An Investigation on the Applicability of Inter-Disciplinary Concepts to Software System Development

LinuxTag 2007, Berlin, Germany

Dr. Christian Heller
introduction
reflexions
  statics and dynamics
  double-hierarchy knowledge
state and logic
realisation
  cybol language
  cyboi interpreter
res medicinae
summary and future
introduction
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introduction

**knowledge**

human being

**information**

fact or message with recognisable news in semantic context

**data**

(machine-readable) characters / numbers that may contain information

**knowledge**

structured data which are inter-related (associated)

**software**

hardware
constructive development – complexity – example
• bundling of attributes and methods – coupling, no flexibility

• reflective meta architectures – bidirectional dependencies

• bidirectional dependencies – complexity, circular references

• global / static data access – untraceable data manipulation

container inheritance – falsified container content

problems – more in cybop book
falsifying container inheritance [iaq, dr. norvig]
introduction

- traditional programming
  - structure
  - procedure
  - class
  - inheritance

- scientific disciplines
  - new concept
  - ideas

+/-

- cybop
  - statics & dynamics
  - knowledge schema
  - state & logic
cybernetics (kybernetes = steersman)
• science of information and control
• in living things or machines (norbert wiener)

bionics (bio-cybernetics)
• biological principles applied to
• study and design of engineering systems

relation
• software engineering = systems engineering
• system as a whole gains in importance
• biological / human → software system
• physical brain: neural network
• logical mind: concepts
introduction
reflexions
  statics and dynamics
double-hierarchy knowledge
state and logic
realisation
  cybol language
cyboi interpreter
res medicinae
summary and future
category
(living thing)

super

is-a

sub

item
(human being)

has-a

whole

part

compound
(brain)

categorisation
plato – aristotle – alexander

category
living thing
human, animal, plant
generalisation
specialisation
compound (brain)

composition
gottfried wilhelm leibnitz
monades

human being
eye, brain, arm

container
element

statics and dynamics

has-a

composition

gottfried wilhelm leibnitz
monades

human being
eye, brain, arm

container
element

statics and dynamics
Health Level 7 - RIM
Reference Information Model

scheduling
role
service

finance
entity
role-role-role-relation

statics and dynamics
java.lang.Object

- parts: HashMap
- set(n: String, o: Object): void
- get(n: String): Object
- remove(n: String): void

Living Subject

- static birthdate: String

Person

- static address: String

Address a = (Address) get("address");
Address a = (Address) get(Person.address);
system owns knowledge (also: biological cell + dna)
introduction
reflexions
  statics and dynamics
double-hierarchy knowledge
state and logic
realisation
  cybol language
cyboi interpreter
res medicinae
summary and future
double-hierarchy knowledge

properties
- happy, sad, aggressive
- black, white
- shape, size
- smell

state structure
- head, eyes, ears, hair
- arms, legs

external concepts
- food, book
- clothes, shoes, hat

change logic
- walk, run, limp
human being

part 0..* legs

property

size

constraint

minimum

meta information

properties:
position, size, colour, order, weight

constraints:
minimum, maximum,

double hierarchy – in space, time etc.
The human mind structures the world into discrete items. These items may belong to a category. A compound model knows about its parts, which can be compounds or primitives indicated by abstraction relations. Relations are unidirectional.

```
item
+ category
+ compound
= schema
```
double-hierarchy knowledge

traditional

program structure

runtime structure

universal memory structure – flexibility

cybop
introduction
reflexions
  statics and dynamics
  double-hierarchy knowledge
  state and logic
realisation
  cybol language
cyboi interpreter
res medicinae
summary and future
misleading tiers – inflexible software architecture
human user

model view controller

application server

data mapper

database server

data transfer object

remote server

communication patterns

state and logic

mouse gui

corba soap

jdbc
star-like (not layer-like) translator architecture
introduction
reflexions
  statics and dynamics
  double-hierarchy knowledge
  state and logic
realisation
  cybol language
  cyboi interpreter
res medicinae
summary and future
cybol language
cybol tags + attributes, abstraction principles
cybol language

<table>
<thead>
<tr>
<th>name</th>
<th>channel</th>
<th>abstraction</th>
<th>model</th>
</tr>
</thead>
<tbody>
<tr>
<td>inline</td>
<td>character</td>
<td>Res Medicine</td>
<td></td>
</tr>
<tr>
<td>file</td>
<td>compound</td>
<td>/resmedicinae/gui/menu_bar.cybol</td>
<td></td>
</tr>
<tr>
<td>file</td>
<td>compound</td>
<td>/resmedicinae/gui/tool_bar.cybol</td>
<td></td>
</tr>
<tr>
<td>file</td>
<td>compound</td>
<td>/resmedicinae/gui/panel.cybol</td>
<td></td>
</tr>
<tr>
<td>file</td>
<td>compound</td>
<td>/resmedicinae/gui/status_bar.cybol</td>
<td></td>
</tr>
</tbody>
</table>

whole-part relation

meta information

template editor with double hierarchy and triple click
introduction
reflexions
  statics and dynamics
double-hierarchy knowledge
state and logic
realisation
  cybol language
cyboi interpreter
res medicinae
summary and future
<table>
<thead>
<tr>
<th>criterion</th>
<th>java world</th>
<th>cybop world</th>
</tr>
</thead>
<tbody>
<tr>
<td>theory</td>
<td>oop (object oriented</td>
<td>cybop (cybernetics</td>
</tr>
<tr>
<td></td>
<td>programming)</td>
<td>oriented programming)</td>
</tr>
<tr>
<td>language</td>
<td>java</td>
<td>cybol</td>
</tr>
<tr>
<td>interpreter</td>
<td>jvm (java virtual machine)</td>
<td>cyboi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(cybernetics oriented</td>
</tr>
<tr>
<td></td>
<td></td>
<td>interpreter)</td>
</tr>
</tbody>
</table>
memoriser

applicator

cyboi

cyboi

controller

manager

checker

handler

controller part dependencies

cyboi control flow
introduction
reflexions
  statics and dynamics
double-hierarchy knowledge
  state and logic
realisation
  cybol language
cyboi interpreter
res medicinae
summary and future
res medicinae
runtime model hierarchy
introduction
reflexions
  statics and dynamics
  double-hierarchy knowledge
state and logic
realisation
  cybol language
  cyboi interpreter
res medicinae
summary and future
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knowledge triumvirate

template
- statics
- cybol language
- design time
- domain expert / application developer

schema
- structure
- cybop concepts
- analysis time
- knowledge architect / information scientist

model
- dynamics
- cyboi interpreter
- runtime
- systems developer

influence

instantiation
software engineering process

- analysis
- design
- implementation

requirements document

state knowledge
logic knowledge

common knowledge abstraction

summary and future
summary and future

traditional

models suffer from complexity

strong coupling / dependencies

inflexible

difficult to maintain

→ one schema as memory structure

→ directed acyclic graph (tree)

→ easily extensible

→ long-life software system

limits: only standard-, no real-time applications
call for developers

- x windows, linux console, tcp sockets
- database access via sql, graphics with OpenGL/ Mesa 3D
- signalling mechanism, threading, mutexes
- port to ms windows using cygwin
- parser/ serialiser to convert different file formats
- debian package, autoconf/ automake --> official GNU
- cybol knowledge templates for various domains
Christian Heller

CYBOP

Cybernetics Oriented Programming

An Investigation on the Applicability of Inter-Disciplinary Concepts to Software System Development

thank you!

http://www.cybop.net

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