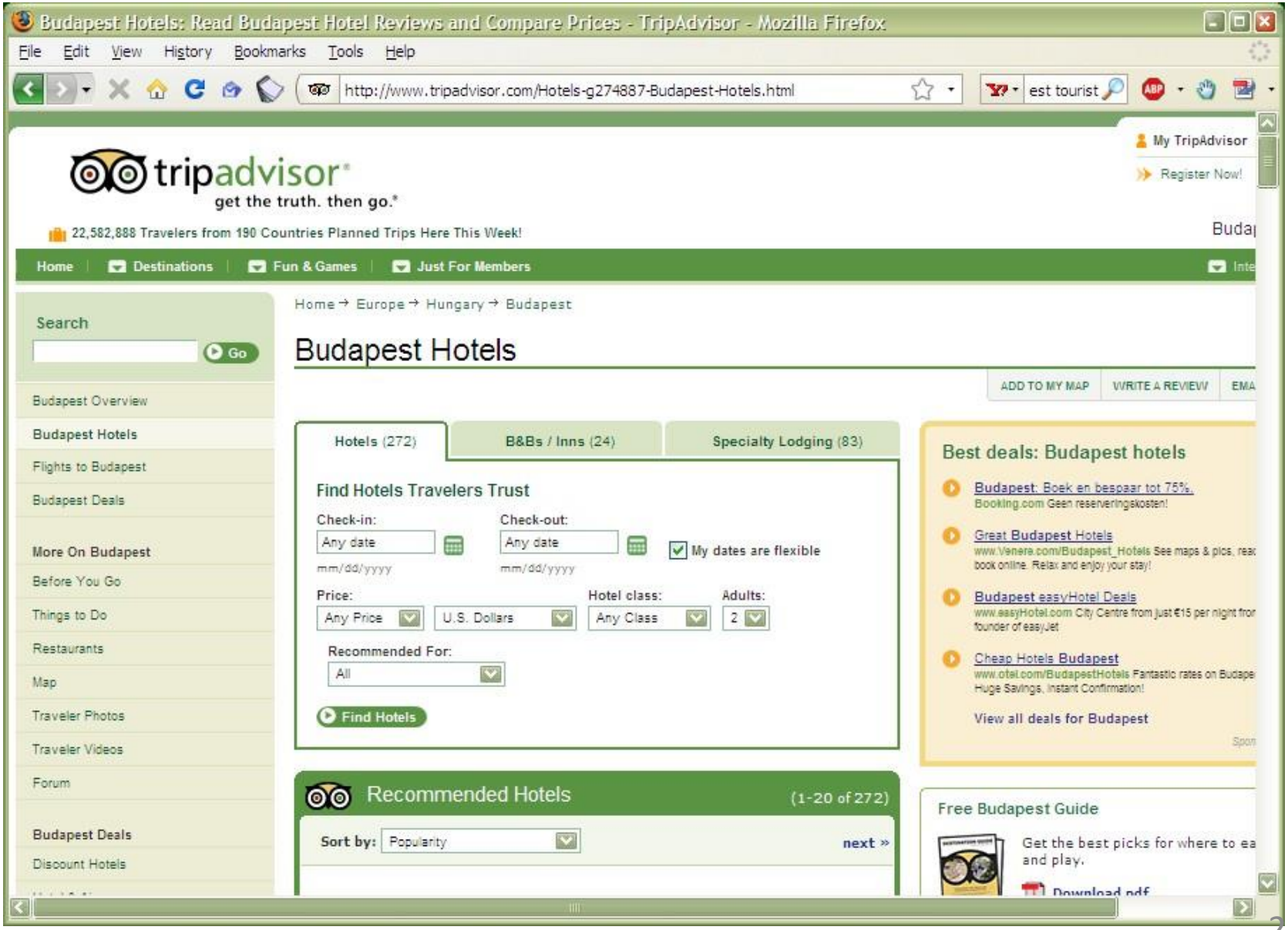
Mashup websites: is a web page, or web application, that uses content from more than one source to create a single new service displayed in a single graphical user interface such as Booking website (www.booking.com)

- Specialized sites (TripAdvisor, Booking, Expedia) do a bit more:
  - they gather and combine data from other sources (usually with the approval of the data owners)
  - but they still control how you see those sources
- But sometimes you want to personalize: access the original data and combine it yourself!

… this one could work



… or this one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get the truth. then go.
My TripAdvisor
Register Now!
22,582,888 Travelers from 190 Countries Planned Trips Here This Week!
Home Destinations Fun & Games Just For Members
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Budapest Overview
Budapest Hotels
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Budapest Deals
More On Budapest
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Things to Do
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Map
Traveler Photos
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Budapest Deals
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Home → Europe → Hungary → Budapest
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ADD TO MY MAP
WRITE A REVIEW
Hotels (272)
B&Bs / Inns (24)
Specialty Lodging (83)
Find Hotels Travelers Trust
Check-in:
Any date
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Check-out:
Any date
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My dates are flexible
Price:
Any Price
U.S. Dollars
Hotel class:
Any Class
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2
Recommended For:
All
Find Hotels
Best deals: Budapest hotels
Budapest: Boek en bespaar tot 75%.
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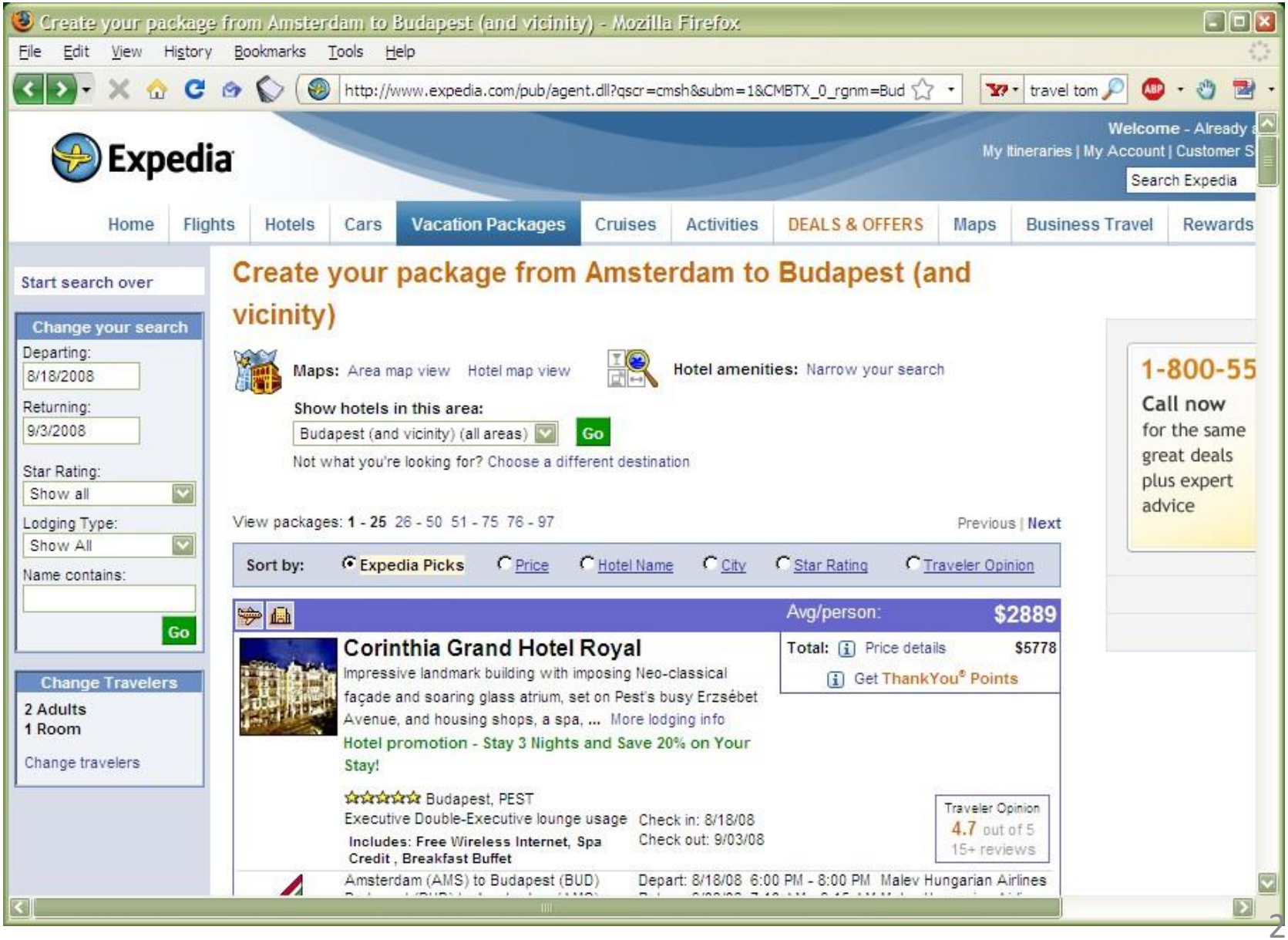
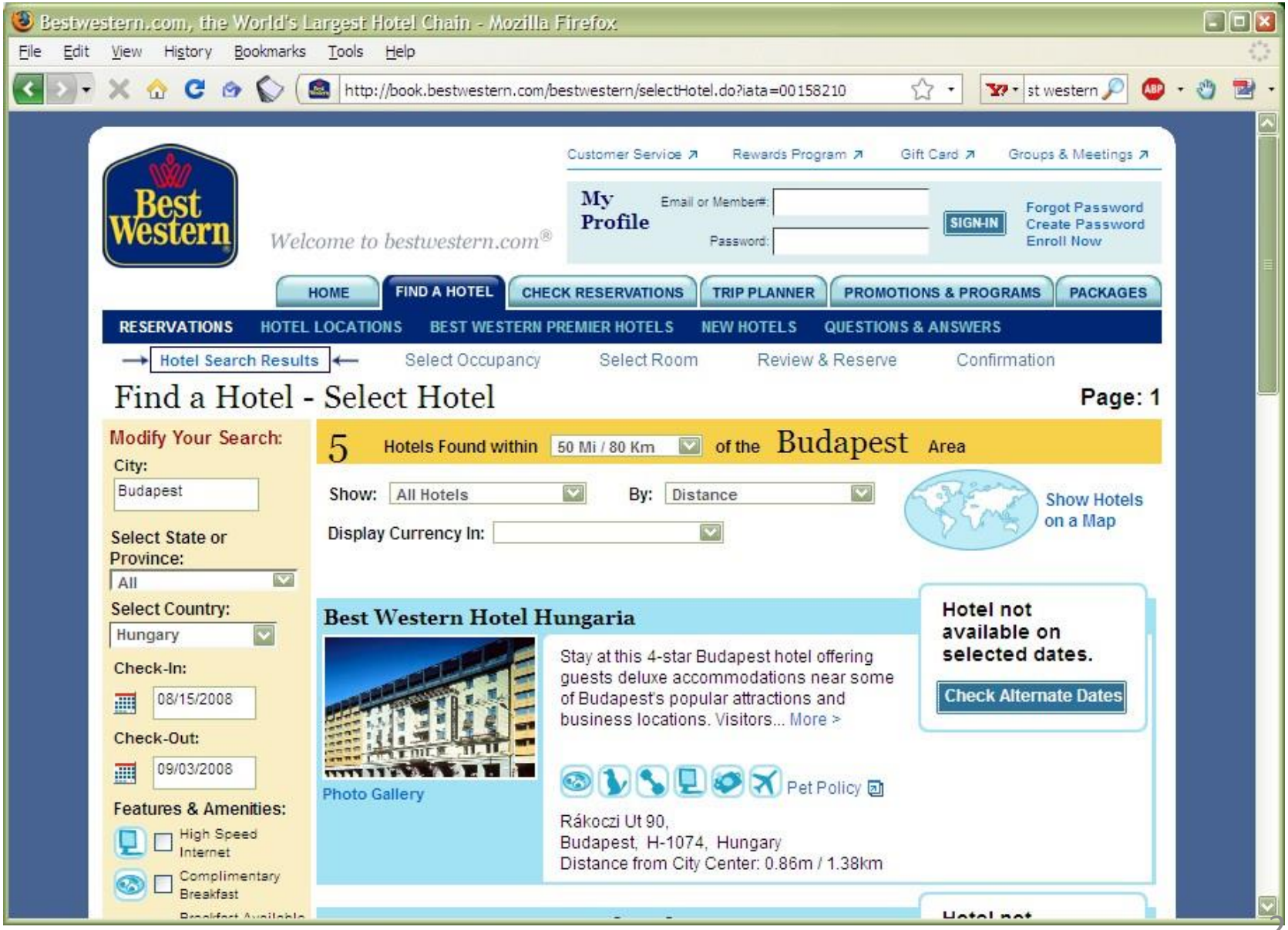


… this one could work



What would we be looking forward to reach?

- Use the data on the Web by the same way as we do with documents:
  - Be able to link to data (independently of their presentation).
  - Allow for applications to exploit the data directly.
  - Use that data by the way I want (present it, mine it, connect it, etc.)
  - Agents, programs, scripts, etc., should be able to interpret part of that data

We would like to extend the current Web to a ***standard*** way for a "Web of data"

What would we be looking forward to reach?

- What we need for a Web of Data:
  - Use Uniform Resource Identifiers (URIs) to publish full data, not only the interface that developer designed.
  - Allow the data to link to other data according to its types and meaning.
  - Characterize/classify the data and the links (the “terms”) to cover some extra meaning.
  - Use standards for all these!

Lecture Outline

- Practical example showing the current web data management.
- What are the problems with the web?
- What is the semantic web?
- Knowledge Management (KM)

What are the Problems with the current Web?

- The amount of information on the Web is huge and amazing sizes.
- The trillions of web resources cover every topic of human interest.
- There are two specific problems:

1. Accessing data.
2. Enabling delegation or authorization (Some level of automation needed)

The First Problem: Accessing data

- Documents are indexed and accessed via plain text:
  - That is, a string-based matching algorithms is used to retrieve documents.
  - This creates problems for ambiguous terms.
  - For example, “Paris” can refer to: the capital of France, history of Paris, French films, or referring to some events in Paris.
- Current Web activities are not well supported by software tools
  - Except for keyword-based search engines (e.g. Google)

Problems of Keyword-Based Search Engines

The First Problem: Accessing Data

- Results are highly sensitive to vocabulary.
- Human involvement is necessary to interpret and combine results.
- Results of Web searches are not accessible by other software tools.

Problems of Keyword-Based Search Engines

The Second Problem: Enabling Delegation

- When users browse the Web, their computers act simply as requesting devices.
  - Displaying text, graphics, audio, and video content.
  - All conclusion and computation is left to the user
- Delegating tasks such as integration of information, data analysis, and meaningful to machines became urgent and not available in **KBSE**.
- Now in reality, the meaning of Web content is not machine-accessible: lack of semantics.

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What is the Semantic Web?

1) The Semantic Web is an extension of the World Wide Web through standards set by the World Wide Web Consortium (W3C).

   – The World Wide Web Consortium (W3C) is an international community where member organizations is a full-time staff, and the public work together to develop Web standards.

2) It provides software programs with machine interpretation of metadata of the published information and data.

   – Metadata is "data that provides information about other data". In other words, it is "data about data.

What is the Semantic Web?

3) In other words, we add further data descriptors to existing content and connect data on the Web.

- The goals of the Semantic Web:
  - Is to make internet data content machine-readable and detailed accessible.
  - Use intelligent techniques to take advantage of these representations.
  - The Semantic Web will gradually evolve out of the existing Web, it is not a race to the current WWW.

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Knowledge Management (KM)

- Knowledge Management (KM): is the process of creating, sharing, using, and managing the knowledge and information of an organization's data using content management systems.
- There are two examples of KM methods:
  - **Portal**: is an idea of a website that offers a broad range of services, such as e-mail, search, news, quotes, and stocks.
  - **Dashboard**: is a user interface that, organizes and presents of information in a way that is easy to read.

Knowledge Management (KM)

Limitations or challenges of Current Knowledge Management Technologies

- Searching information:
  - Keyword-based search engines.
- Extracting information
  - Human involvement necessary for browsing, retrieving, interpreting, combining.
- Maintaining information
  - Inconsistencies in terminology, outdated information.
- Viewing information
  - Impossible to define views on Web knowledge

Relationship bet. Semantic Web and Knowledge Management

- Semantic Web enabling and enhancing knowledge management through:
  - Knowledge will be organized in conceptual methods according to its meaning.
  - Automated tools for maintenance and knowledge discovery.
  - Semantic query answering.
  - Query answering over several documents.
  - Defining who may view certain parts of information (even parts of documents) will be possible.

Thank you

Prof. Khaled Wassif