PANEL ON ADVCOMP/SEMAPRO/EMERGING

TOPIC: HANDLING/OPTIMIZING COMPUTATION COMPLEXITY: LESSONS LEARNED FROM DOMAIN APPLICATIONS

Dr. Constandinos X. Mavromoustakis
Department of Computer Science
University of Nicosia,
Cyprus
Introduction/the panelists

Dejan Zupan, University of Ljubljana, Faculty of Civil and Geodetic Engineering, Slovenia

Mikael Fridenfalk, Uppsala University, Sweden

Stéphane Schicklin, bioMérieux, France

Michela Quadrini, UNICAM, Italy
(MOBILE?) CLOUD COMPUTING
IN CONTEXT

Dr. Constandinos X. Mavromoustakis
Department of Computer Science
University of Nicosia,
Cyprus
OUTLINE

- MOTIVATION
- WHAT IS MOBILE CLOUD COMPUTING? HOW REDUCTION IN COMPLEXITY COMES?
- ADVANTAGES/APPLICATIONS
- OFFLOAD THE BEST WAY TO “GAIN” RESOURCES (?)
In human life, Mobile devices e.g., smartphone, tablet pcs, etc) become an essential part of our daily lives. "Information at your fingertips anywhere anytime" Resources may be exploited at a remote location (not a static one only, but a “nearby” mobile device)

When compared to conventional information processing devices these Mobile devices are lacking resources.

*Mobile Cloud Computing (MCC)*
MOBILE CLOUD COMPUTING (MCC) FOR COMPUTATIONAL COMPLEXITY REDUCTION

MCC refers to an infrastructure where both the data storage and data processing happen outside of the mobile device.

Mobile cloud applications move the computing power and data storage away from the mobile devices and into powerful and centralized computing platforms located in clouds, which are then accessed over the wireless connection based on a thin native client.

MOBILE CLOUD COMPUTING (MCC) = Mobile Computing + Cloud Computing
WHY MCC IS NOW INCREMENTALLY BECOMING A NECESSITY

Everything goes Mobile..

- Mobile devices face many **resource challenges** (battery life, storage, bandwidth etc.)

- Cloud computing offers advantages to users by allowing them to use infrastructure, platforms and software by cloud providers at low cost and elastically in an **on-demand** fashion.

- Mobile cloud computing provides mobile users with data storage and processing services in clouds, obviating the need to have a powerful device configuration (e.g. CPU speed, memory capacity etc.), as all resource-intensive computing can be performed in the cloud. 

**Shared Memory Code Offload by Migrating Execution Transparently**
APPLICATIONS

Mobile Commerce
Mobile HealthCare
Mobile Learning
Mobile Gaming
Aviation Communication (through HAPs contribution etc.)

One key issue is to run remotely something that will benefit the mobile device and distribute the computational complexity among devices

Offloading/Migrate
OFFLOADING/MIGRATING THE BEST WAY TO “GAIN” SOURCES (?)

Answer: No-one knows ➡️ This is our answer today!

Offloading may cause problems
- Security (i.e. Code Offloading/code may be stolen-case of “Cloudlet”)
- Selfishness
- Resources may be kept and devices’ starve (still may be hungry to run and execute)
Thank you!

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Solution Strategies in Solving Large Systems of Non-linear Equations: Experiences From Spatial Frame Structures

the Panel on ”Handling/Optimizing Computation Complexity: Lessons Learned from Domain Applications”

8th International Conference on Advanced Engineering Computing and Applications in Sciences

Rome, Italy
August 24 – 28, 2014

*University of Ljubljana, Faculty of Civil and Geodetic Engineering, Slovenia
**Governing equations**

The complete set of equations of a beam element consists of:

i) **constitutive equations** (relating strains and stresses)

\[
\begin{align*}
R(x)C_N(\gamma_G(x), \kappa_G(x)) - N_g(x) &= 0 \\
R(x)C_M(\gamma_G(x), \kappa_G(x)) - M_g(x) &= 0,
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ii) **equilibrium equations** (relating displacements, rotations and stresses)

\[ N'_g(x) + n_g(x) = 0 \]
\[ M'_g(x) + m_g(x) - N_g(x) \times \mathbf{R}(x)(\gamma_G(x) - c_G(x)) = 0, \]
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\end{align*}
\]

iii) **and kinematic equations** (relating displacements, rotations and strains)

\[
\begin{align*}
r'_g(x) - \mathbf{R}(x) (\gamma_G(x) - c_G(x)) &= 0 \\
v'_g(x) - \mathbf{T}^{-T} (x) (\kappa_G(x) - d_G(x)) &= 0.
\end{align*}
\]
Three different approaches were analyzed:

i) **direct global approach** where the constitutive stress-resultant force and moment vectors are evaluated directly from the known strains in each step of the global iteration;
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i) **direct global approach** where the constitutive stress-resultant force and moment vectors are evaluated directly from the known strains in each step of the global iteration;

ii) **indirect global approach** where the strain vectors are obtained iteratively from the equilibrium stress-resultant force and moment vectors in each step of the global iteration;

iii) **partly reduced approach** where the constitutive equation for forces is eliminated from the system of governing equations.
Observations

- For all the cases numerical results agree completely.
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- The computational costs are extremely different.
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• Higher number of global iterations occurs when a single local iteration is used in reduced approach.
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- Computational cost of reduced approach is lower if only one step of the local iteration is carried out.
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- The direct global approach requires the lowest computation costs.
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#### 2 linear elements

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2 5-node elements

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Biaxially bent columns

$\alpha = \pi/6$

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Frame of Ferguson and Breen

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Ontology as advisor of data preprocessing

Michela Quadrini
E-mail: michela.quadrini@unicam.it

Computer Science Division,
School of Sciences and Technologies,
University of Camerino

Panel Section, IARIA Conference, 2014
Ontology in Ambient Assisted Living

- DATA TEST
- MERGE STATIC AND DINAMIC KNOWLEDGE
- DELETE DATA REDUNDANCY
- FACILITATE DATA INTEGRATION
- DATA SELECTION

ONTOLEGY In AAL
MERGE STATIC AND DYNAMIC KNOWLEDGE

Clinical Sensors

Environmental Sensors

Smart objects

Domestic Environment

DB

mapping

AAL Ontology
We can considerate a temperature sensor.

This device has particular features:

- Communication protocol;
- Measured physical characteristics;
- Range of values.

The range of registered values is different if the sensor is installed into the house or outdoor.
FACILITATE DATA INTEGRATION

We can take 4 presence sensors into account (Boolean output) which are installed into the same room (for example, kitchen).

When the person is in the room, at least one sensor takes note of the event.

If we want to verify the presence in the kitchen, we have to combine the values of the sensors as a whole.
DELETE DATA REDUNDANCY

We allow for

• a light switches installed in the fridge;
• a door sensor installed on the fridge’s door.

In this case:

different output, different sensors,
but the same semantic event.
On the other hand, there is a connection between data collected from two devisors.

When data don’t fulfill the connection, the sensor or the connection is broken.
DATA SELECTION

ONT/OLOGY

DATA VIEW 1

DATA VIEW 2

ANALYSIS

ANALYSIS
Thank you
Handling/Optimizing Computation Complexity: Lessons Learned from Domain Applications

Mikael Fridenfalk
mikael.fridenfalk@speldesign.uu.se
Max^N
\[ \alpha = [\ldots, -\infty, -\infty, -\infty] \]

\[ \alpha_1 = [\alpha_1, -\infty, -\infty] \]

\[ \alpha_3 = [\alpha_1, -\infty, \alpha_3] \]

\[ \alpha_2 = [\alpha_1, \alpha_2, \alpha_3] \]

Hypermax
## Experimental Results

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Semapro Panel

Handling/Optimizing Computation Complexity: Lessons learned from Domain Application

SEMAPRO 2014
Stéphane Schicklin
Data deluge
- Different technologies
- Different formats, contents

Hurdle to data & knowledge sharing
- Plodding access to data
- Loss of knowledge between and within projects

Need a system offering connectivity
- Connection between heterogeneous data
- Centralized and collaborative
- Linked data

Birth of BioPedia

Time saving for decision making and project leading based on facts
Mediawiki: free software open source wiki package written in PHP, originally for use on Wikipedia

SMW: Semantic Mediawiki is a free, open-source extension to MediaWiki that lets you store and query data within the wiki’s pages. It turns a wiki into a powerful and flexible knowledge management system that uses semantic Web technologies (#ask parser function, …)

- Semantic Drilldown (using categories and filters on semantic properties)
- Interwiki
- … (about 20 extensions by wiki, some self-made)
  - 4 main domains (one wiki by domain)
  - A wiki with 11 categories
    - One with 26 properties (~ 40 000 instances)
    - Another one with 13 properties (~ 400 000 instances)

Drilldown does not work, wiki’s navigation become very slow…
even with « subobjects » or « Internal Objects »
Data still locked in their wiki domain
BioPedia: iteration 2

**Extraction of the wiki content (XML/RDF)**
- XML/RDF serialization from SMW lasts approximately **6 hours**

  ![SMW](image)

  **4store**

- Load in 4store takes less than **4 minutes** (same hardware: 8 CPU, 16 Gb RAM, CentOS)

**Some counts:**
- About **6’000’000 triples** for this domain
- Between **7** and **8 million** of serialized lines (XML/RDF)

  ![Arrow](image)

  The **data of all domains** are **together**, even if we keep them **separated** into distinct **graphs**

  ![Arrow](image)

  We have **lost wiki functionalities** (GUI, collaborative approach, …). **SPARQL 1.1 is not fully implemented**
Extraction of the wiki content (XML/RDF)
- RDF (Turtle, N3, …) serialization from 4store is as effective as import

load in virtuoso is, at least, as fast as 4store load

Some counts:
- About 16 million of triples (all domains combined)

The data of all domains are together, separated graphs
All SPARQL 1.1 functionalities implemented (?)
- Property paths
- Federated queries (SERVICE …)
- SPARUL, Bind …

Still need to develop a GUI