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What is the tutorial about?

Directions:

- Is High End Computing a *solution* for decision making? No.
- Is decision making a *solution* to be used with High End Computing? No.
- Will the *goal* be computer-assisted decision making? No.

a) Decision making is the base for any process.
b) Decision making is process and result itself.

During the following discussion we will see (selected) aspects of decision making and what it can mean for High End Computing. It is intended to have a live discussion and feedback on the consequences for various topics.
Aspects and Challenges

**Focus:**

Increasing the overall long-term efficiency of
- gathering and using information, knowledge and computing,
- scientific research,
- related application scenarios,
- respecting the interests of users and disciplines, services, and providers of resources.
Aspects:

- Learn from history and failures.
- Motivation.
- Processes.
- Techniques.
- Knowledge.
- Overview of High End Computing (HEC).
- Consequences for participated parties.
- Consequences for selected application scenarios.
Classical, medieval, modern, ... 

Heron of Alexandria: (greek antique, “Steam Ball”)  
⇒ “entertainment” but **not used as technology**.

Isidore of Seville: (encyclopedic, broad documentation)  
⇒ end of medieval phase, **not further used**.

Polyhistor: (Martin Vogel, broad knowledge)  
⇒ broad base, **not further used**.

In percentage we nearly know nothing about the past.

- Ancient and historical objects are mostly lost.
- Ancient and historical documentation is mostly lost.
- Ancient and historical technology is not fully understood.
- Context of past applications is not available.
What others do: “Experts say: Best practice is for theory.”

Let us take a look on what a virtual, “effective” institution will do.

NUTS set up, to ”accelerate and shorten” processes:
- Executive chairing in-house group,
- Administrative expert in-house group,
- Technical delegation somewhere group.

NUTS define in-house and nice to have:
- Good and best practice,
- Experiences,
- Knowledge ("present one").

NUTS state the development idea:
- Structures can be kept when restructuring,
- Quality of Service is definable,
- Hierarchy is on top of expertise.
Knowledge base:

Knowledge transfer is essential.

Over generations of objects and subjects, this requires:

- Knowledge recognition (expertise).
- Knowledge documentation, for any aspect of nature and society (sciences, literature, technical descriptions, tools, cultural heritage, mythology, songs, media, ...).
- Long-term means.
Basics of Decision Making ("DM")
Decision making is the fundamental base for any process as well as decision making is a process and result itself.

Nevertheless it is very common
- ... to have deficits in decision making processes.
- ... to underestimate the value of knowledge creation.
- ... to have opposition due to historical and social development.

Aware of!
- No decision is an influence to the "selection", too!
- To shorten planned decision making processes means significant interaction.
What we can learn from others (references):

http://www.cartoonstock.com/directory/d/decision-making.asp
http://www.decision-making-solutions.com/management_cartoons.html
http://search.dilbert.com/comic/Decision%20Making

--- ABOVE EXAMPLES FOR DISCUSSION LEFT OUT HERE ---
Lemma 1:
- It is easy to do any decision without expertise.

Lemma 2:
- A decision (making process) should be fast and perfectly correct.

In case a decision cannot be fast and perfect, it should be fast or perfect.

In no case should a decision be slow and wrong.
Essential relation:

Decision making! $\iff$ Selection making!
... prominent YES or NO decision example:

(Y/N)?
Problem Analysis

Description:

- Performance analysis (current status / resulting status),
- Problem / target identification (e.g., deviations from performance standard, causes, change of distinctive feature),
- Problem / target description,
- Distinguishing marks between what has been effected by a cause and what has not,
- Deduction of causes from relevant changes found with the problem analysis (identification),
- Cause to a problem is most likely the one that exactly explains the sum of facts.
Example Decision Making Process

**Description:**

- Establishing the objectives,
- Classification of objectives,
- Place classified objectives in order of importance,
- Development of alternative actions,
- Evaluation of alternatives against all the objectives,
- The tentative decision is that alternative being is able to achieve all the objectives,
- Evaluation of the tentative decision for possible consequences,
- Take decisive actions, take additional actions (prevent adverse consequences from becoming problems)
- Start problem analysis and decision making process iteratively,
- Steps for decision model in order to determine an optimal production plan and reduce conflict potential.
Description:

For best practice, introduce a decision planning process to important decisions in order to result in the following benefits:

1. **Establish independent goals.**
   That means a conscious and directed series of choices.

2. **Aim to a standard of measurement.**
   The measurement should provide information on the distance to the goal.

3. **Convert values to action.**
   The resulting information should be used to support the planning.

4. **Commit limited resources in an orderly way.**
   Planning and commitments for any kind of resources, e.g., staff, money, time.
Example Decision Making Phases

**Phases:**

**Orientation stage:** Starting with kick-off or warm-up, exchange with all parties.

**Conflict stage:** Dispute, arguments, working on common denominators and positions.

**Emergence stage:** Vague positions and opinions being discussed.

**Reinforcement stage:** Decision making and justification.
Selected Decision Making Techniques

Techniques:

**Rational decision making**: List the pro and contra (advantages and disadvantages) of each option. Contrast the costs and benefits of alternatives.

**Elimination by aspects**: Choosing alternatives by “mathematical psychology”. Covert elimination process, comparing the available alternatives by aspects. Choose an aspect and eliminate the alternatives without the aspect. Repeat until one alternative remains.

**Simple prioritisation**: Choosing an alternative showing the highest probability-weighted utility from all alternatives, resulting from the decision analysis process.

**Satisficing**: The examination of alternatives is stopped as soon as an acceptable alternative is found.
Visualising Flow Basics

Symbols

- Decision
- Input / Output
- Process
- Document
- Display
- Sort

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Trees and Forks

- Root
  - Right
    - Child
  - Left
    - Child
Areas of Automated Application

Commonly no tools with:
- Private,
- Evolution.

Prominent (support only) tools with:
- Environment,
- Catastrophy,
- Geostatistics,
- Military,
- Games,
- Exploration,
- Medicine,
- Traffic,
- Court,
- Contracts,
- Computer,
- Budget,
- Security,
- ...
Examples for decision systems and support:

- **Environment:**
  - **FLODIS:** Sustainable Floodmanagement of the Oder river IS.
  - **STEWARD:** Support Technology for Environmental, Water and Agricultural Resource Decisions.
  - **SDSS:** Spatial Decision Support System.
  - **LANDS:** Land Analysis and Decision Support (system).
  - **WEDSS:** Whole Earth Decision Support System (international).

- **Catastrophy:**
  - **WDSS:** Warning Decision Support System (oceanography).

- **Geostatistics:**
  - **MCDM:** Multicriterion Decision Making.

- **Military:**
  - **ADA:** Applied Decision Analysis.
  - **EOTDA:** Electro-Optical Tactical Decision Aid.

- **Games:**
  - ... For example, Chess, mathematical basics, defined alternatives.
Why are there no systems for?:

- Natural sciences fundamentals,
- Informatics development,
- Basic algorithms,
- Geophysical data analysis,
- Computing architectures,
- Hardware systems development,
- ...
Invisible things can make a difference:

```
1
2
3
4
5
<E0F>
```
Add Forensics to the Decision

Invisible things can make a difference:

1
2
3
4
5
<EOT>

The invisible seen here:

1
2
3
4
5
$
Add Forensics to the Decision

Invisible things can make a difference:

```
1
2
3
4
5
<EOF>
```

The invisible seen here:

```
1 $  
2 $  
3 $  
4 $  
5 <EOF>
```

The translation is:

```
1 F  
2 I  
3 R  
4 E  
5 <EOF>
```
Understanding Knowledge

Where knowledge is . . .

Knowledge is created from a subjective combination of different attainments as there are intuition, experience, information, education, decision, power of persuasion and so on, which are selected, compared and balanced against each other, which are transformed and interpreted.

And the consequences . . .

Authentic knowledge therefore does not exist, it always has to be enlived again. Knowledge must not be confused with information or data which can be stored. Knowledge cannot be stored nor can it simply exist, neither in the Internet, nor in computers, databases, programs or books.
Processes

- Knowledge base creation,
- Knowledge base transfer over generations,
- Documentation of requirements respective algorithms,
- Documentation of context respective architectures,
- Usage development within tender processes.
Objects and Relations

Root object

Child object
Quality of Relations
Quality of Relations
Object, Relations, and Quality (Mindmapping)

Quality of Relations

Quality of Objects
Object, Relations, and Quality (Mindmapping)

Quality of Relations

Quality of Objects
Wrong terms can be very persistent:

- Sunrise (earth is flat?),
- Sunset (from dusk till dawn?),
- Malaria (and prejudice is ahead of scientific results?).
- ...
Examples

- Depiction, traffic signs and their description different.
- Companies do try critical products in countries with reduced privacy perception.
- Overall personal security will mean insecurity for society.
- Color perception is different by society.

Description

- “Standardisation” and “internationalisation”.
- Foreign word “privacy”.
- Trend for hidden security.
- Words for new colors have been added to languages and perception.
International and other differences

- Privacy perception,
- Different terminology,
- Legal regulations,
- Legal frameworks.
Even off-topic items can make a difference (not only in Harvard):

Small things can completely change the meaning without changing a word!

- Tweetie, Tom and Jerry do have different opinions.
- Tweetie, Tom, and Jerry do have different opinions.
Even off-topic items can make a difference (not only in Harvard):

Small things can completely change the meaning without changing a word!

- Tweetie, Tom and Jerry do have different opinions.
- Tweetie, Tom, and Jerry do have different opinions.
- Fishes, mammals and birds are three different kind of genus.
- Fishes, mammals, and birds are three different kind of genus.
Classical one: Who said this?

- Egg
- Box
- Girl

Hint: Try in different languages.
Classical one: Who said this?

Easier, English terms: Egg + Box + Girl.
Classical one: Who said this?

Easier, English terms: Egg + Box + Girl.

Hint: Try in different languages.
Theory and practice

- Structural deficits.
- Content can be described and even signed to a certain extend.
- Context cannot be handled to a comparable extent. (Users can sign a PDF document, but what about signing it’s context?)
- Long-term issues are mostly out of sight. (What will signature validity mean to archiving and reuse?)
- What does this in general mean to long-term knowledge-based processes?
Universal Decimal Classification (UDC)

The Universal Decimal Classification (UDC) is a general plan for the knowledge classification. UDC is a hierarchical decimal classification system that divides the main knowledge fields into 10 main categories (numbered from 0 to 9). Each field is in turn divided into 10 subfields, each subfield is in turn divided into 10 subsubfields, and so on. A more extensive classification code in general describes a more specific subject.

Faceted and multi-disciplinary context

“Facetted” and “multi-disciplinary” is synonym to the Universal Decimal Classification (UDC), http://www.udcc.org. UDC uses a “(...)” notation in order to indicate aspect. These descriptions are called facets. In multi-disciplinary object context a faceted classification does provide advantages over enumerative concepts. The classification deployed for a universal documentation must be able to describe any object with any relation, structure, and level of detail. Objects include any media, textual documents, illustrations, photos, maps, videos, sound recordings, as well as realia, physical objects such as museum objects.
### Documentation and Form (UDC, excerpt, English)

<table>
<thead>
<tr>
<th>1</th>
<th>(0.02)</th>
<th>Documents according to physical, external form</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>(0.03)</td>
<td>Documents according to method of production</td>
</tr>
<tr>
<td>3</td>
<td>(0.034)</td>
<td>Machine-readable documents</td>
</tr>
<tr>
<td>4</td>
<td>(0.04)</td>
<td>Documents according to stage of production</td>
</tr>
<tr>
<td>5</td>
<td>(0.05)</td>
<td>Documents for particular kinds of user</td>
</tr>
<tr>
<td>6</td>
<td>(0.06)</td>
<td>Documents according to level of presentation and availability</td>
</tr>
<tr>
<td>7</td>
<td>(0.07)</td>
<td>Supplementary matter issued with a document</td>
</tr>
<tr>
<td>8</td>
<td>(0.08)</td>
<td>Separately issued supplements or parts of documents</td>
</tr>
<tr>
<td>9</td>
<td>(0.01)</td>
<td>Bibliographies</td>
</tr>
<tr>
<td>10</td>
<td>(0.02)</td>
<td>Books in general</td>
</tr>
<tr>
<td>11</td>
<td>(0.03)</td>
<td>Reference works</td>
</tr>
<tr>
<td>12</td>
<td>(0.04)</td>
<td>Non-seral separates. Separata</td>
</tr>
<tr>
<td>13</td>
<td>(0.041)</td>
<td>Pamphlets. Brochures</td>
</tr>
<tr>
<td>14</td>
<td>(0.042)</td>
<td>Addresses. Lectures. Speeches</td>
</tr>
<tr>
<td>15</td>
<td>(0.043)</td>
<td>Theses. Dissertations</td>
</tr>
<tr>
<td>16</td>
<td>(0.044)</td>
<td>Personal documents. Correspondence. Letters. Circulars</td>
</tr>
<tr>
<td>17</td>
<td>(0.045)</td>
<td>Articles in serials, collections etc. Contributions</td>
</tr>
<tr>
<td>18</td>
<td>(0.046)</td>
<td>Newspaper articles</td>
</tr>
<tr>
<td>19</td>
<td>(0.047)</td>
<td>Reports. Notices. Bulletins</td>
</tr>
<tr>
<td>20</td>
<td>(0.048)</td>
<td>Bibliographic descriptions. Abstracts. Summaries. Surveys</td>
</tr>
<tr>
<td>21</td>
<td>(0.049)</td>
<td>Other non-seral separates</td>
</tr>
<tr>
<td>22</td>
<td>(0.05)</td>
<td>Serial publications. Periodicals</td>
</tr>
<tr>
<td>23</td>
<td>(0.06)</td>
<td>Documents relating to societies, associations, organizations</td>
</tr>
<tr>
<td>24</td>
<td>(0.07)</td>
<td>Documents for instruction, teaching, study, training</td>
</tr>
<tr>
<td>25</td>
<td>(0.08)</td>
<td>Collected and polygraphic works. Forms. Lists. Illustrations. Business publ.</td>
</tr>
<tr>
<td>26</td>
<td>(0.09)</td>
<td>Presentation in historical form. Legal and historical sources</td>
</tr>
<tr>
<td>27</td>
<td>(0.091)</td>
<td>Presentation in chronological, historical form. Historical presentation.</td>
</tr>
<tr>
<td>28</td>
<td>(0.092)</td>
<td>Biographical presentation</td>
</tr>
<tr>
<td>29</td>
<td>(0.093)</td>
<td>Historical sources</td>
</tr>
<tr>
<td>30</td>
<td>(0.094)</td>
<td>Legal sources. Legal documents</td>
</tr>
</tbody>
</table>
### Languages, natural and artificial (UDC, excerpt, English)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Indo-European languages of Europe</td>
</tr>
<tr>
<td>11</td>
<td>Germanic languages</td>
</tr>
<tr>
<td>12</td>
<td>Italic languages</td>
</tr>
<tr>
<td>13</td>
<td>Romance languages</td>
</tr>
<tr>
<td>14</td>
<td>Greek (Hellenic)</td>
</tr>
<tr>
<td>15</td>
<td>Celtic languages</td>
</tr>
<tr>
<td>16</td>
<td>Slavic languages</td>
</tr>
<tr>
<td>17</td>
<td>Baltic languages</td>
</tr>
<tr>
<td>2</td>
<td>Indo-Iranian, Nuristani (Kafiri) and dead Indo-European languages</td>
</tr>
<tr>
<td>21</td>
<td>Indic languages</td>
</tr>
<tr>
<td>29</td>
<td>Dead Indo-European languages (not listed elsewhere)</td>
</tr>
<tr>
<td>3</td>
<td>Dead languages of unknown affiliation. Caucasian languages</td>
</tr>
<tr>
<td>35</td>
<td>Caucasian languages</td>
</tr>
<tr>
<td>4</td>
<td>Afro-Asiatic, Nilo-Saharan, Congo-Kordofanian, Khoisan languages</td>
</tr>
<tr>
<td>5</td>
<td>Ural-Altaic, Palaeo-Siberian, Eskimo-Aleut, Dravidian and Sino-Tibetan</td>
</tr>
<tr>
<td>521</td>
<td>Japanese</td>
</tr>
<tr>
<td>531</td>
<td>Korean</td>
</tr>
<tr>
<td>541</td>
<td>Ainu</td>
</tr>
<tr>
<td>6</td>
<td>Austro-Asiatic languages. Austronesian languages</td>
</tr>
<tr>
<td>7</td>
<td>Indo-Pacific (non-Austronesian) languages. Australian languages</td>
</tr>
<tr>
<td>8</td>
<td>American indigenous languages</td>
</tr>
<tr>
<td>81</td>
<td>Indigenous languages of Canada, USA and Northern-Central Mexico</td>
</tr>
<tr>
<td>82</td>
<td>Indigenous languages of western North American Coast, Mexico and Yucatán</td>
</tr>
<tr>
<td>84</td>
<td>Ge-Pano-Carib languages. Macro-Chibchan languages</td>
</tr>
<tr>
<td>85</td>
<td>Andean languages. Equatorial languages</td>
</tr>
<tr>
<td>86</td>
<td>Chaco languages. Patagonian and Fuegian languages</td>
</tr>
<tr>
<td>88</td>
<td>Isolated, unclassified Central and South American indigenous languages</td>
</tr>
<tr>
<td>9</td>
<td>Artificial languages</td>
</tr>
<tr>
<td>92</td>
<td>Artificial languages for use among human beings. Int. aux. languages (interlanguages)</td>
</tr>
<tr>
<td>93</td>
<td>Artificial languages used to instruct machines. Programming/computer languages</td>
</tr>
</tbody>
</table>
Computer Science and Technology (UDC, excerpt, English)

1  004.2  Computer architecture
2  004.3  Computer hardware
3  004.31  Processing units. Processing circuits
4  004.33  Memory units. Storage units
5  004.382.2  Supercomputers
6  004.4  Software
7  004.414  Definition phase of system and software engineering
8  004.414.2  Computer system analysis and design
9  004.414.3  Software requirements analysis
10  004.415  Development phase of system and software engineering
11  004.415.5  Software quality assurance
12  004.416  System and software maintenance
13  004.42  Computer programming
14  004.423  Syntax and semantics of programs
15  004.43  Computer languages
16  004.43.C  C programming language
17  004.43.C++  C++ programming language
18  004.43.FOR  FORTRAN programming language
19  004.431  Low level languages
20  004.432  High level languages
21  004.451  Operating systems
22  004.462  Data handling
23  004.7  Computer networks
24  004.71  Computer communication hardware
25  004.738.5  Internet
26  004.774  HTTP application. World Wide Web in the strict sense. Web resources / content
27  004.82  Knowledge representation
28  004.89  Artificial intelligence application systems. Intelligent knowledge-based systems
29  004.932  Image processing
30  004.94  Simulation
UDC Operations

Standardised operations with UDC are, e.g.,

<table>
<thead>
<tr>
<th>Operation</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addition</td>
<td>“+”</td>
</tr>
<tr>
<td>Consecutive extension</td>
<td>“/”</td>
</tr>
<tr>
<td>Relation</td>
<td>“:”</td>
</tr>
<tr>
<td>Subgrouping</td>
<td>“[]”</td>
</tr>
<tr>
<td>Non-UDC notation</td>
<td>“*”</td>
</tr>
<tr>
<td>Alphabetic extension</td>
<td>“A-Z”</td>
</tr>
</tbody>
</table>

besides place, time, nationality, language, form, and characteristics.

Examples

1. (0.02/.08) Special auxiliary subdivision for document form
2. 1/8 Natural languages
3. 1/2 Indo-European languages
4. 9/93 Artificial languages
5. 59+636 Zoology and animal breeding
6. (7):(4) Europe referring to America
7. 311:[622+669](485) statistics of mining and metallurgy in Sweden
8. 004.382.2:[902+550.8] CPR Supercomputers ref. to archaeology and geosciences, CPR author
Obstacles reducing success and efficiency with the processes

- Time consumption (e.g., staff, project timelines),
- Documentation (e.g., low percentage of reusability),
- Classification (e.g., limited views),
- Tools (e.g., changing repeatedly),
- “Standards” (e.g., changing repeatedly),
- ...
- Different perception of goals, strategies, and completeness.
### Structure
- Must be able to contain and refer to any content.

### Full text and keywords
- Groups, regular expressions, search functions, ...

### Soundex
- Algorithm for calculating codes from text strings, representing phonetic properties.
- Originally only used for names, in English.
- The original algorithm mainly encodes consonants.
- Goal is to encode homophones with the same representation, minor spelling differences do result in the same representation.
- Various modifications for any language, topics, any kind of words, support for many programming environments.
Staff and resources

- **Quantity of Staff and Resources** depends.
- **Quality of Data (QoD)** can optimise requirements for staff and resources.
Multi-disciplinary status

- Medical Informatics,
- Geoinformatics,
- Legal Informatics,
- Geoforensics,
- Archaeology and Digital Archaeology,
- Medical Geology,
- Digital Forensics,
- ...
Content

- Overall information is widely distributed.
- Sometimes very difficult and a long lasting challenge not only to create information but even to get access to a few suitable information sources.
- Digital and realia objects.
- All participating disciplines, services, and resources have to be prepared for challenges as big data, critical data, accessibility, longevity, and usability.

... digital and long-term issues

- Even best practice cannot preserve realia and data context.
- Context is often destroyed.
- Long-term issues.
- Currently neither a standard being used for one discipline nor an international standard.
- ...
Goal

- Need integrated knowledge base for archaeological and natural sciences.
- Necessary to collect data from central data centers or registers. Examples archaeological and geophysical data:
  - North American Database of Archaeological Geophysics (NADAG).
  - Center for Advanced Spatial Technologies (CAST).
  - Archaeology Data Service (ADS).
  - Records as with Center of Digital Antiquity.
  - Records as with the Digital Archaeological Record (tDAR).
- An integrated “Collaboration house” framework is designed to consider all aspects and to handle any kind of object.
... digital and long-term issues

- Documentation.
- Natural sciences data integration?
- Catalogs (International Classification / Catalog of Diseases, ICD).
- Classification (Universal Decimal Classification, UDC).
- Data security.
- Privacy.
- Anonymity.
- ...
... digital and long-term issues

- Documentation.
- Catalogues.
- Classification (Universal Decimal Classification, UDC). Today about 150000 libraries are using UDC classification and implementing information systems herewith.
- Referencing.
- Search.
- Licensing.
Basics and prerequisites

- Real goals. Define the goals, different views.
- Need for basic understanding and knowledge base for HEC.
- Prominent HEC and collaboration aspects decision making processes are necessary for.
- Separate the topics (disciplines, resources, ...).
- Gather the real requirements for the analysis.
- Up-to-date resource policies in theory and practice.
- Interesting fields of application are processes within disciplines.
- Future deployment of integration and classification with components of complex systems.
Components (all areas, no sort order):

- Architecture,
- Operating System,
- Applications,
- Programming languages,
- Tools,
- System modeling,
- Vendors,
- Strategy,
- Targets,
- Staff,
- Operation,
- Services,
- System management,
- Complex licensing,
- Policies,
- Governance,
- ...
Components (all areas, no sort order):

- Components (all areas) with strong focus on
- Applicability, efficiency,
- Architecture applicability,
- Operating System applicability,
- Efficient applications,
- Programming languages,
- Tools,
- System modeling,
- Vendors,
- Strategy,
- Targets,
- Staff,
- Operation,
- Services,
- System management,
- Complex licensing,
- Policies,
- Governance,
- ...
Overview

- Requirements
  - Fast CPU.
  - Parallel processing.
  - Large memory.
  - Fast I/O.

- Hardware / resources

- System / software / configuration

- Applications

- Examples?

- High Performance Computing. Base, parallel developments are integrated for HPC.

- Cluster computing, optimised utilisation of heterogeneous resources (Condor).

- Cloud and Grid Computing (e.g., Globus Toolkit, UNICORE).

- Cloud and Grid islands: Different companies – different technology and terms.
Architecture and Security

- Hardware / Computing.
  - MPP (Massively Parallel Processing).
  - SMP (Symmetric Multi-Processing).
- System software.
  - Operating systems.
  - Cluster management.
  - Storage management.
  - File management.
- Networks.
  - InfiniBand for I/O.
  - InfiniBand for Message Passing Interface (MPI).
  - NumaLink.
  - Service networks.
- Parallel filesystems (GPFS, Lustre, ...).
- Batch system, scheduling, load balancing.
  (Moab, Torque, ...).
- Accounting ...
- Data handling, archive / backup.
- Optional Grid, Cloud services level.

MPP compute nodes
SMP compute nodes
Login server, admin server
Management server
Storage server
File server
MDS server, OSS server
Batch server
Archive / backup server
Common ones

- Use abstraction,
- Use standards,
- Use high-level,
- Use modularisation,
- Use process and workflow modeling,
- Consider legal regulations,
- Define policies,
- Iterate processes,
- Implement an independent auditing,
- (consult other best practice, if available),
- ...
Isolated Approaches in computing:
- Internationalisation,
- Transliteration,
- Syntax unification,
- Semantics,
- ...

Isolated Approaches in programming:
- High level languages,
- Object-oriented paradigms,
- Literate programming,
- Standardisation,
- ...

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Anyhow, on the current base today:

Has someone seen an implementation that has been done perfect?
Selection processes need to be made for:

- Purpose and usage,
- Budget,
- Components,
- Content and data security,
- Science, research, and staff,
- Policies,
- Access,
- Security,
- Operation and staff,
- ...
Selection Process

For which purpose do we need a selection process regarding:

- Resources,
- Information Mining and Management,
- Broadband networks,
- Fibre channel networks,
- Mobile Services,
- ...
Terms, brands, names (historical excerpt)

- **Sun:**
  - Cluster Grids
  - Enterprise Grids
  - Global Grids

- **HP:**
  - Utility Computing

- **IBM:**
  - Autonomic Computing, resources, dynamic VO
  - Grid + provisioning via Cloud Computing (SaaS, DaaS, AaaS . . .)

- . . .
Security engineer:

- disciplines: working security, factory security, IT, ...
- employee of the company,
- exclusively honorary function,
- shall not be a disciplinary superior,
- supports the professional and technical experts by keeping an eye on security devices and possible threats, perils,
- can in no case take the function of a specialist for the security in the disciplines handled.
### Categories of filesystems:

<table>
<thead>
<tr>
<th>Filesystem type</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distributed</td>
<td>NFS, AFS, NCP, CIFS/SMB, XtreemFS, Ceph, Btrfs, HDFS</td>
</tr>
<tr>
<td>Shared</td>
<td>SAN, CXFS, GFS, Polyserve, StorNext, QFS</td>
</tr>
<tr>
<td>Parallel</td>
<td>GPFS, Lustre, PVFS, IBRIX, OneFS, PanFS, NFS/pNFS</td>
</tr>
</tbody>
</table>
Basic issues:

- Administration, Authentication, Authorisation, Accounting.
- Full management tool set should be available.
- With individually customised user management the overall system does not get simpler but it can get much more complex!
- Different requirements and conventions in Supercomputing and Grid / Cloud computing.

Present and future concepts of user management:

- Currently no standardised components and no modularisation and separation of data and implementation.
- Currently invasive customisation necessary.
- Future vendor support for standardised interfaces.
- Future centralised and decentralised components and interfaces.
Available components and status (selection)

- Dynamic Host Configuration Protocol (DHCP): For nodes, invasive, can reduce availability.
- Pluggable Authentication Module (PAM): For nodes, invasive.
- Preboot Execution Environment (PXE): For nodes.
- Network File System (NFS): For nodes.
- Batch system and scheduler: Should by itself support the user management and monitoring.
- Shell scripts: In distributed environment error prone.
- Radius / Eduroam: Small number of attributes for diversity of user groups (e.g., no separation of user, employee, consultant)
- Moonshot: Not for productive use, very invasive, special ssh
- Shibboleth: Attributes available but invasive to complex infrastructures and policies special PAM ECP, NSSWITCH, etc., reduced data security level (unqualified, trust-based due to sshd).
Distributed and bundled implementations:
- Singular, standalone system,
- Cooperation, distributed,
- Alliance, distributed,
- Other.

Benefits (excerpt)
- Support for all disciplines, 365/7/24 via several means of communication.
- Support can be provided for efficient use of resources (HW, SW, compiler, libraries, MPI / OpenMP / others, I/O systems, batch systems, etc.).
- Provisioning and support of SW (commercial and freely available).
- Programming and algorithm support.
- Feedback for the overall community (not only for the providers!).
- Archiving and backup.

Do not promise this if you do not have an excessive and long-term support base!
Support base: quantity and quality, staff, consultants, ...
Information Technology Governance

- IT-Governance is a subset discipline of Corporate Governance focused on IT systems and their performance and risk management.
Rising interest in IT-Governance is partly due to compliance initiatives, as well as the acknowledgment that information technology systems, operation, and projects (e.g., networks, computing, cloud) can be hard to control and can heavily affect the overall performance of institutions and organisations.

Compliance initiatives:
- Basel II, Europe.
- Sarbanes-Oxley Act (SOX), USA.
ISO and IEC

- ...
Challenges with:

- International collaboration,
- Frameworks and standards,
- Services provisioning,
- License models,
- Software Licenses (core numbers, floating, etc.),
- Not hardware, not software (firmware),
- Third parties,
- Operation,
- Maintenance,
- Non-deniability,
- Security,
- ...
Aspects

- Infrastructure security (power on/off security),
- Information technology security (power on/off security),
- Data security,
- Privacy,
- ...

Categories:

- Scientific security research, encryption, in-silico security,
- Low level security (end user application, end user devices and algorithms),
- Day to day / trivial services and support issues,
- ...

Operating System Protection Profile (OSPP)

- Local auditing,
- Crypto-communication,
- Access control,
- Communication packet filtering,
- Security management.

((Practical/theoretical security.))
Data and Content Security

Issues:

- Research – Industry,
- Homomorphic application environments,
- Policies,
- Encryption,
- Signatures,
- Privacy,
- Anti-privacy,
- Plagiarism prevention and detection,
- ...
Categories:

- Plagiarism prevention.
- Plagiarism detection.

Principal, legal, and technical issues:

- Authors/student work before copyright signed in review.
- Databases of third parties, reliability issues.
- Introduction into databases of third parties.
- Problem with double blind / blind review.
- Removal of references and / or citations.
- Self-plagiarism only for a small extend.
- Graphics cannot be checked.
- Sources checked with and without permission of authors?
- Sources might even not be published by authors.
- Too heterogeneous conditions in practice.
- Very time intensive process for authors, reviewers, editors, and publishers.
- Restrictions due to workflow, widely used procedures and structures.
- ...
Aspects

- Trivial documentation,
- Technical and applications’ documentation,
- Scientific documentation,
- Structure,
- Classification,
- Re-use.
Long-term problems?

- Public Domain,
- Freeware,
- GPL (and derivatives),
- Charityware (vim),
- Postcardware,
- Giftware,
- ...
- Open Access model, Open Access publishing,
- ...
- Open Source is trademark but this does not mean products labeled with Open Source are provided without limitations of any kind.
- Bilsky Case.
- Patent Absurdity.
Unified Modeling Language (UML)

The Unified Modeling Language (UML) can be used for various purposes with information sciences, software development, and even independent from information sciences, e.g. in economics and business context:

- “business model”
- classes
- messages, objects in their timing sequence
  - coarse overview
  - dynamic
  - parallel processes
  - distributed systems
UML Diagrams

- Use-case diagram
- Class diagram
- Package diagram
- Interaction diagram
- State diagram
- Activity diagram
- Implementation diagram
### Use-case diagram

**Diagram:** Use-Case  
**Phase:** Requirements, predefinition, application design – building, delivery  
**Operational area:** business processes, common
Use-case diagram

Diagram: Use-Case
Phase: Requirements, predefinition, application design – building, delivery
Operational area: business processes, common

Class diagram

Diagram: class diagram
Phase: predefinition, application design – building
Operational area: anywhere, the class diagram is the most important UML diagram.
Use-case diagram

Diagram: Use-Case
Phase: Requirements, predefinition, application design – building, delivery
Operational area: business processes, common

Class diagram

Diagram: class diagram
Phase: predefinition, application design – building
Operational area: anywhere, the class diagram is the most important UML diagram.

Package diagram

Diagram: package diagram
Phase: application design – building
Operational area: overall orientation purposes, which classes in which modules, partitioning into sub-projects, libraries, translation units.
Interaction diagram

Diagram: interaction diagram
Phase: Requirements, predefinition, application design – building, delivery
Operational area: shows the message flow and therefore the cooperation of objects in timing sequence.

Special interaction diagrams are:
- Sequence diagram: timing call structure with few classes.
- Collaboration diagram: timing call structure with few messages.
Interaction diagram

**Diagram:** interaction diagram

**Phase:** Requirements, predefinition, application design – building, delivery

**Operational area:** shows the message flow and therefore the cooperation of objects in timing sequence.

Special interaction diagrams are:
- Sequence diagram: timing call structure with few classes.
- Collaboration diagram: timing call structure with few messages.

State diagram

**Diagram:** state diagram

**Phase:** Requirements, predefinition, application design – building, delivery

**Operational area:** presentation of dynamical behaviour
**Activity diagram**

**Diagram:** activity diagram

**Phase:** predefinition, application design – building

**Operational area:** various purposes.
Activity diagram

Diagram: activity diagram
Phase: predefinition, application design – building
Operational area: various purposes.

Implementation diagram

Diagram: Implementation diagram
Phase: predefinition, application design – building, delivery
Operational area: especially for presentation of distributed applications and components; in general: presentation of implementation aspects (translations units, executable programs, hardware structure)

Special implementation diagrams are:
• component diagram: coherence of software.
• deployment diagram: hardware structure.
Requirements

Needs and requirements from disciplines classically are in contrast with how resources and services are managed and operated.

Building services on this base typically polarises interests of participated groups.

From this point of view, most building processes regarding computing environments reveal a very small grade of efficiency.
Disciplines involvement goals, examples:

- Long-term knowledge creation (results, data, algorithms, computing instructions, etc.).
- Structure of knowledge.
- Reasoning (society and needs).
- Perception (grow with needs).
- Redundancy and availability.
- Formats, portability.
- System architectures.
- Batch-queue configuration.
- Workarounds and science / technology balance.

What does this mean for knowledge resources and transfer?
References:

- Infonomics for Distributed Business and Decision-Making Environments
  http://www.igi-global.com/reference/details.asp?ID=34799

- Infonomics Society
  http://www.infonomics-society.org

- Infonomics Internet- and database recherche
  http://www.infoseeking.de

- AIIM Infonomics
  http://www.aiim.org/infonomics/

- Infonomics.nl
  http://www.infonomics.nl

- Infonomics.at
  http://www.infonomics.at

- Infonomics.com.au
  http://www.infonomics.com.au
References


http://www.igi-global.com/reference/details.asp?ID=34799
References


Topics:

- Integrated Systems, Information, Communication, and Computation
- Collaboration, Frameworks, and Legal Aspects
- High End Computing, Storage, and Services
- Communication, Computation, Advanced Scientific Computing
- Advanced Applications, Modelling and Simulation in Natural Sciences, Geosciences, Medicine
- Big Data Exploration, Visualisation, Education, and Social Media
- Spatial Sciences, Social Sciences, Teaching, Learning, and Digital Media

http://www.igi-global.com/book/integrated-information-computing-systems-natural/67413
http://dx.doi.org/10.4018/978-1-4666-2190-9
In almost all cases the percentage of re-used knowledge over system generations is very small, leading to perpetuous “re-invention” and “re-discussion” for every cycle.

The suggested rate of re-use is below 10 percent.
Services differ by physics and intention, especially:

- **Latencies and bandwidth**: Low segment: Latency 100 $\mu$s to several milliseconds (distributed), latency 1–2 $\mu$s (local), bandwidth 1.5–4 GB/s (local),

- **Distributed data transfer**: Data transfer for supercomputing is essential with any big (volume) data, physics provide limitation to economical distributed solution.

- **Distributed memory usage**: Shared memory usage for supercomputing is essential with shared memory algorithms, physics provide limitation to economical distributed solution.
High Performance Computing I/O Compute Resource (HPC Center)

- minimal entry level per job (logical AND):
  - publicly funded research, no production jobs or industry users
  - will be validated that the minimal access requirements are fulfilled and reasonable
  - 512 nodes
  - 4096 Cores (e.g., Intel)
  - maximum: about double nodes and cores
  - 3 GB memory usage per core
  - already parallelized MPI read/write into 1-1000 files
  - extensive and already optimised MPI I/O communication from mostly all cores used (max 1-2 TB per second overall)
- runtime per job 12 hours
- job must be batch system based
- environment fixed, depending on installation
- ssh access only
- programming, compilation, installation by user
High Performance Computing Compute Resource (HPC Center)

- minimal entry level per job (logical AND):
- publicly funded research, no production jobs or industry users
- will be validated that the minimal access requirements are fulfilled and reasonable
- 512 nodes
- 4096 Cores (e.g., Intel)
- maximum: about double nodes and cores
- 3 GB memory usage per core
- already parallelized MPI read/write into 1-100 files
- extensive MPI compute communication from mostly all cores used
- runtime per job 36 hours
- job must be batch system based
- environment fixed, depending on installation
- ssh access only
- programming, compilation, installation by user
High Performance Computing SMP Resource (HPC Center)

- minimal entry level per job (logical AND):
  - publicly funded research, no production jobs or industry users
  - will be validated that the minimal access requirements are fulfilled and reasonable
- 32 nodes
- 32×8 Cores (e.g., Intel)
- maximum: 2-3 jobs/tasks in parallel
- 512 GB memory usage per job
- OpenMP communication
- runtime per job 12 hours
- job must be batch system based
- environment fixed, depending on installation
- ssh access only
- programming, compilation, installation by user
Cloud / Grid (Provider, Computing Center)

- minimal entry level per job:
  - 1-64 nodes
  - \( n \) (Intel or other) cores depending on architecture and provider
  - small to medium sized memory usage per core
  - small I/O (Giga-Bytes not TeraBytes overall)
- hundreds of cores
- loosely coupled, parallel jobs, task-parallel, moderate MPI parallel
- further services/anything else per-pay that scientific HPC Centers might not provide
- efficiency requirements depend on provider and customer agreements
- middleware and access depending on provider
Requirements

- Economical environment.
- Efficient operation.
- Sustainable investment.
- Defined policies.
- ...
More than a tool? Always think of knowledge:

- Content.
- Context.
A knowledge base has to be multi-disciplinary and facetted:

- Disciplines,
- Services,
- Providers.
Which architecture?

- Standalone / workstation,
- Cluster,
- Grid,
- Cloud,
- High Performance Computing (HPC),
- Other.
How do you provision services or resources?

- Institute,
- Alliance,
- Hosting,
- Housing,
- Other.
Which type?

- Research
- Industry
- Mix
- Other
Which kind of usage?

- Interactive
- Batch
- Hybrid
- Other
How can the architecture be used efficiently?

- MPP (Massively Parallel Processing),
- SMP (Shared-Memory Parallel),
- Other.
Which model?

- Low Level: MPI (Message Passing Interface),
- Low Level: OpenMP,
- High Level: PGAS (Partitioned Global Address Space),
- Virtualisation: PVM (Parallel Virtual Machine),
- Other.
How do you gather information about productivity?

- Profiling,
- Benchmarking,
- Polling,
- Quality of . . . “measurements”,
- Other.
How do YOU gather knowledge?

... and are there differences?

- In general.
- Within disciplines.
- With High End Computing.
How to build long-term knowledge transfer?

- Requirements studies with user groups,
- Documentation of tender processes,
- Documentation of operation and service,
- ...

Disciplines: Natural sciences, spatial sciences, archaeology, geosciences, etc.

- Disciplinary,
- Inter-disciplinary,
- Multi-disciplinary,
- ...

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Multi-step cycle of 4-7 years:

Requirements:

- **Users / disciplines**
  - request users / disciplines for comments.

- **Infrastructure**
  - participate infrastructure planners, architects, administration, etc.

- **Legal regulations (non-discrimination / environment / procedures)**
  - participate lawyers.

- **Technical developments**
  - information from developers and industry.

- **Future planning**
  - participate hierarchy.

- ...
Can High End Systems be compared seriously? Remember:

- Every HEC / Supercomputing system is unique in its overall hardware, software stack, and configuration.
- Development cycle is about 5 years.
- Most tests for the bleeding edge components have to be done on final, entire systems.

Extraordinary With Singular Aspects: The Greatest, Biggest, Greenest

**Top500**
Top500 list with the “fastest” supercomputers in the world.
Only standard-benchmark: High Performance Linpack (HPL).

**Green500**
“Ecological” list going for performance in relation to energy consumption.
Only energy, and only in operation.

...
Supercomputing Resources – Examples

For the further dialog within the tutorial, the tutorial discusses some selected historical and up-to-date High Performance Computing systems and hardware and components used with Advanced Scientific Computing.

- Cray2
- JUMP
- BSC
- HLRB
- Shenzhen
- Jaguar
- Tianhe
- SuperMUC
- Sequoia
- and others . . .

--- ABOVE EXAMPLES FOR DISCUSSION LEFT OUT HERE ---
Application scenarios and decision making support

The following case studies show simplified, practical application scenarios for:

- separating essential knowledge (e.g., knowledge resources, structure)
- creating knowledge based components (e.g., Active Source)
- supporting increased decision potential (e.g., UDC classification)
- integrating high end resources (e.g., compute and storage)
**One view: (classification)**

- Type: Poster,
- Format: Image,
- Content: Supercomputing system,
- Context: Type and size of resources,
- System: North-German Supercomputing Alliance (HLRN),
- Secondary information: PDF/image information (author, subject),
- Originary sources: long-term, LX Hardware Trace, created: 2008,

**Another view: (classification)**

- Content: Number of cores, compute nodes, disks, hardware architecture, massively parallel system, communication properties.
- Context: Supercomputing system,
- Usage and application: Geosciences, earth sciences, physics, …
- System: HLRN-II, North-German Supercomputing Alliance (HLRN),
Frameworks supporting integration of:

- Information (e.g., knowledge resources),
- Computation (e.g., advanced scientific computing),
- Collaboration (e.g., collaboration frameworks).
- Disciplines (e.g., knowledge, collaboration, interfaces),
- Services (e.g., policies, interfaces),
- Resources (e.g., management, architecture, policies).
Integrated systems and resources for advanced scientific computing (GEXI)
Using the following concepts, we can, mostly for any system, implement:

- Application communication via IPC.
- Application triggering on events.
- Storage object requests based on envelopes.
- Compute requests based on envelopes.

Used for demonstration and studies with Integrated Systems:

- Active Source Information System components for
- Flexible implementation,
- Maximum transparency,
- Separate knowledge (Structure, UDC, CEN OEN),
- Allowing OO-support (object, element) on application level,
- Multi-system support.
Application communication with framework-internal and external applications (IPC)

```tcl
1 catch {
2     send {rasmol #1} "$what"
3 }
```

- Self-descriptive Tcl syntax.
- Inter-Process Communication `send` starting molecular graphics visualisation.
- Catching messages for further analysis by the components.
### Application triggering, linking to application components

1. `text 450.0 535.0 -tags {itemtext relictrotatex} -fill yellow -text "Rotate $x$" -justify center`
2. ...
3. `$w$ bind relictrotatex <Button-1> {sendAllRasMol {rotate x 10}}$
4. `$w$ bind relictballsandsticks <Button-1> {sendAllRasMol {spacefill 100}}$
5. `$w$ bind relictwhitebg <Button-1> {sendAllRasMol {set background white}}$
6. `$w$ bind relictzoom100 <Button-1> {sendAllRasMol {zoom 100}}$
Storage object requests

Generic Object Envelopes (OEN)

```
<ObjectEnvelope> <!-- ObjectEnvelope (OEN) -->
  <Object>
    <Filename>GIS_Case_Study_20090804.jpg</Filename>
    <Md5sum>...</Md5sum>
    <Sha1sum>...</Sha1sum>
    <DateCreated>2010-08-01:221114</DateCreated>
    <DateModified>2010-08-01:222029</DateModified>
    <ID>...</ID>
    <CertificateID>...</CertificateID>
    <Signature>...</Signature>
    <Content><ContentData>...</ContentData></Content>
  </Object>
</ObjectEnvelope>
```

- OEN containing element structures, handling and embedding data / information.
- End-user public client application, implementation via browser plugin / services.
- Instructions embedded in envelopes, content-stream and content-reference.
- Respect any meta-data for objects, handle different object formats, staying transparent, portable, keep original documents unmodified, supports signed object elements and PKI, usable with sources and binaries like Active Source.
Compute requests

Generic Compute Envelope (CEN)

```xml
<ComputeEnvelope>
  <!-- ComputeEnvelope (CEN) -->
  <Instruction>
    <Filename>Processing_Batch_GIS612.pbs</Filename>
    <Sha512sum>...</Sha512sum>
    <DateCreated>2010-08-01:201057</DateCreated>
    <DateModified>2010-08-01:211804</DateModified>
    <CertificateID>...</CertificateID>
    <Signature>...</Signature>
    <Content>
      <DataReference>https://doi...</DataReference>
    </Content>
    <Script>
      <Pbs>
        <Shell>#!/bin/bash</Shell>
        <JobName>#$PBS -N myjob</JobName>
        <Oe>#$PBS -j oe</Oe>
        <Walltime>#$PBS -l walltime=00:10:00</Walltime>
        <NodesPpn>#$PBS -l nodes=8:ppn=4</NodesPpn>
        <Feature>#$PBS -l feature=ice</Feature>
        <Partition>#$PBS -l partition=hannover</Partition>
        <Accesspolicy>#$PBS -l naccesspolicy=singlejob</Accesspolicy>
        <Module>module load mpt</Module>
        <Cd>cd $PBS_O_WORKDIR</Cd>
        <Np>np=$(cat $PBS_NODEFILE | wc -l)</Np>
        <Exec>mpiexec_mpt -np $np ./dyna.out 2>&1</Exec>
      </Pbs>
    </Script>
  </Instruction>
</ComputeEnvelope>
```

- Compute requests for resources handled via CEN interfaces, self-descriptive, environment preconfigured, references parallel processed on various architectures.
Example: Search objects and realia references in volcanology dimension

Volcanology

- Plate tectonics
  - First level relation object: Plate tectonics
- Volcano
  - First level relation object: Volcano
- Lava
  - First level relation object: Lava
- Vesuvius
- Soufrière
- Mt. Scenery
- Samples
  - Third level relation object: Samples (Realia)

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International Tutorial INFOCOMP 2012: Decision Making and HEC
Example: Simple workflow with knowledge base

1. Discipline
2. Knowledge base
3. Integrated system
4. Select object group
5. Process objects
6. Has the tentative result improved?
7. No
8. Alter processing
9. Yes
10. Result
Effective decision making does mean selection based on knowledge!
Process fundamentals:

- Knowledge and experience are more important than hierarchy.
Process fundamentals:

- Knowledge and experience are more important than hierarchy.
- Find the essential information.
Process fundamentals:

- Knowledge and experience are more important than hierarchy.
- Find the essential information.
- *Rational problem analysis and decision planning.*
Process fundamentals:

- Knowledge and experience are more important than hierarchy.
- Find the essential information.
- Rational problem analysis and decision planning.
- Add forensics to all possible information.
### Process fundamentals:

- Knowledge and experience are more important than hierarchy.
- Find the essential information.
- Rational problem analysis and decision planning.
- Add forensics to all possible information.
- **The decision making process needs to define the focus.**
Process fundamentals:

- Knowledge and experience are more important than hierarchy.
- Find the essential information.
- Rational problem analysis and decision planning.
- Add forensics to all possible information.
- The decision making process needs to define the focus.
- The decision making process needs to define goals.
Process fundamentals:

- Knowledge and experience are more important than hierarchy.
- Find the essential information.
- Rational problem analysis and decision planning.
- Add forensics to all possible information.
- The decision making process needs to define the focus.
- The decision making process needs to define goals.
- There should be only one final instance for selection processes.
Process fundamentals:

- Knowledge and experience are more important than hierarchy.
- Find the essential information.
- Rational problem analysis and decision planning.
- Add forensics to all possible information.
- The decision making process needs to define the focus.
- The decision making process needs to define goals.
- There should be only one final instance for selection processes.
- Multiple views for a process must be allowed and supported.
Process fundamentals:

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- Multiple views for a process must be allowed and supported.
- Define results.
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- The decision making process needs to define the focus.
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- There should be only one final instance for selection processes.
- Multiple views for a process must be allowed and supported.
- Define results.
- Define service and responsibilities.
Process fundamentals:

- Knowledge and experience are more important than hierarchy.
- Find the essential information.
- Rational problem analysis and decision planning.
- Add forensics to all possible information.
- The decision making process needs to define the focus.
- The decision making process needs to define goals.
- There should be only one final instance for selection processes.
- Multiple views for a process must be allowed and supported.
- Define results.
- Define service and responsibilities.
- List requirements and parts.
Process fundamentals:

- Knowledge and experience are more important than hierarchy.
- Find the essential information.
- Rational problem analysis and decision planning.
- Add forensics to all possible information.
- The decision making process needs to define the focus.
- The decision making process needs to define goals.
- There should be only one final instance for selection processes.
- Multiple views for a process must be allowed and supported.
- Define results.
- Define service and responsibilities.
- List requirements and parts.
- **Tools are needed for making the selection.**
Process fundamentals:

- Knowledge and experience are more important than hierarchy.
- Find the essential information.
- Rational problem analysis and decision planning.
- Add forensics to all possible information.
- The decision making process needs to define the focus.
- The decision making process needs to define goals.
- There should be only one final instance for selection processes.
- Multiple views for a process must be allowed and supported.
- Define results.
- Define service and responsibilities.
- List requirements and parts.
- Tools are needed for making the selection.
- Keep the tools simple.
Process fundamentals:

- Knowledge and experience are more important than hierarchy.
- Find the essential information.
- Rational problem analysis and decision planning.
- Add forensics to all possible information.
- The decision making process needs to define the focus.
- The decision making process needs to define goals.
- There should be only one final instance for selection processes.
- Multiple views for a process must be allowed and supported.
- Define results.
- Define service and responsibilities.
- List requirements and parts.
- Tools are needed for making the selection.
- Keep the tools simple.
- Best practice should be used in order to support the process.
Essential aspects:

- Dissemination.
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- **Scientific research and consultancy.**
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- Service and operation.
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- Quality of Data counts, aware of long-term usage.
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- Support structuring the application scenarios with architecture/disciplines.
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- Support structuring the application scenarios with architecture/disciplines.
- Support essential knowledge to be long-term persistent (structure, UDC, OEN, CEN, ...).
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- Try to support dynamical application scenarios.
Essential aspects:

- Dissemination.
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- Service and operation.
- Transparency for legal issues.
- Written definition of goals, acknowledged by all parties.
- Quality of Data counts, aware of long-term usage.
- Support structuring the application scenarios with architecture/disciplines.
- Support essential knowledge to be long-term persistent (structure, UDC, OEN, CEN, ...).
- Try to support dynamical application scenarios.
- Acknowledge that for some party prestige and presentation might be an aspect with any system.
Decision Subjects

**Decision on:**

- User (scientific and industry) requirements,
- Content,
- Context,
- Operation lifecycle,
- Staff and operation,
- Services,
- Architecture (specification, networks),
- Policies,
- Goals (of the system/service),
- Dissemination,
- (Funding).
Future Challenges

Following events:

Are there aspects for future multi-disciplinary topics?
Future Challenges

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Overall goals:
- Improve long-term creation of knowledge.
Future Challenges

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- Improve decision making processes.
Future Challenges

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Are there aspects for future multi-disciplinary topics?

**Overall goals:**

- Improve long-term creation of knowledge.
- Improve decision making processes.
- **Improve Quality of Data.**
Future Challenges

Following events:

Are there aspects for future multi-disciplinary topics?

Overall goals:

- Improve long-term creation of knowledge.
- Improve decision making processes.
- Improve Quality of Data.
- Improve multi-disciplinary work.
Future Challenges

Following events:

Are there aspects for future multi-disciplinary topics?

Overall goals:

- Improve long-term creation of knowledge.
- Improve decision making processes.
- Improve Quality of Data.
- Improve multi-disciplinary work.
- Support integrated systems.
Following events:
Are there aspects for future multi-disciplinary topics?

Overall goals:
- Improve long-term creation of knowledge.
- Improve decision making processes.
- Improve Quality of Data.
- Improve multi-disciplinary work.
- Support integrated systems.
- Dissemination with processes, learning, and education.
Future Challenges

Following events:
Are there aspects for future multi-disciplinary topics?

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- A “State of the art for long-term issues”.
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- Where we are: Content, Classification, Modelling.
Following events:

Are there aspects for future multi-disciplinary topics?

Overall goals:

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- Improve decision making processes.
- Improve Quality of Data.
- Improve multi-disciplinary work.
- Support integrated systems.
- Dissemination with processes, learning, and education.
- A “State of the art for long-term issues”.
- Where we are: Content, Classification, Modelling.
- Mid- and long-term: Context.
Presentation: Using UDC with computing and information systems

- **Monday, 2012-10-22, 15:45 – 17:30**

INFOCOMP 3–Session, Discussion on:
Enabling Dynamical Use of Integrated Systems and Scientific Supercomputing Resources for Archaeological Information Systems.

Program: [http://www.iaria.org/conferences2012/ProgramINFOCOMP12.html](http://www.iaria.org/conferences2012/ProgramINFOCOMP12.html)

International Panel INFOCOMP 2012

- **Monday, 2012-10-22, 17:30 – 19:00**

International Panel on Future High End Systems:
Chances and Challenges for Intelligent Applications and Infrastructures.

Program: [http://www.iaria.org/conferences2012/ProgramINFOCOMP12.html](http://www.iaria.org/conferences2012/ProgramINFOCOMP12.html)
Thank you for your attention!
Wish you an inspiring conference and a pleasant stay in Venice!