Challenges on Services

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Outline

• Challenge 1:  
  Devices Evolution → Services Evolution

• Challenge 2:  
  Mobiles Evolution → Services Evolution

• Challenge 3:  
  Business Evolution → SOAs evolution
DEVICES EVOLUTION → SERVICES EVOLUTION (I)

Personal Computers
Laptops
Mobile Devices
PDAs
TVs
Electrical Appliances
Vehicles
Et cetera
DEVICES EVOLUTION → SERVICES EVOLUTION (II)

Adapting to the device type

Generic answer

Invocation

Adaptation
MOBILES EVOLUTION \rightarrow SERVICES EVOLUTION (I)
MOBILES EVOLUTION → SERVICES EVOLUTION (II)

Adapting to the device model and user preferences

Generic answer

Invocation
MOBILES EVOLUTION → SERVICES EVOLUTION (III)
MOBILES EVOLUTION → SERVICES EVOLUTION (IV)

- Giving them **as much services as possible**
- **Adapting** these services to mobile devices **properly**
- Making devices **aware of user context**
BUSINESS EVOLUTION \(\rightarrow\) SOAs EVOLUTION (I)

- Invocation.
- Tourist information?
- Event
- Adaptation
- Generic answer

Invocation. Tourist information?
BUSINESS EVOLUTION → SOAs EVOLUTION (II)

Complex event pattern

detected

Avian influenza suspect case

Complex event

OR

AND
Remarks

- Challenge 1:
  Devices Evolution $\rightarrow$ Services Evolution

- Challenge 2:
  Mobiles Evolution $\rightarrow$ Services Evolution

- Challenge 3:
  Business Evolution $\rightarrow$ SOAs evolution
Thanks for your attention!
Elastic Clouds Enable Intelligent Applications

Panel on Cloud Computing Challenges
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Elastic Clouds Provide Massive Resources at Low Cost

- **Elasticity** is the ability to ramp up resources quickly to meet demand
  - Like electric power distribution
- With elastic clouds the enormous dark blue area becomes available
- Applications that need enormous resources for short times can get them for low cost!
  - Like electric power distribution, you pay only for the volume (cost is product of time and number of machines)
  - This is exactly what intelligent applications need!

\[
\begin{align*}
  r \cdot t & \leq c_0 \\
  r_0 & \leq r(t) \\
  t_0 & \leq t
\end{align*}
\]

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The “Next Internet Revolution”: Elastic Applications

- The Internet has gone through four revolutions since its inception
  - Each revolution takes about ten years to be internalized
  - Old timers like me saw many of them (I started using it in 1983)
- We are now on the brink of a fifth revolution fueled by elasticity and based on a combination of cloud computing and data-intensive algorithms
  - Applications that use massive resources in short bursts can be run at low cost
  - Large-scale machine learning will be used heavily
Intelligent Applications need Elasticity

Query/use phase
- elastic resource requirements
  - response time constraints

Learning/setup phase
- elastic resource requirements
  - learning time constraints

Tomorrow’s applications

Advanced applications
- Weather forecasting

Standard applications
- Google Search
- Google Translate
- Recommendation sys.
- Speech recognition
- Skype connection
- Social networks
- Media translation

One-shot
- One-way stream
- Conversation

Interactivity (learning + query)

Query/use phase
- elastic resource requirements
  - response time constraints

One-way	
  stream

Conversation

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An Elastic Application: Real-Time Voice Translation

- The pieces of this application already exist; for example the IRCAM research institute has implemented many of them.
- It requires combining domain knowledge (in sound and language) with an enormous sound fragment database, hosted on a cloud.

(purely hypothetical design!)

- Performance will be gradually improved through feedback from bilingual speakers and speech recognition technology.
- Google is working on this since 2010 (announcement by Franz Och, head of translation services at Google, on Feb. 10, 2010).

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Some More Applications…

- Real-time audio language translation
  - Google is already working on this (announced Feb. 2010)!
  - Full media interchangeability (text, audio, image, video)

- Knowledge extraction from raw data
  - A huge amount of raw data already exists in digital form: $1.2 \times 10^{21}$ bytes (2010)
  - Learning algorithms based on large corpora, inferencing, and canonical forms

- Expert guidance (a form of augmented reality)
  - Guiding humans interactively in real time to perform expert tasks
  - For example, anyone can become an expert car mechanic

- Creative problem solving (tamed brute force search)
  - Combining information to provide useful solutions to human-specified problems
  - The exponential search is tamed by learning algorithms

- Continuous fluid interaction
  - No detours through WIMP GUIs; direct interaction with detailed immersive reality
  - Not programmed, but learned by example and user feedback
Agents, Mobile Devices, Context Awareness, Adaptation, Intelligence, Control, and Decision-making

Kendall E. Nygard
North Dakota State University
Wireless connections will more than double to 3 billion+ in about 2 years!
The Application-Centric View

• The predominant approach by companies selling apps
• Apps are not normally aggregated
• When people work, considerable shifting among apps is often necessary
• Extensive personalization is called for
Personalization

• Gear the user experience toward how people use devices versus rather than around an app
• Smarter devices
• Engage ecosystems of knowledge
• Device synchronization
• App aggregation (e.g., flights, transportation options, hotels, entertainment, dining, online-payments, local information)
SmartPhones Allegiance

- 75% fall asleep with their phone
- 69% are more likely to leave their wallet behind than their phone
- 41% said that losing their phone would be tragic
- 30% regard the iphone as their “doorway to the world.”
- 25% regard the iphone as “dangerously alluring”
More SmartPhone Allegiance

• 9% have patted their phone
• 3% let nobody else touch their phone
• 3% have named their phone
• 8% of Iphone users thought that their Ipod was jealous of their iPhone
• Many want to be Buried with their Smart Phone when they Die
Reactiveness and Directedness

Reactiveness is achieved by a set of behaviors

Directedness identifies and exploits structure, maintains a knowledge base, and accesses system knowledge to advantage
Personalization using Agents for...

- Monitoring resources
- Aggregate apps
- Managing context
- Initiating configurations of other agents
- Match and adapt content and logic from remote services
- Learn and anticipate
- Manage concurrency
- Monitoring the user profile/preferences
- Synchronizing protocols for inter-agent communication and consultation
- Negotiating conflicts among agents
- Managing and customizing user interaction
- Adapting the interface to the device
- Balance local autonomy with global consistency and control via remote services
- Synching with laptop, notebook, or other devices
- Managing policies
- Integrating geolocation
- Providing security