

System integrity and stability with APL

Overview of a sheaf of APL workspace

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About

Constant onslaught in the regulation game

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About

Constant onslaught in the regulation game

- German health insurance highly regulated

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- German health insurance highly regulated
- divers agents with different demands

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- German health insurance highly regulated
- divers agents with different demands
- actuarial department with many obligations and responsibilities

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About

Constant onslaught in the regulation game

- German health insurance highly regulated
- divers agents with different demands
- actuarial department with many obligations and responsibilities
- a sheaf of APL workspaces used as defence

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Outline

1 Infrastructure level

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Outline

- 1 Infrastructure level
- 2 Base level

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Outline

- 1 Infrastructure level
- 2 Base level
- 3 Utility level

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Outline of section on infrastructure level

In this section we outline:

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Outline of section on infrastructure level

In this section we outline:

Agents some agents in the regulation game

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Outline of section on infrastructure level

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Agents some agents in the regulation game

Infrastructure general requirements on infrastructure

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The Red Team

The Red Team is very big

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The Red Team

The Red Team is very big

- multitude of laws and ministries

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- multitude of laws and ministries
- supervising authority (**BaFin** – Bundesanstalt für Finanzdienstleistungsaufsicht)

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- multitude of laws and ministries
- supervising authority (**BaFin** – Bundesanstalt für Finanzdienstleistungsaufsicht)
- independent trustee (**TH** – Treuhänderin)

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The Red Team

The Red Team is very big

- multitude of laws and ministries
- supervising authority (**BaFin** – Bundesanstalt für Finanzdienstleistungsaufsicht)
- independent trustee (**TH** – Treuhänderin)
- internal (Revision) and external audits (**WP** – Wirtschaftsprüfer)

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- internal guidelines (RL – Richtlinien)

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- individual customers

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- individual customers
- courts of law

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Some Special Red Agents

There are some Important Red Agents

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Some Special Red Agents

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VAG insurer's supervision law – Gesetz über die
Beaufsichtigung der Versicherungsunternehmen

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Some Special Red Agents

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- VAG** insurer's supervision law – Gesetz über die Beaufsichtigung der Versicherungsunternehmen
- KVAV** health insurance decree – Verordnung betreffend die Aufsicht über die Geschäftstätigkeit in der privaten Krankenversicherung

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- DSGVO** data protection framework – Datenschutz-Grundverordnung (Germany)

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The Blue Team

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- 1-2 developers

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- 1-2 developers
- 2-5 users

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The Blue Team

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- 1-2 developers
- 2-5 users
- a powerful tool of thought

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The Blue Team

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- 1-2 developers
- 2-5 users
- a powerful tool of thought
- some other tools

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Some Special Blue Agents

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DIV basic tools and utilities

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Some Special Blue Agents

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DIV basic tools and utilities

KV tools and utilities for health insurance

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Some Special Blue Agents

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DIV basic tools and utilities

KV tools and utilities for health insurance

GRD basic actuarial data and controls for health insurance

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GRD basic actuarial data and controls for health insurance

TEX interface to \LaTeX and SVN

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Some Special Blue Agents

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- DIV** basic tools and utilities
- KV** tools and utilities for health insurance
- GRD** basic actuarial data and controls for health insurance
- TEX** interface to \LaTeX and SVN
- DWH** specifications and controls for Data Warehouse health

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- H7101** database side management of actuarial data proper

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- RST** control of reserves in balance sheet

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- BF** control of premium recalculation
- LIM** management of capping schemes

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The Game

The Game's rules are unfair

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The Game

The Game's rules are unfair

- the **Red Team** can demand almost anything

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The Game

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- the **Red Team** can demand almost anything
- the **Red Team** never loses, at best it concedes the outcome of a round to be OK

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- the **Blue Team** has to keep on going. . .

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The Game

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- the **Red Team** can demand almost anything
- the **Red Team** never loses, at best it concedes the outcome of a round to be OK
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▶ A challenge!

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Reproducibility of code and data

Challenge code and data must be reproducible

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Reproducibility of code and data

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Adversaries **VAIT**, **DORA**, **IDV-RL**
APL as such, proper programming, div.build, Link,
SVN/Git

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Reproducibility of code and data

- Challenge code and data must be reproducible
- Adversaries **VAIT**, **DORA**, **IDV-RL**
APL as such, proper programming, `div.build`, `Link`,
`SVN/Git`
- Interception proper programming (not Excel!), `Link` as base
framework for using `Link`, code as text
use tool like `SVN/Git` for full reproducibility
proper (reproducible) programs with defined output
for reproducible data

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Versioning and documentation

Challenge code must be versioned and documented

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Adversaries **VAIT, DORA, IDV-RL**

div.build, Link, **SVN/Git**, tex.svn, tex.exp

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Versioning and documentation

Challenge	code must be versioned and documented
Adversaries	VAIT, DORA, IDV-RL div.build, Link, SVN/Git, tex.svn, tex.exp
Interception	full versioning like SVN/Git trivially lists versions! documentation mainly with different tools like L ^A T _E X functions for listings versions in documents functions supports creation of (semi-) automated documents

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Privileges on applications and data

- Challenge
- privileges must follow “need to know” and “least privilege necessary”
 - privileges must be regularly “re-certified”
 - contracts restrict number of product licences

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Privileges on applications and data

- Challenge privileges must follow “need to know” and “least privilege necessary”
 privileges must be regularly “re-certified”
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- Adversaries **VAIT, DORA, IDV-RL, CARE (ERGO), licence contracts, DBA (DB2 database administration)**
 kv.ad, kv.racf, grd, dwh

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Privileges on applications and data

- Challenge privileges must follow “need to know” and “least privilege necessary”
 privileges must be regularly “re-certified”
 contracts restrict number of product licences
- Adversaries **VAIT, DORA, IDV-RL, CARE (ERGO), licence contracts, DBA (DB2 database administration)**
 kv.ad, kv.racf, grd, dwh
- Interception basic functions extract data from AD (Active Directory) or RACF (Resource Access Control Facility)
 utilities control use of L^AT_EX, network shares. . .
 number of needed APL licences easily monitored
 interface to DBA (DB2 database administration)

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Outline of section on base level

In this section we outline:

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Outline of section on base level

In this section we outline:

Changes due process for changes/projects

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Outline of section on base level

In this section we outline:

Changes due process for changes/projects

Actuarial data calculation and usage of actuarial data

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Changes in APL programs

Challenge tests and expected results must be defined
 tests must be done and documented

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Changes in APL programs

- Challenge tests and expected results must be defined
 tests must be done and documented
- Adversaries **VAIT, DORA, IDV-RL**

build, <mns>.build.check in each workspace

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Changes in APL programs

- Challenge tests and expected results must be defined
tests must be done and documented
- Adversaries **VAIT**, **DORA**, **IDV-RL**
div.build, **<mns>.build.check** in each workspace
- Interception framework for test cases
expected results as well as tests themselves exhaustively documented
covers also stability of APL under external changes

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Changes of DB2 structures

Challenge tests and expected results must be defined
 tests must be done and documented

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Changes of DB2 structures

- Challenge tests and expected results must be defined
 tests must be done and documented
- Adversaries **VAIT, DORA, Essence model (ERGO), DBA (DB2
 database administration)**
 grd.db2str, dwh.db2str, grd.kvref

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Changes of DB2 structures

- Challenge tests and expected results must be defined
tests must be done and documented
- Adversaries **VAIT, DORA, Essence model (ERGO), DBA (DB2 database administration)**
grd.db2str, dwh.db2str, grd.kvref
- Interception DB2 objects listed and described independently from implementation
full references if actuarial department is responsible
automated comparisons with to dos for DBA separately documented

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Projects in general

Challenge specifications must come from the business side
 projects must be controlled

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Projects in general

- Challenge specifications must come from the business side
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- Adversaries **VAIT, DORA, Essence model (ERGO)**
 wr

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Projects in general

- Challenge specifications must come from the business side
projects must be controlled
- Adversaries **VAIT, DORA, Essence model (ERGO)**
wr
- Interception ad hoc functions that accompany initialisation / migration of data or implementation of new structures
when necessary later transformation into permanent control function

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Actuarial test suites and data protection

Challenge all aspects of changes must be tested before going to production
data protection must be maintained throughout

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Actuarial test suites and data protection

- Challenge all aspects of changes must be tested before going to production
- Adversaries data protection must be maintained throughout
VAIT, DORA, Essence model (ERGO), DSGVO /
GDPR
tb

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Actuarial test suites and data protection

- Challenge all aspects of changes must be tested before going to production
data protection must be maintained throughout
- Adversaries **VAIT, DORA, Essence model (ERGO), DSGVO / GDPR**
tb
- Interception define arbitrary test suites (sets of contracts) in production, for example appropriate sample or whole business in force or specific plan
copy to test via DB2 utilities
anonymise insurance number and achieve at the same time separation of test suites

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Management of base/auxiliary actuarial data

- Challenge
- base/auxiliary data provided as lists or constants
 - some managed in APL as primary source, some as reference values
 - special classes of data (capping schemes) managed in APL interactively
 - data must be transferred correctly to DB2 or checked against DB2

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 - grd, lim, h7101

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- Adversaries **VAIT, DORA, IDV-RL, BaFin, TH, internal**
 grd, lim, h7101
- Interception provide as many internal consistency and complete-
 ness checks on the APL side as possible
 provide SQL server tables as dedicated intermediate
 storage vessels
 then use standard mechanisms for DB2 transfer

Transfer of actuarial data proper

- Challenge
- actuarial data proper calculated in dART
 - main transfer of data to DB2 not APL
 - transfer of the data to DB2 must be checked, controls must be documented
 - backup for transfer must be in place

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h7101, rgl

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transfer of the data to DB2 must be checked, controls must be documented
backup for transfer must be in place
- Adversaries BaFin, TH, internal
h7101, rgl
- Interception provide program that checks transfer on purely technical level, based on table keys and values
this may double as alternative for data transfer
another program checks transfer using as much actuarial knowledge as possible, including data importance and rounding

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Consistency and correctness of actuarial data proper

Challenge actuarial data proper must be consistent and complete, and adhere to actuarial requirements on its data model
the calculation in dART must be checked

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Consistency and correctness of actuarial data proper

- Challenge actuarial data proper must be consistent and complete, and adhere to actuarial requirements on its data model
 the calculation in dART must be checked
- Adversaries BaFin, TH, internal
 rgl
- Interception force DB2 as well as dART data into a more abstract data model
 check as many points on consistency and completeness as possible
 replicate the calculation kernel of dART

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Use of actuarial data proper in simulations

Challenge simulations need actuarial data proper to work with
it must be guaranteed that the same actuarial data
is used for balance sheet and portfolio management
that fore reference systems must also use the same

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rgl
- Interception output data in homogenous way (component files
with specific contents)
build general interface to this output
use for all simulations

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Analysis and modification of actuarial data proper

Challenge on demand or for internal purposes actuarial data proper must be analysed, for example split into components
for projections into the future actuarial data must be modified or estimated

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rgl.apl

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Analysis and modification of actuarial data proper

- Challenge on demand or for internal purposes actuarial data proper must be analysed, for example split into components
for projections into the future actuarial data must be modified or estimated
- Adversaries **BaFin, TH, board of executives, internal rgl.apl**
- Interception provide interface to internal calculation for controlled modifications (for example interest rate)
prepare range of specific changes/modifications (for example only interest rate)
combine into more complex mechanisms and corresponding output

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Outline of section on utility level

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Outline of section on utility level

In this section we outline:

Reserves controls of reserves in balance sheet

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Outline of section on utility level

In this section we outline:

Reserves controls of reserves in balance sheet

Premium recalculation information on and controls of premium recalculation

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Outline of section on utility level

In this section we outline:

Reserves controls of reserves in balance sheet

Premium recalculation information on and controls of premium recalculation

Capping schemes conception, evaluation and documentation of capping schemes

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Reference system for reserves

Challenge balance sheet dominated by benefit reserves
reserves must be calculated exactly (Cents!)
Chief Actuary (VA) is personally liable for errors
calculation of reserves must be checked and controls documented

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rst
- Interception build reference system that duplicates the official calculation
provide comparison function that documents differences (in Excel as dead-end storage)

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Infrastructure for calculation of reserves

Challenge to fulfil previous requirements infrastructure needed

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Infrastructure for calculation of reserves

Challenge to fulfil previous requirements infrastructure needed
Adversaries IDV-RL, internal
 kv, rgl, rst

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Infrastructure for calculation of reserves

- Challenge to fulfil previous requirements infrastructure needed
- Adversaries **IDV-RL, internal**
kv, rgl, rst
- Interception use general purpose functions to read input data
and official results from Core databases
use general purpose functions for basic calculations
use general interfaces to import actuarial data
provide a complete suite of functions for the calculation of reserves

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Reference system for premium recalculation

Challenge premium recalculation most important update
 hundreds of thousands of contracts affected
 premiums must be calculated exactly (Cents!)
 premium recalculation must be checked and controls documented

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 bf

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Reference system for premium recalculation

- Challenge premium recalculation most important update
 hundreds of thousands of contracts affected
 premiums must be calculated exactly (Cents!)
 premium recalculation must be checked and controls documented
- Adversaries VAG, KVAV, BaFin, WP, TH, internal
 bf
- Interception build reference system that duplicates the official
 recalculation
 provide comparison function that documents differences (in Excel as dead-end storage)

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Infrastructure for premium recalculation

Challenge to fulfil previous requirements infrastructure needed

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Adversaries **IDV-RL, internal**
kv, rgl, rst, lim, bf

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Infrastructure for premium recalculation

- Challenge to fulfil previous requirements infrastructure needed
- Adversaries **IDV-RL, internal**
kv, rgl, rst, lim, bf
- Interception use general purpose functions to read input data and official results from operative / Core databases
use general purpose functions for basic calculations
use general interfaces to import actuarial data
use general functions for reserve calculation and capping scheme evaluation
provide a complete suite of functions for the premium recalculation

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Information on premium recalculation

Challenge sales wishes divers forms of information on upcoming premium recalculations among those data about individual contracts, so that insurees may be forewarned

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Information on premium recalculation

- Challenge sales wishes divers forms of information on upcoming premium recalculations among those data about individual contracts, so that insurees may be forewarned
- Adversaries **board of executives, sales**
bf
- Interception create export function that uses the simulated results
function creates simple text files
those can be fed into a general interface to sales systems

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Implementation of premium recalculation

Challenge premium recalculation must be implemented
update in DB2 affects hundreds of thousands of
contracts and cannot practically be reversed in case
of errors
that fore it must be supervised closely

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Implementation of premium recalculation

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contracts and cannot practically be reversed in case
of errors
that fore it must be supervised closely
- Adversaries **VAIT, BaFin, WP, board of executives, internal
bf**
- Interception create function that allows the blocking of classes
of plans
implement logging of update progress
provide auxiliary functions that compare the last
test updates with the first production ones on a
purely technical level

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Basics on capping schemes

Challenge surplus must be managed according to laws concerning the participation of insured persons as part of premium recalculation amount of surplus earmarked for capping scheme must be defined and approved by the independent trustee (TH) **before** implementation on approval capping scheme **and** its cost become **both** legally binding

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- Adversaries **VAG, KVAV, BaFin, TH, board of executives**
lim
- Interception build simulation system that duplicates the official evaluation of a capping scheme
use the system for the whole process

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Infrastructure for capping schemes

Challenge to fulfil previous requirements infrastructure needed

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- Interception use general purpose functions to read input data
and official results from Core databases
use general purpose functions for basic calculations
use general interfaces to import actuarial data
use general functions for reserve calculation and
premium recalculation
provide a complete suite of functions for the evaluation of capping schemes

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Definition of capping schemes

Challenge to define a meaningful capping scheme extensive information is needed
the cost of an arbitrary number of possible components muss be provided in comprehensive form
only so can a fair model which uses the amount of surplus earmarked for it be found

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- Adversaries **board of executives, TH**
lim
- Interception simulate premium recalculation without capping
compress resulting data in special form facilitating cost estimation of capping schemes
provide for building, estimating and storing schemes

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Determination of “correct” capping scheme

- Challenge “correct” capping scheme must be chosen in a multistage process
- internal discussions, followed by decision of Chief Actuary (VA) and then of board of executives
 - independent trustee (TH) approves scheme

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internal discussions, followed by decision of Chief Actuary (VA) and then of board of executives
independent trustee (TH) approves scheme
- Adversaries **internal, board of executives, TH**
lim
- Interception evaluate capping scheme
provide wide range of reports and statistics to facilitate fact based decisions
implement GUI for interesting / special contracts
create document with all information needed by TH to approve scheme while observing legal obligations and due process

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Control of capping scheme implementation

- Challenge
- impact of the capping scheme on the business in force must be checked
 - control must be documented
 - surplus needed must be confirmed to be the one allocated before approval of the scheme

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Control of capping scheme implementation

- Challenge impact of the capping scheme on the business in force must be checked
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- Adversaries **VAIT, DORA, IDV-RL, WP, TH, internal**
 lim

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Control of capping scheme implementation

- Challenge impact of the capping scheme on the business in force must be checked
control must be documented
surplus needed must be confirmed to be the one allocated before approval of the scheme
- Adversaries **VAIT, DORA, IDV-RL, WP, TH, internal**
lim
- Interception extract impact information from business in force
import official statistics on impact
compare both with evaluation of scheme (simulated impact)

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Actuarial alternatives, analyses and estimations

- Challenge
 - changes in the way premiums are recalculated or capping schemes applied must occasionally be considered
 - divers projections/estimations must be produced

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Actuarial alternatives, analyses and estimations

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Actuarial alternatives, analyses and estimations

- Challenge changes in the way premiums are recalculated or capping schemes applied must occasionally be considered
- Adversaries divers projections/estimations must be produced
BaFin, WP, TH, internal
lim
- Interception use generic infrastructure for capping scheme for alternatives/analyses/estimations/...

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Conclusion

What comes next?

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Conclusion

What comes next?

- the game is never over

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Conclusion

What comes next?

- the game is never over
- there are constantly new challenges

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Conclusion

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- there are many more ideas waiting for implementation...

◀ begin

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Overview of examples and illustrations

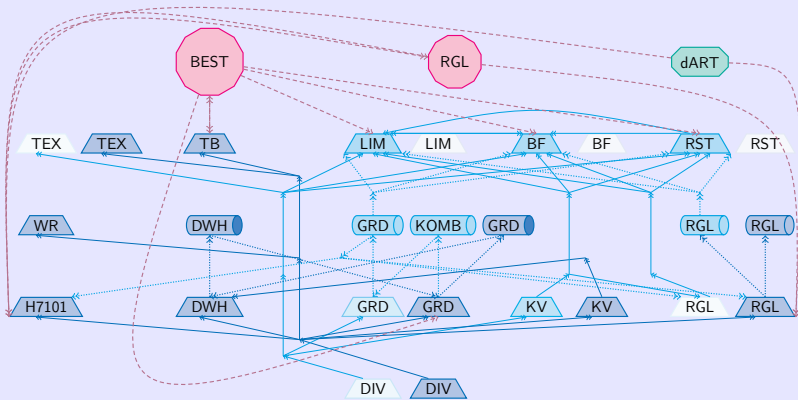
▶ Workspace overview

▶ A challenge!

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Workspace overview

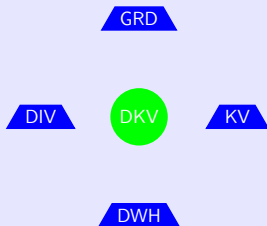


† Some Special Blue Agents

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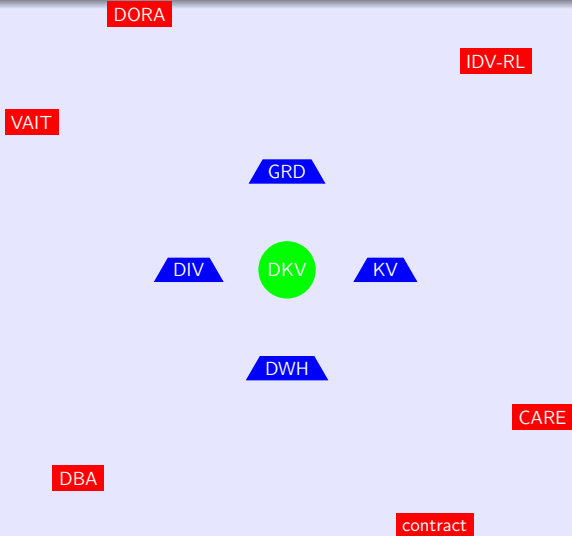
Workspace overview



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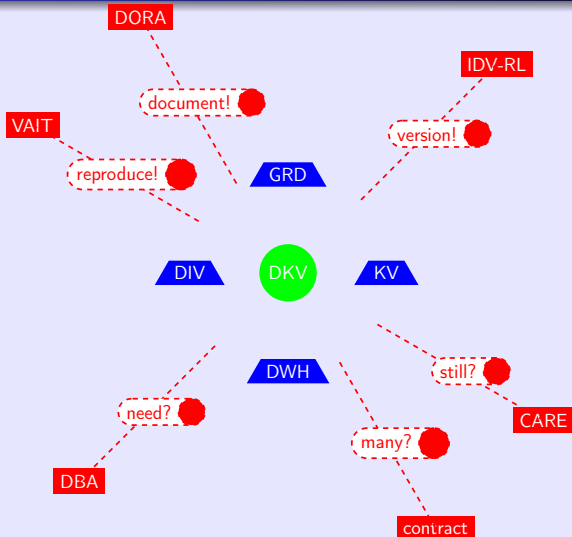
Workspace overview



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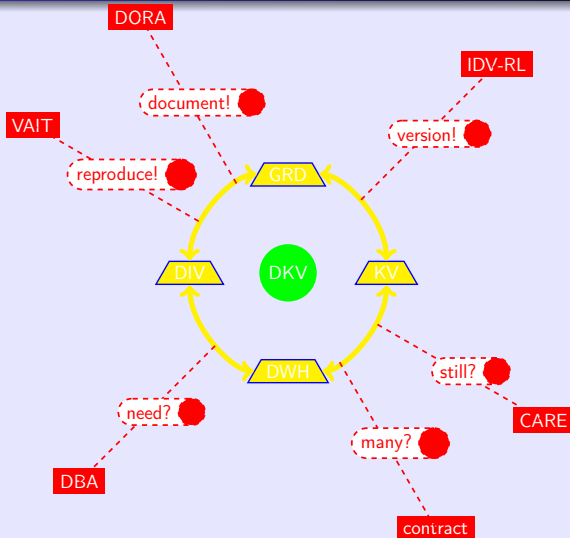
Workspace overview



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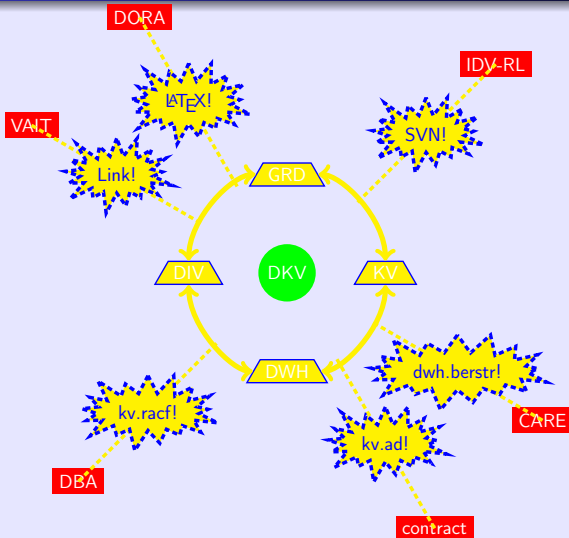
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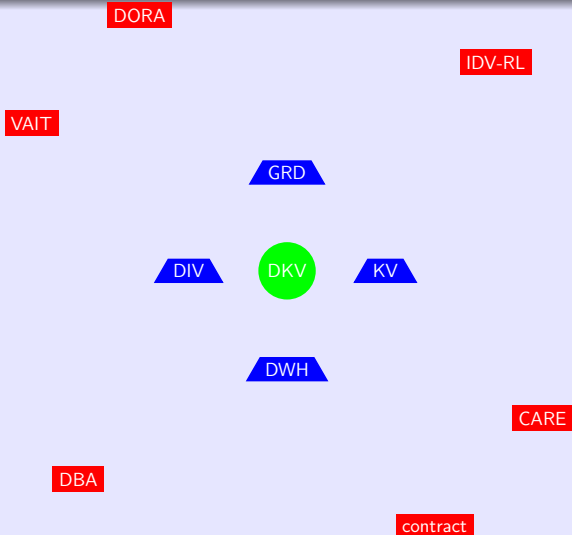
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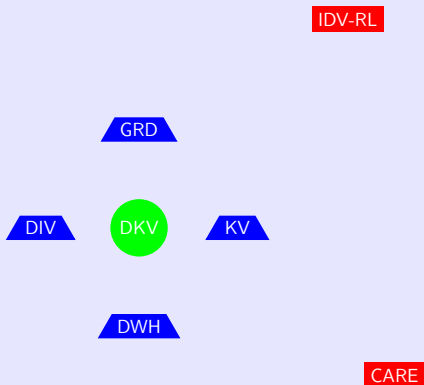
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