SMART API Technical Specification
5.8.0

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Abbreviations

SMART   - SwapClear Margin Approximation Risk Tool

LCH   - LCH.

EOD   - End of Day

API   - Application Programming Interface

Introduction

Background

In 2011, the SwapClear Margin Approximation Risk Tool (SMART) was introduced to allow members and clients of LCH. Limited's ("LCH") SwapClear service to assess the impact of simulated trades on their Initial Margin Requirements and also to estimate and analyse their Initial Margin and Initial Margin Multipliers. The original SMART product is implemented as an Excel add-on written in C++ (the back-end of the tool) plus an Excel worksheet (the front-end of the tool) and provides following capabilities:

- Load base market data from SwapClear End of Day (EOD) reports
- Load the base portfolio sensitivity from SwapClear EOD Member reports
- Allow user to input simulation trades
- Allow user to input simulation sensitivity profiles
- Allow user to input margin multipliers
- Provide initial margin estimate for base portfolio, simulation trades and sensitivities, or a combination of these

SMART was well received by the user community. However LCH has received a number of enhancement requests from members and SEFs - the primary ones being:

- Being able to access the SMART Tool's calculator via a Library API thus enabling members, clients, SEFs and approved third parties to integrate within their internal systems. E.g. Members want to utilize in their client portals so that they or their clients can load in trades/portfolios and estimate margin
- Integration with ClearLink API to provide indicative valuation and margin as part of the FCM acceptance process
- A web-based application rather than or in addition to a standalone application
- Access to and integration with position viewer for member and client positions showing prior day end of day (does not have to be intraday)
- Real-time IM and VM calculation based on up-to-date market data and the members' and clients current intraday position

In response to these requests, LCH has put together a phased plan to upgrade the SMART product. The first phase of the enhancement was to convert the core calculation engine of SMART from C++ to Java and provide it as a Library API that members and SEFs can embed within their own application.

Document Purpose

The purpose of this document is to describe the high level design and the API specification of the reengineered SMART Library that has been delivered in Phase 1 of the SMART Roadmap.

1   Release Notes

1.1   Changes in 5.8.0

This 5.8.0 release of SMART is a mandatory upgrade which has the following enhancements:

1.1.1   Enhancements

- Provide ability to import FPML trades into desktop
- Fix to support the new name for MXN regulatory body in REP00003
- Liquidity Add-on column removed from estimated IM table
- Fixed Curve assignment to include the NOK index OIBOR (curvemap.csv)
- VNS eligibility extended to include CHF,CZK,DKK,HKD,HUF,MXN,NZD,SGD,ZAR (eligibility.csv)

1.2   Changes in 5.7.6

1.2.1   Enhancements

This 5.7.6 release of SMART is an upgrade which has the following enhancements:

- Introduction of NOK-NIBOR-OIBOR index (to initially run in tandem, with the NOK-NIBOR-NIBR equivalent)
- VNS support extended for NOK, PLN, SEK
- Eligibilty changes for DKK, NOK, PLN

1.3   Changes in 5.7.5

1.3.1   Enhancements

This 5.7.5 release of SMART is an upgrade which has the following enhancements:

- Support for the new Listed Rates Exchange LDM for Listed Rates and Spider
- The ability to calculate unscaled VAR add-on for Listed Rates and included this in Portfolio Balancing for Spider
- VNS support extended for JPY, CAD and AUD

1.4   Changes in 5.6.0

1.4.1   Enhancements

The new version of SMART will be introduced with the release of Portfolio Margining, Version 5.6.0. The new version will include the following enhancements:

- The ability to calculate margin and add-ons (liquidity margin) for Listed Rates
- Revised add-ons for SwapClear
- The ability to run portfolio margining using the EOD reports:
    1. View resulting margin and add-ons post portfolio balancing
    2. View transferred futures
    3. Manually simulate a portfolio of swaps and futures for the purposes of portfolio margining

Note that SMART will not replicate the portfolio balancing results obtained because SMART works on EOD SwapClear reports, whereas the Portfolio Balancer uses a snapshot of the SwapClear portfolio at approximately 5pm EST

1.4.2 API Changes
Below is a summary of high level changes to the API introduced as part of this release.

- The API now requires Java 1.7 or above
- The API can also be used by Listed Rates members to simulate the initial margin and initial margin Add Ons of their Listed Rates portfolio. The Position Statement Report published by Listed Rates will need to be supplied along with the other input reports. SMART will use the future positions from the Position Statement Report to calculate the initial margin and the liquidity margin add on for the portfolio.
- The API also lets users calculate the initial margin for a simulated portfolio of listed futures. The simulation set has been extended to provide the ability to specify the list of simulated future positions and has the ability to specify the margin asset class. To facilicate this, new methods have been added to the SMART Session Interface to provide for the ability to value listed futures and have them included in the session for for the initial margin calculations.
- The result returned from an initial margin calculation has now been extended to provide the entire PnL vector of the portfolio which provides the PnL against each of the PAIRS scenarios.
- The Margin Estimate now includes figures for all applicable add-ons including newly introduced add-ons. The add-ons are now represented as a list of margin add-on estimate objects.
- The SMART session now has the ability to let the user estimate the results of portfolio margining an OTC and Listed portfolio as per the portfolio balancing rules. Here the user can specify the OTC Account along with the corresponding Listed Rates Party and Account to be portfolio margined against.

1.5 Changes in 5.4.1

1.5.1 Enhancements
This 5.4.1 release of SMART is an upgrade which has the following enhancements:

- SMART has now been extended to support the product/curve extensions
- Supports the new Delta based IMMFP implementation
- Provides ability to load the new client trade report SMART0003C/CL
- Changes to the eligibility as per changes in Swap Clear.
- Valuation fixes for FRA, Basis Swaps and Compounding Swaps
- Basis Risk threshold reduced from 10M to 3M GBP
- MXN is now included for Basis Risk calculations
- Ability to explicitly specify EOM convention of 28th and 29th in GUI and API
- Ability to specify known amount as an alternative to fixed rate in the API and trade csv.

1.6 Changes in 5.4.0

1.6.1 Enhancements
- SMART has now been extended to support the product/curve extensions
- Support for MXN Swaps

1.7   Changes in 5.3.1

1.7.1   Enhancements
- SMART has now been extended to handle zero coupon inflation swaps (ZCIIS)
- Additional reports have been included for inflation curves and seasonality
- Fixed the issue with incorrect sensitivity ladders for forward starting swaps
- Support for package FPML transactions

1.7.2   API Changes
- Added a new method getTradeValuations to SMARTSession to support the ability to value a Packaged FPML message and get back the valuations to all the trades within the FPML
- TradeType has an additional enumeration INF to specify that the trade is an inflation swap
- LegType has an additional enumeration INFLATION to specify an inflation leg
- There are additional attributes on the Leg to specify inflation specific attributes namely initial_inflation_level, inflation_interpolation_method and known_amount
- MeasureType now has CROSS_GAMMA in addition to DELTA and GAMMA to specify a cross gamma amount
- MarginScenarioValue has new attribute cross_gamma that hold the cross gamma if applicable.

1.8   Changes in 5.3.0

The 5.3.0 release of SMART is a mandatory upgrade which has the following enhancements

1.8.1   Enhancements
- SMART now supports LIBOR OIS basis swaps (GBP LIBOR OIS Basis Swaps and USD FEDFUND LIBOR Basis Swaps) and JPY TONA OIS Swaps
- SMART uses the Tenor Sensitivity report 103 instead of IM Sensitivity reports 102 Ois/Spread/Tenor (which are no longer available) to calculate Basis Risk Add-on
- Performance improvements
- Support for CAD 1M curve (when the curve gets added the VM space).

1.9   Changes in 5.2.1

1.9.1   Enhancements
- SMART calculates the new Unscaled Addon to initial margin
- More details are available from the Liquidity Addon and Basis Risk Addon calculations
- Various usability improvements

1.9.2   API changes
- SMART API now compiled with Java 7
- The bundled Protocol Buffers library has been updated from version 2.4.1 to 2.5.0
- API methods have been added to expose various details of both the Liquidity and Basis Risk addon calculations (please see javadocs)
- Optional index field added at Leg level. Only required for Libor/OIS basis swaps. Expected value is full ISDA index name as found in the FpML (e.g. "USD-Federal Funds-H.15-OIS-COMPOUND" or "GBP-LIBOR-BBA"
- Optional known amount field added at Leg level for zero coupon fixed legs with a known payment amount

- Sensitivity structure extended to include a second curve point (to accommodate cross-gammas), as yet unused
- MarginEstimate imm_add_on deprecated in favour of liquidity_add_on
- Margin Estimate total_initial_margin deprecated in favour of total_im since the former does not include all add ons
- New MarginEstimate unscaled_var_add_on field

1.10 Changes in 5.1.0

The 5.1.0 release of SMART is a mandatory upgrade which has the following enhancements :

- SMART allows for the use of the Account column in various reports to contain segregated account information.
- The SMART API now supports FRA additional payments in trade FpML.
- Correction to bootstrapper to incorporate compounding swaps.
- SMART now matches Murex as in it discards CAD ois discounting risk included in the CAD hedge trade ladders.
- Correction to IMMFP bucketing to match hedge trade maturities and not the nearest from the par curve.
- Introduction of JPY 1M curve into the VM space for forward estimation.
- Introduction of HKD 3M and 6M curves into the VM space for forward estimation.
- Introduction of SGD 3M and 6M curves into the VM space for forward estimation.
- The number of futures in the GBP and EUR STD and 3M VM curves has increased to align the curves more to the market.

1.11 Change in 5.0.4.0

1.11.1 Enhancements
1. Basis Risk Implementation
2. SMART reporting generated for clients and funds to load prexisting positions (SMART002c.dat and SMART002f.dat and 102cl and 102cf)
3. Trades with front AND back stubs accepted through the FpML interface.

1.12 Changes in 5.0.3.0

1.12.1 Enhancements
1. Implement CAD OIS curves and CAD 3M forward curves

2. CAD OIS Semi Annual Trade Eligibility

3. Configuration update to allow the use of the new index SGD-SOR-VWAP

1.12.2 Bug fixes
1. Fix to bad data in the configuration file immThresholdsMultipliers5.0-us.csv

2. Minor fix to the IMMFP calculation in some edge cases

3. Corrected the units of Gamma on the Sensitivities tab

4. Fixed issue with processing FpML trades where payment frequency is 1T and calculation period roll convention is set to value other than NONE

2 High Level Requirements

2.1 Phase 1 Requirements

The following high level requirements were set for the reengineered SMART Calculator.

Ref	Description
REQ-1	The SMART Risk Calculator must be available as library that can be embedded in customer applications
REQ-2	The library must provide a well defined programming API
REQ-3	The library must support multiple deployment platforms
REQ-3	The library must be designed to scale to a fully hosted server solution
REQ-4	The library must allow multiple simultaneous threads of execution
REQ-5	All of the current functional features of the SMART product must be retained
REQ-6	The library must allow the hosting application to provide its own input data
REQ-7	The library must support multiple business dates, and multiple parties
REQ-8	The library must be highly performing

3 High Level Design

The high level design is presented below.

3.1 Logical View of SMART components

```
┌─────────────────────────────────────────────────────────────────────┐
│                          ▣ SMARTFactory                             │
├─────────────────────────────────────────────────────────────────────┤
│ ⚙ getSMARTInstance ( businessDate : String ) : SMART                │
│ ⚙ setDataProviderFactory ( dataProviderFactory : DataProviderFactory )│
└─────────────────────────────────────────────────────────────────────┘

┌─────────────────────────────────────────────────────────────────────┐
│                             ▣ SMART                                 │
├─────────────────────────────────────────────────────────────────────┤
│ ⚙ startSession ( party : String ) : SMARTSession                    │
│ ⚙ close ( )                                                         │
└─────────────────────────────────────────────────────────────────────┘

┌─────────────────────────────────────────────────────────────────────┐
│                          ▣ SMARTSession                             │
├─────────────────────────────────────────────────────────────────────┤
│ ⚙ addTrade ( trade : Trade ) : Integer                              │
│ ⚙ listTrades ( ) : String [*]                                       │
│ ⚙ removeTrade ( tradeId : String )                                  │
│ ⚙ addSensitivityProfile ( sensitivityProfile : SensitivityProfile ) : Integer │
│ ⚙ listSensitivityProfiles ( ) : String [*]                          │
│ ⚙ removeSensitivityProfile ( sensitivvityId : String )              │
│ ⚙ getTradeValuation ( tradeId : String ) : TradeValuation           │
│ ⚙ calculateMarginEstimate ( account : String, trades : String [*], sensitivities : String [*] ) : SMARTResultSet │
│ ⚙ close ( )                                                         │
└─────────────────────────────────────────────────────────────────────┘

┌─────────────────────────────────────────────────────────────────────┐
│                         ▣ SMARTResultSet                            │
├─────────────────────────────────────────────────────────────────────┤
│ ⚙ getMarginScenarioDetail ( curveName : String, scenario : Integer ) : MarginScenarioDetail │
│ ⚙ getMarginEstimate ( ) : MarginEstimate                            │
│ ⚙ getPortfolioSensitivity ( ) : SensitivityProfile                  │
│ ⚙ close ( )                                                         │
└─────────────────────────────────────────────────────────────────────┘

┌─────────────────────────────────────────────────────────────────────┐
│                       ▣ DataProviderFactory                         │
├─────────────────────────────────────────────────────────────────────┤
│ ⚙ getDataProvider ( businessDate : String ) : DataProvider          │
└─────────────────────────────────────────────────────────────────────┘

┌─────────────────────────────────────────────────────────────────────┐
│                          ▣ DataProvider                             │
└─────────────────────────────────────────────────────────────────────┘
```

The main components in the SMART API Library are as follows:

Component	Responsibility
SMARTFactory	Responsible for creating instances of SMART and for associating the SMART instance with the DataProvider
SMART	Each SMART instance is attached to a particular business day, i.e., the base market data for the specified business day

The SMART instance also provides access to available portfolio data. |

SMARTSession	A SMARTSession handles the interactions required for performing initial margin calculation. The session holds all input trades and sensitivities in memory.
SMARTResultSet	The results of a simulation run are returned in a SMARTResultSet object. Various accessor methods are provided to retrieve the data.
DataProviderFactory	A Factory for creating DataProvider objects by business date.
DataProvider	Responsible for providing all the base market to SMART. The default Data Provider relies upon the SwapClear End of day Reports.
SMARTDataProviderFactory	Default DataProviderFactory that uses the SwapClear End of day Reports.
SMARTClientDataProviderFactory	This data provider factory allows automatic downloading of the latest market data from LCH 's website.
PortfolioBalanceInputSet	Defines the inputs for simulating a portfolio balancing an OTC and and Listed Rates portfolio
PortfolioBalanceResultSet	This results of the portfolio balancing simulation are via this and provides the status and details of the opeation.

3.2   Data Providers

The DataProvider interface provides access to a number of more granular Data Providers.

Data Provider	Responsibility
CalendarService	Provides access to business day calendars – obtains data from report REP00006.
FXService	Provide access to FX rates. Data is obtained from REP00016a, REP00016c or REP00018 in order of preference
IndexFixingService	Provides access to index fixings obtained from REP00003. Also provides access to Index Market conventions obtained from indexConventions.csv
CurvesService	Provides access to IM and VM curves obtained from reports REP00079a and REP00100a respectively

ScenarioDataService	Provides access to SwapClear PAIRS scenario data from report REP00090.
IMMConfig	Provides access to IM multipliers data from configuration file immThresholdsMultipliers.csv
EligibilityRules	Provides access to trade eligibility rules maintained in configuration file eligibility.csv

3.3 SMART Interaction

A typical interaction with SMART library using the API is shown below.
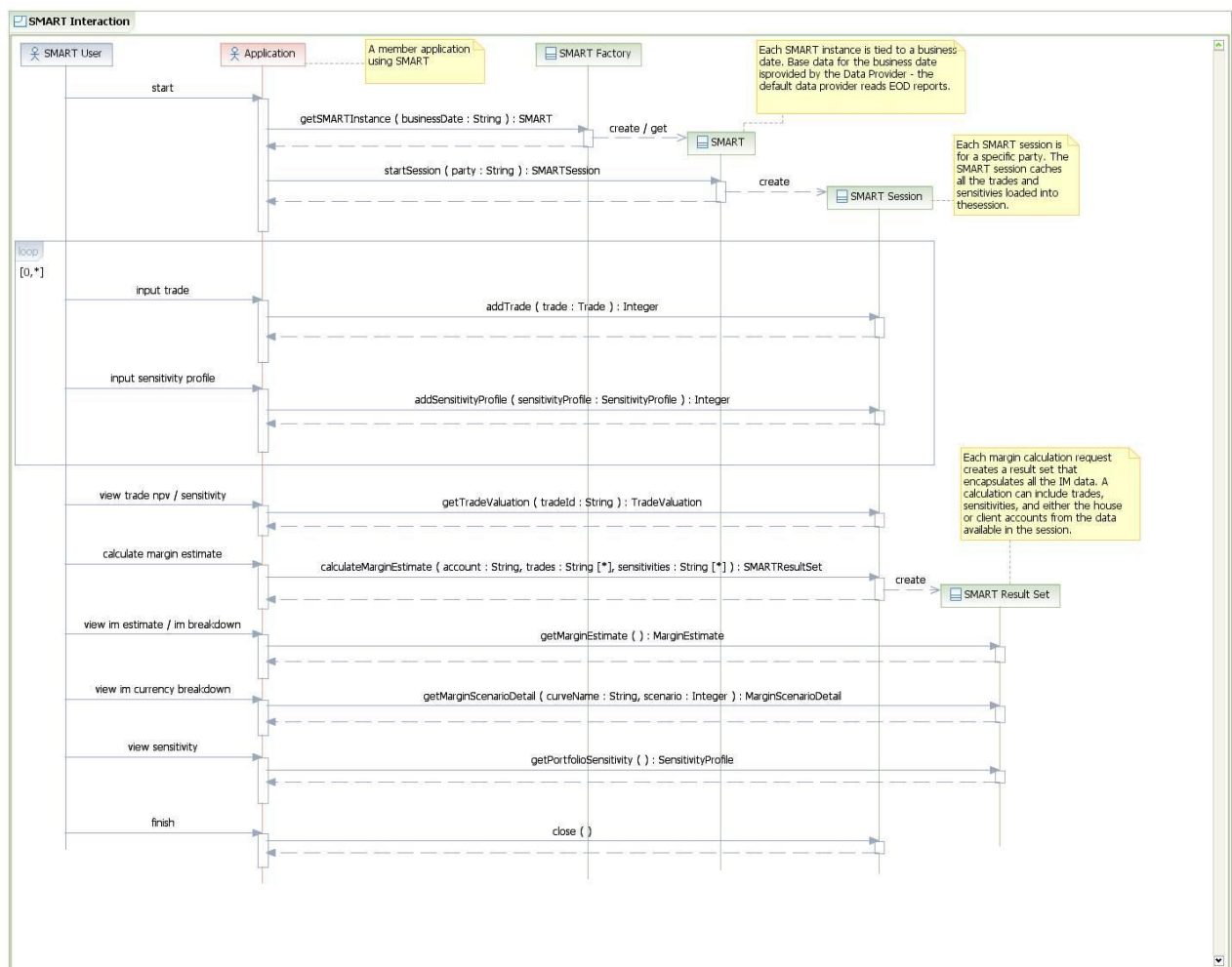
The SMART Calculator is responsible for performing calculations. All user interaction must be handled by the hosting application. Data Persistence, if desired, must also be handled by the hosting application.

4 SMART Java API

4.1 Overview

The SMART Java API has two main parts:

- The DataProvider API is for providing input data used by SMART.
- The SMART API is for use by applications.

4.2 SMART API JavaDoc

SMART API uses data types that are implemented using Protocol Buffers to allow the data to be serialised across programming languages. The Protocol Buffer definition file is provided with the SMART.

The SMART API documentation is provided in the form of javadoc style documentation. Note that the data types defined using protocol buffers are shown in terms of interfaces that LCH will support going forward. The actual implementations are not necessarily interfaces, and there may be additional functionality available in the implementation that is not guaranteed to be supported in future.

4.3 Pre-requisites

The SMART API is written in Java 1.7, and requires Java 1.7 or above.

The following OpenSource products are required at runtime:

- Log4J - http://logging.apache.org/log4j/1.2/. The SMART API has been tested with Log4J 1.2.16
- Simple Logging for Java (slf4j) - http://www.slf4j.org/.
- Google Protocol Buffers - http://code.google.com/p/protobuf/
- COLT Matrix library - http://acs.lbl.gov/software/colt/

These third-party libraries must be present in the Classpath when running SMART. The required libraries are supplied in the lib folder.

4.3.1 Portfolio Balancing

The Portfolio balancing component of SMART uses a native C++ library to carry out portfolio balancing. To carry out portfolio balancing an additional library is required at run-time

- COIN|OR CLP - https://projects.coin-or.org/Clp. The SMART API has been tested against version 1.15.11

.Please note that along with the SMART API distribution, only the windows compatible version of the CLP library has been included. To use the functionality on a different platform or operating system the appropriate library would need to be used.

4.4 Configuration Files

The API uses a number of configuration files. These are no longer packaged inside the jar; the required files are in the etc folder. The application using SMART API must ensure that the configuration files are available in the CLASSPATH of the application.

4.5 Log4J configuration

The SMART API uses the logger name of "com.lchclearnet" to log a few informative messages. By adding an appropriate log4j configuration in the classpath, these log messages can be captured. A sample log4j configuration file is supplied in the etc folder.
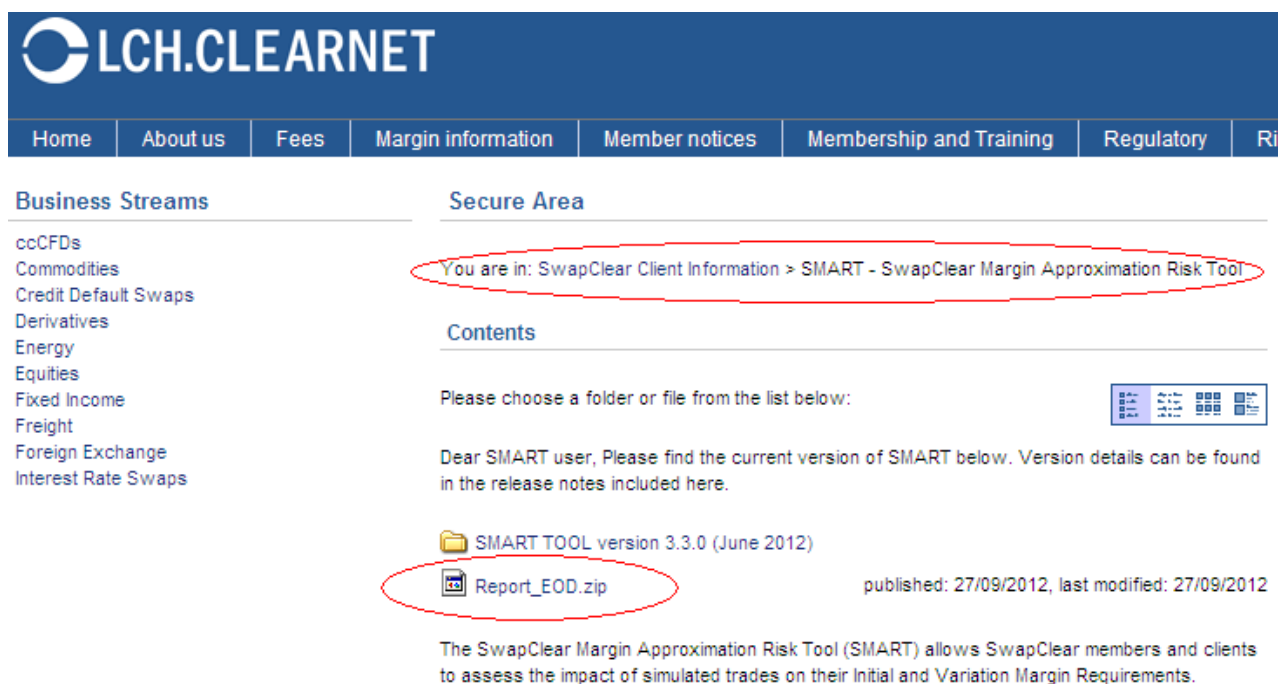
4.6 SwapClear End of day Reports

These are further described in §8. The reports must be downloaded and saved into a single folder per business date. The location of this folder must be supplied as an argument to SMARTDataProviderFactory class.

4.6.1 SMARTClientDataProviderFactory

The API allows reports to be downloaded automatically from the LCH website. The download option does not include portfolio sensitivities hence the application must load the entire trade population into SMART.

The SMARTClientDataProviderFactory requires a user id and password. The supplied user id must have access to LCH secure area shown below. Additionally it accepts an optional instance id – default is "SwapClear". "SwapClear.US" as the second instance, which results is data being downloaded from the SwapClear LLC instance.

Note that multiple failed attempts to access the secure area will cause the user's account to be locked; if the first attempt fails, please check access to the secure area using a regular Web Browser to ensure that the credentials are correct.

The downloaded ZIP file is deleted post processing.

Reports 102, 102c, 16a and 16c are not available in this option.

4.6.2 Handling of Portfolio Reports 102 and 102c

The base portfolio data is obtained from reports 102 and 102c if present. The available accounts and portfolio data vary depending upon the reports available. There will now be 102 for clients and fund managers too – 102cl and 102cf. The semantics below though continues.

Reports Availability	Behaviour
Both 102 and 102c present	The API will return House, Client and individual client accounts. The accounts will be ordered as House, Client followed by individual clients. If House account is used when calculating IM, the IM will be as per member mode. If Client account is used, the result will be in IM in client mode but without a base portfolio. If an individual client account is used when calculating IM, the IM will be in client mode.
Only 102 is present	The API will return House and Client accounts. The order will be House followed by Client. Using House account in IM calculation will trigger member mode IM - base portfolio in report 102 will be included. Choosing Client account in IM calculation will trigger client mode IM - base portfolio will not be available.
Only 102c is present	The API will return Client and individual client accounts. The order will be Client followed by individual clients. The IM will be in client mode when any of the accounts is used. If the Client account is used when calculating IM, it will mean client mode IM without base portfolio.
Neither 102 nor 102c present	The API will return Client and House accounts. The order will be Client followed by House. There will not be a base portfolio for either account. If Client account is used in the IM calculation then the IM will be in client mode – no base portfolio. If House account is used in the IM calculation then the IM will be in house mode – no base portfolio.

4.6.3   Handling of Portfolio Reports 103 and 103c

The base portfolio data - tenor sensitivities are obtained from reports 103 and 103c if present. The available accounts and portfolio data vary depending upon the reports available. There will now be 103 for clients and fund managers too – 103cl and 103cf. The data from the reports is used to calculate Basis Risk Addon.

4.6.4   Handling of Listed Rates position report Listed_Position_Statement.xml
The EOD listed rates positions are obtainted from this report if present. This would be used to obtain the details of the positions for the house account as well as all the other client accounts for this member.

4.6.5   Handling of Reports 16a, 16c and 18
FX rates are obtained from report 16a, 16c or 18, in order of preference. The FX rates quoted in 16a or 16c correspond to the values used by SwapClear in the End of day Initial Margin calculation. The FX rates quoted in report 18 correspond to the FX rates used by LCH 's Collateral system.

4.7   SMARTSession options

When a SMARTSession object is created, there are two possible options – Caching mode and Non-Caching mode. The differences between these two modes are described below.

Feature	Caching Mode	Non-Caching Mode
Design Goal	Designed for highest performance; but scalability limited by amount of memory available and Java garbage collector performance	Designed for scalability, can handle any volume of trades; less flexible in how trades can be combined for IM calculation
Trade Sensitivity Calculation	Performed when trade is added to the session; sensitivity per trade maintained in session	Performed when trade is added to the session; however the sensitivity is immediately merged with the combined trade portfolio
Trade Level Caching	Per Trade Sensitivity cached in the Session (this takes memory as more trades are added to the session)	No caching of sensitivity by trade; sensitivity immediately combined with other trades to maintain a portfolio wide trade sensitivity
Memory usage	High – usage grows with trade volumes	Low – usage is steady despite adding trades
Flexibility in IM calculation	Trades added to the session can be combined in various ways by supplying trade ids – ideal for simulation	All trades added to the session included in the IM calculation; it is not possible to exclude a trade in the IM calculation once it has been added to the session

| Remove trade from session | Supported | Not supported as individual trades not maintained within the session |

The caching mode requires about 512MB of RAM per 5000 trades.

4.8   Initial Margin options

The SMART API allows various different combinations of Initial Margin to be produced depending upon options specified in the SimulationSet parameter. These options are described below.

Option	Caching Mode Behaviour	Non-Caching Mode Behaviour
Account	If account is specified, the base portfolio of the specified account is obtained from 102 or 102c and used in the IM calculation. Note that it is an error to include the Account without appropriate access to reports 102 and 102c. In particular if you use the SMARTClientDataProviderFactory then these reports are not available.	Same behaviour as Caching mode.
Trade Id List	Only the specified trades identified will be included in the IM calculation. Note that these trades must already be present in the session; else an error will occur.	Ignored - all trades available in the session will participate in the IM calculation.
Sensitivity Profile Id List	Only the specified sensitivity profiles will be included in the IM calculation. Note that these sensitivity profiles must already be present in the session; else an error will occur.	Ignored - all sensitivity profiles in the session will participate in the IM calculation
Currency	If detailed scenario breakdown for a particular currency is required then the currency should be specified here. It is used in combination with Index and Scenario Number parameters.	Same behaviour as Caching mode
Index	If detailed scenario breakdown for a particular index is required then the index should be specified here. It is used in combination with Currency and Scenario Number parameters.	Same behaviour as Caching mode

Scenario Number	If detailed scenario breakdown for a particular scenario is required then the scenario number should be specified here. It is used in combination with Currency and Index parameters.	Same behaviour as Caching mode
IsClient	This boolean parameter is used only when the Account is not set. It controls whether the IM calculation should include the client IM scaling or not. It defaults to false if it is not set.	Same behaviour as Caching mode
Request Full Margin Breakdown	Setting this option causes the entire scenario level breakdown to be returned; 2500 scenarios per Currency/Index pair. This is useful if you want to analyse the P&L by scenario.	Same behaviour as Caching mode
IM Method	Optional parameter that accepts "IM" as the only value in this release.	Same behaviour as Caching mode
Request Basis Risk Breakdown	This boolean controls whether the detailed breakdown of basis risk addon should be returned.	Same behaviour as Caching mode
Position Id List	Only the specified positions identified will be included in the IM calculation. Note that these positions must already be present in the session; else an error will occur.	Ignored - all positions available in the session will participate in the IM calculation.
Requested Margin Class	This specifies the margin class of the account for whom the margin calculation is being requested. If unspecified it defaults to OTC	Same behaviour as Caching mode
Include Offset Positions	This boolean controls whether initial margin for a Listed Rates Portfolio should be calculated against the original positions (prior or balancing) or against the positions post balancing (i.e. include offset portfolios). This doesn't apply to OTC portfolios	Same behaviour as Caching mode
Associated Account	This provides the ability for supplying the associated rate	Same behaviour as Caching

	account. This would be used to calculate the correct liquidity margin for this member and report the contribution against this margin class.	mode
Exclude Future Sensitivities	This provides the application to exclude the future from the initial margin for a OTC portfolio	Same behaviour as Caching mode

4.9 Portfolio Balancing options

The SMART API allows various different combinations of Portfolio Balancing to be produced depending upon options specified in the PortfolioBalance parameter. These options are described below.

Option	Caching Mode Behaviour	Non-Caching Mode Behaviour
OTC Account	If account is specified, the base portfolio of the specified account is obtained from 102 or 102c and used in the IM calculation. Note that it is an error to include the Account without appropriate access to reports 102 and 102c. In particular if you use the SMARTClientDataProviderFactory then these reports are not available.	Same behaviour as Caching mode.
OTC Trade Id List	Only the specified trades identified will be included in the IM calculation. Note that these trades must already be present in the session; else an error will occur.	Ignored - all trades available in the session will participate in the IM calculation.
OTC Sensitivity Profile Id List	Only the specified sensitivity profiles will be included in the IM calculation. Note that these sensitivity profiles must already be present in the session; else an error will occur.	Ignored - all sensitivity profiles in the session will participate in the IM calculation
Listed Account	If listed account is specified the positions are obtained from the listed position statement that was include in the input report set.	Same behaviour as Caching mode
Listed Position Id List	Only the specified positions identified will be included in the IM	Same behaviour as Caching

	calculation. Note that these positions must already be present in the session; else an error will occur.	mode
IsClient	This boolean parameter is used when the Account is not H or House. It controls whether the IM calculation should include the client IM scaling or not. Note that by default this is true if the Account is not H or House. Note also that for H or House account this parameter is ignored.	Same behaviour as Caching mode
Request OTC Pnl Breakdown	Setting this option causes the entire scenario level pnl breakdown to be returned; This is useful if you want to analyse the P&L by scenario.	Same behaviour as Caching mode
IM Method	Optional parameter that lets user override the default im method.	Same behaviour as Caching mode

4.10 Initial Margin Models

This release of SMART API supports only the new IM model. The IM model is selected by supplying the IM Method parameter in SimulationSet.

4.11 Technical Details

4.11.1 Market Conventions

When trade data is accepted through the API, a number of values are defaulted based on market conventions. The defaults are based upon currency/index pair and are defined in the configuration file indexConventions.csv.

A sample indexConventions.csv file is shown in appendix B.

When a new currency/index pair is added to SwapClear, this configuration file needs to be updated as otherwise the API cannot process trades using the new currency/index pair. Users are not expected to maintain this file as it is included in every release.

4.11.2 Stubs on IRS trades

The API attempts to infer a stub when a trade has no stub specified, but appears to start in an irregular date, inconsistent with the roll convention. The algorithm used is as follows:

- The regular period start for the first period is computed and compared with the effective date.
- If the two do not match and there are more than one period in the schedule then a front stub is inferred.

- If the stub period would end up being less than 7 days then it is merged with the succeeding period to create a long stub.
- Else the first period is setup as a short stub.

4.11.3 Roll Conventions

The API infers roll conventions when a non-FpML trade input is provided and roll convention has been omitted. The algorithm used is as follows:

- If a front stub is present then the roll day is taken from the unadjusted termination date.
- If a back stub is present then the roll day is taken from the unadjusted effective date.
- If no stubs are present then the roll day is taken from the unadjusted effective date.
- If the roll day is 31 or the last day of the month in both the unadjusted effective and unadjusted termination dates then EOM convention is inferred (the API also allows EOM convention to be specified explicitly)
- Else the roll day is taken as the inferred roll convention
- The inference logic cannot identify IMM roll conventions – the API allows these to be specified explicitly.

4.11.4 Curves used in NPV calculations

The API uses VM curves to calculate the NPVs. Tenor specific curves are used where available.

4.11.5 Curves used in IM calculations and Trade Sensitivities

The API uses IM curves to calculate Initial Margin, and trade sensitivities. The IM curves are not tenor specific hence for Basis Swaps, the IM calculation does not consider Basis risk. This is limitation of SwapClear's IM methodology rather than the SMART API.

4.11.6 Curve mappings

The API uses a configuration file called curvemap.csv to determine which IM or VM curve to use. The API attempts to find the most specific match based on input parameters. The relevant parameters are:

- Currency
- Asset class – IRS or FRA
- Calculation type – IM or VM
- Index
- Tenor

4.12 FpML Trade Input

The SMART API supports input of trades in FpML format. The parsing of the FpML is done without schema validation; hence the parsing should work for both 4.x and 5.x FpML formats; although testing has primarily been done against FpML 5.x. The FpML parser looks for the <trade> element in the provided string – it does not process the enclosing elements; hence the parsing works irrespective of the wrapper used as long at the content is valid XML and the <trade> element is formatted as per FpML rules.

The supported FpML features are as per the ClearLink S1.3 specification. The only products supported are Interest Rate Swaps and Fras (features limited to those supported by SwapClear).

When providing an FpML format trade, the caller must specify a counterparty. The counterparty provided must be present in the trade as the payer or receiver; the sign of the NPV will depend upon the role of the counterparty in the trade.

The FpML processing can handle Fee payments – the fees are included in the Fixed or Floating leg as fixed amount payments depending upon the payer of the fee.

4.13 Field Mapping

Following table shows how the columns in the Desktop application to the API calls in SMART.

Field Name	Description	API Equivalent
Trade Id	A unique trade ID	trade.setTradeId(TradeId.newBuilder().setId(f))
Trade Type	The Trade Type, at present suported types are OIS, IRS, FRA and VNS	trade.setTradeType(TradeType.valueOf(f))
Notional	Notional in local currency	trade.setNotional(getDouble(f))
Currency	The currency of the instrument	trade.setCurrency(f)
Effective Date	Effective date of the instrument. IRS instruments must have the unadjusted effective date specified FRA instruments must have adjusted effective date specified	trade.setEffectiveDate(makeDate(f))
Termination Date	Termination Date of the instrument IRS instruments must have the unadjusted termination date specified FRA instruments must have adjusted termination date specified	trade.setTerminationDate(makeDate(f))
(Pay/Receive) Leg Type	Leg Type of the instrument, either FLOAT or FIXED	leg.setLegType(LegType.valueOf(f))

(Pay/Receive) Rate (or Spread)	If the leg is FIXED, the Rate in percentage [%] or If the leg is FLOAT the spread in basis points [bp]	if(LegType.FLOAT)
		   leg.setSpread(getDouble(f))
		if(LegType.FIXED)
		   leg.setFixedRate(getDouble(f))

(Pay/Receive) Payment Period	Leg Payment Period, either 1M, 3M, 6M or 12M, OIS defaults to 12M	leg.setPaymentFrequency(getPaymentFrequency(f))
(Pay/Receive) Day Count Fraction	Day Count Fraction of the leg, implimented conventions are; 30/360, ACT/ACT, ACT/360, ACT/365 and 30E/360	leg.setDayCountFraction(f)

(Pay/Receive) Compounding Method	FLAT or STRAIGHT compounding	leg.setCompoundingMethod(cm)
(Pay/Receive) Index Period	Index period for compounding IRS trades – note - not to be set for OIS trades! For a floating leg FRA set to i for interpolated or leave blank for default	leg.setIndexTenor(f)

(Pay/Receive) Stub Type	For a broken period swap either LB,LF,SB or SF;
	
	where L = long, S = short, B = back and F = front
		if (f contains "F" or "f")
		   pos = StubPosition.FRONT;
		else if (f contains "B" or "b")
		   pos = StubPosition.BACK;
		leg.setStubPosition(pos);
		if (f contains "L" or "l")
		   type = StubType.LONG;
		else if (f contains "S" or "s")
		   type = StubType.SHORT;
		legBuilder.setStubType(type);

Roll Convention	Roll Convention - values supported are EOM, IMM, IMMAUD, IMMNZD, IMMCAD. Otherwise should be left blank.	payleg.setRollConvention(RollCovention.valueOf(f)) receiveLeg.setRollConvention(RollCovention.valueOf(f))
VNS Steps	The notional, spread and/or fixed rate steps can be specified in a VNS trade	The API requires steps to be explicitly specified. Fixed Leg.addFixedRateStep() Any Leg.addNotionalStep() Floating Leg.addSpreadStep()
(Inflation Leg) inflation_lag	Inflation lag in months. If not specified, defaulted as per the index convetion	Inflation leg.setInflationLag()
(Inflation Leg) inflation_interpolation_method	Interpolation method for inflation. If not specified, defaulted as per the index convetion	Inflation Leg.setInflationInterpolationMethod()
(Fixed leg) specify payment amount instead of fixed rate	Specify an amount instead of fixed for the fixed leg.	Fixed leg.setKnownAmount()
(Floating Leg/Inflation Leg) Index Name	IndexName - index name (optional expect for Libor/OIS basis swaps and Inflation leg)	Floating Leg.setIndexName()
Inflation Interpolation Method (Inflation Leg)	interpolation type - NONE OR LINEAR (only for inflation swaps)	Leg.setInflationInterpolationMethod()

4.14 Examples of Trades

4.14.1 IRS

```
Trade trade = Trade
        .newBuilder()
```

```
.setTradeId(TradeId.newBuilder().setId("-irsR449").build())
.setTradeType(TradeType.IRS)
.setCurrency("DKK")
.setNotional(17000000)
.setEffectiveDate(
        com.lchclearnet.swapclear.smart.types.Date.newBuilder()
                .setDay(31).setMonth(5).setYear(2011))
.setTerminationDate(
        com.lchclearnet.swapclear.smart.types.Date.newBuilder()
                .setDay(31).setMonth(5).setYear(2015))
.setPayLeg(
        Leg.newBuilder().setLegType(LegType.FLOAT)
                .setSpread(0.0)
                .setPaymentFrequency("3M")
                .setDayCountFraction("ACT/360"))
.setReceiveLeg(
        Leg.newBuilder().setLegType(LegType.FIXED)
                .setFixedRate(3)
                .setPaymentFrequency("12M")
                .setDayCountFraction("ACT/ACT"))
.build();
```

4.14.2 VNS

```
Trade trade = Trade
        .newBuilder()
        .setTradeId(TradeId.newBuilder().setId("vnsR001").build())
        .setTradeType(TradeType.VNS)
        .setCurrency("USD")
        .setNotional(17000000)
        .setEffectiveDate(
                com.lchclearnet.swapclear.smart.types.Date.newBuilder()
                        .setDay(1).setMonth(1).setYear(2015))
        .setTerminationDate(
                com.lchclearnet.swapclear.smart.types.Date.newBuilder()
                        .setDay(1).setMonth(3).setYear(2015))
        .setPayLeg(
                Leg.newBuilder()
                .setLegType(LegType.FIXED)
                .setFixedRate(3)
                .setPaymentFrequency("1M")
                .setDayCountFraction("ACT/ACT")
                .addFixedRateStep(
                        StepValue.newBuilder().setDate(
                                Date.newBuilder()
                                        .setDay(1)
                                        .setMonth(1)
                                        .setYear(2015))
                                .setValue(3).build())
                .addFixedRateStep(
                        StepValue.newBuilder().setDate(
                                Date.newBuilder()
                                        .setDay(1)
                                        .setMonth(2)
                                        .setYear(2015))
                                .setValue(3.5).build())
```

```
                .addNotionalStep(
                        StepValue.newBuilder().setDate(
                                Date.newBuilder()
                                        .setDay(1)
                                        .setMonth(1)
                                        .setYear(2015))
                                .setValue(17000000).build())
                .addNotionalStep(
                        StepValue.newBuilder().setDate(
                                Date.newBuilder()
                                        .setDay(1)
                                        .setMonth(2)
                                        .setYear(2015))
                                .setValue(17500000).build())
                )
        .setReceiveLeg(
                Leg.newBuilder()
                .setLegType(LegType.FLOAT)
                .setSpread(0.0)
                .setPaymentFrequency("1M")
                .setDayCountFraction("ACT/360")
                .addSpreadStep(
                        StepValue.newBuilder().setDate(
                                Date.newBuilder()
                                        .setDay(1)
                                        .setMonth(1)
                                        .setYear(2015))
                        .setValue(0).build())
                .addSpreadStep(
                        StepValue.newBuilder().setDate(
                                Date.newBuilder()
                                        .setDay(1)
                                        .setMonth(2)
                                        .setYear(2015))
                        .setValue(5).build())
                .addNotionalStep(
                        StepValue.newBuilder().setDate(
                                Date.newBuilder()
                                        .setDay(1)
                                        .setMonth(1)
                                        .setYear(2015))
                        .setValue(17000000).build())
                .addNotionalStep(
                        StepValue.newBuilder().setDate(
                                Date.newBuilder()
                                        .setDay(1)
                                        .setMonth(2)
                                        .setYear(2015))
                        .setValue(17500000).build())
                )
        .build();
```

4.14.3 INF (Inflation)

```
Trade trade = Trade
        .newBuilder()
```

```
.setTradeId(TradeId.newBuilder().setId("-infR449").build())
.setTradeType(TradeType.INF)
.setCurrency("GBP")
.setNotional(10000000)
.setEffectiveDate(
        com.lchclearnet.swapclear.smart.types.Date.newBuilder()
                .setDay(31).setMonth(5).setYear(2011))
.setTerminationDate(
        com.lchclearnet.swapclear.smart.types.Date.newBuilder()
                .setDay(31).setMonth(5).setYear(2015))
.setPayLeg(
        Leg.newBuilder().setLegType(LegType.INFLATION)
                .setIndexName("UK-RPI")
                .setInitialInflationLevel(251.9)
                .setPaymentFrequency("ZERO C")
                .setDayCountFraction("1/1"))
.setReceiveLeg(
        Leg.newBuilder().setLegType(LegType.FIXED)
                .setFixedRate(3)
                .setPaymentFrequency("ZERO C")
                .setDayCountFraction("1/1"))
.build();
```

4.15 Future Position Input

The SMART API supports input of listed rates future positions. To add positions to the session Listed position objects would need to be built and added to the session.

4.16 Future Position Field Mapping

Following table shows how the columns in the Desktop application to the API calls in SMART.

Field Name	Description	API Equivalent
Contract Code	Represent the code of the future contract for e.g. NI is the code for 3-MONTH EURIBOR	listedInstrument.setProductCode("NI");
Exchange	The exchange where the future is traded for e.g. NLX	listedInstrument.setExchange("NLX");
Expiry	The expiry month of the future for.e.g 20190600 for June 2019	listedInstrument.setExpiry("20190600");
Simulated Position	Long or Short position in the future.	listedPosition.setInstrument(listedInstrument); listedPosition.setLongPosition(longPosition); listedPosition.setShortPosition(shortPosition);

4.17 Examples of Positions

4.17.1 Long STIR Future Position

```
ListedPosition.Builder lpb = ListedPosition.newBuilder();
ListedInstrument.Builder lib = ListedInstrument.newBuilder();
lib.setExchange("NLX");
lib.setExpiry("20150900");
lib.setProductCode("NI");
lpb.setInstrument(lib.build());
lpb.setLongPosition(1000);
PositionId p1 = PositionId.newBuilder().setId("P1").build();
lpb.setPositionId(p1);
ListedPosition pos = lpb.build();
```

4.18 Sample application

A simple sample application is included in the distribution as an Eclipse project. This shows how the API can be used to start a session, add a swap trade and obtain the Initial Margin estimate.

4.19 SMART Java Desktop

A SMART Java Desktop application is available – please see the SMART Java Desktop User Guide for more details. The desktop application uses the API to provide an easy to use application for users.

4.20 SMART Command Line

The SMART API distribution includes a command line implementation that takes inputs as CSV files and generates outputs as CSV files. The script smart.cmd is supplied as an example of how this command line utility can be invoked.

The command line utility is further described in the document CommandLine.txt included in the distribution.

Note that the command line tool cannot process VNS trades in the current release. This functionality will be added in the future.

The SMART API also includes an additional command line application to carry out a portfolio balancing simulation that takes the inputs as CSV files and returns the results of the balancing as CSV fines. The details of this are also described in the document CommandLine.txt

5 Theoretical Background

5.1 Delta Gamma Approximation

Taylor series is an efficient way of obtaining an approximation of a function by a power serie. A function of x, such as f(x), will in a neighbourhood around 'a' be approximated by a the sum of a constant term, a linear term, a quadric term and a cubic term, higher order terms are truncated:

$$f(x+a) \cong f(x) + \frac{f'(x)}{1!}a + \frac{f''(x)}{2!}a^2 + \frac{f'''(x)}{3!}a^3 + ...$$

In the Delta Gamma approximation for SwapClear, the function in scope is the NPV of a Swap with respect to the Zero Rates in all Knot Points on the curve:

$$NPV(z_1, z_2, z_3, ..., z_N) = x$$

The Delta Gamma approximation dealing with changes of the NPV includes the first and second order terms of the Taylor Expansion. The change of NPV due to a movement of a particular Knot Point i by an amount a can be expressed as:

$$NPV(z_1, ..., z_i + a_i, ..., z_N) - NPV(z_1, ..., z_i, ..., z_N) \cong$$

$$\frac{\partial NPV(z_1, ..., z_i, ..., z_N)}{\partial z_i}(a_i) + \frac{1}{2}\frac{\partial^2 NPV(z_1, ..., z_i, ..., z_N)}{\partial z_i^2}(a_i)^2$$

For a complete description of SwapClear Valuation and Sensitivity methodology please see the document "SwapClear Risk Analytics".

5.2 Liquidity Multipliers

In addition to the calculation of the Initial Margin (IM), the Desktop Simulation Tool has the functionality to estimate Initial Margin Multiplier (IMM) requirements. This functionality can be found in the 'summary' tab, and also in the tab "Estimated IM". IMMs are charged at concentrated risk positions, either due to individual curve concentrations, or due to the total IM breaching the liquidity thresholds. Where a member has the possibility to incur both types of IMM it is typically the larger of the two that will be charged.

For a complete description of SwapClear Liquidity Multipliers methodology please see the document "SwapClear - Initial Margin Liquidity Multiplier" that can be found on the LCH secure web site.

6   SMART Tool Frequently Asked Questions

1.   What is the purpose of the tool?

SMART is used to approximate the Initial Margin for a portfolio of swaps margined at SwapClear.   Initial Margin (IM) is the returnable deposit required when opening new positions at the clearing house. It is held in case of default in which LCH would inherit the defaulting positions, and therefore would have the potential to incur losses while transferring the defaulting portfolio.

By using SMART it is possible to assess the IM requirement of a SwapClear portfolio.

2.   How is the Initial Margin calculated in SwapClear?

SwapClear uses PAIRS (Portfolio Approach to Interest Rate Scenarios) to calculate the required IM to be paid on a portfolio. PAIRS calculates the worse case loss (WCL) over a 5 business day holding period based on volatility filtered historical simulation of a rolling 10 year history of rate data. This is designed to give the clearing house a 5 day period to neutralise the risk of a members positions if they were to default. In calculating IM for client positions the scenarios that SwapClear holds for a 5 day holding period are scaled by $\sqrt{(7/5)}$ to take into account an additional two day holding period to allow for the expected time taken to transfer the client to a surviving clearing member.

For a complete description of PAIRS methodology please see the document "PAIRS TIP V4" that can be found on the LCH secure web site.

3.   How does SMART calculate Initial Margin?

SwapClear performs a full cash flow revaluation for all trades margined at the clearing house.   SMART calculates the IM based on a Delta Gamma approximation. The main drivers of tool for the IM calculation are Zero sensitivities in local currency.

4.   How are Sensitivities calculated for trades?

LCH calculates Delta and Gamma sensitivities analytically. There is no bucketing or apportionment of the sensitivities as SwapClear calculates the exact P&L attribution at each knot point on the curve that is being shifted.

For a complete description of SwapClear Valuation and Sensitivity methodology please see the document "SwapClear Risk Analytics" that can be found on the LCH secure web site.

5.   What are Liquidity Multipliers?

Liquidity multipliers are additional margin that can be called due to concentrated risk positions, termed Initial Margin Multipliers (IMM).

Each year LCH asks all members to participate in a currency liquidity review to access the maximum amount of each currency the market can absorb given a normal trading day. Using the feedback LCH determines a set of thresholds based on the liquidity of the currencies. The thresholds are applied to the currency WCL balance and where the threshold is breached additional margin is called based on this balance.

6.   What dates do the scenario numbers denote?

Scenarios are numbered in reverse chronological order, with scenario 1 being the most recent one, and scenario 2500 the oldest one.

7.   How accurate is the tool relative to official portfolio valuation by SwapClear?

While SMART uses a Taylor Delta Gamma approximation SwapClear uses a full revaluation of each trade, this will produce a small difference. The size of the difference is typically around 2%, and dependent on several factors such as the portfolio composition and scenarios. It should be remembered at all times that this tool is just for estimation purposes only and in no way should be relied on as definitive or predictive of what actual margin will be.

SMART Spider FAQ

1. Can I reduce my total IM liabilities by perfectly hedging my OTC portfolio with listed products?

Although a prefect hedge is not achievable between OTC and Listed, a great level of IM reduction can be achieved.

For example a single OTC swap resetting on STIRS futures dates can be hedged with an equivalent strip of STIR futures providing a large total IM reduction.

In reality OTC portfolios are usually very diversified with a lower level of direct offset achievable. The resulting total final IM is also affected by additional add-ons that can further decrease the offset effect.

2. I have my largest OTC risk on the mid-long end of the swap curves ie.10Y+, can I still benefit by cross margin using STIRS futures up to 3Y or 5Y?

Yes, there should be some cross margining benefit, because the IM optimization works on IM scenario rather than deltas, it takes in account the portfolio margining characteristics across all products, risk factors and currencies.

3. I have added some simulated positions to my OTC and/or Listed portfolio and my resulting transferred listed portfolio is now very different from before, is that normal?

Many different solutions can be close to the optimal solution, the addition of few trades or moving into a new business day can cause the transfer positions to be very different, however this should not be of concern as the Total final IM is not expected to change substantially unless the risk added is substantial.

4. Is there a way to identify the listed positions that reduces my total IM the most?

A starting listed positions set is always required. Users can simulate listed trade positions, use original position or a mix of simulated and original ones.

To exclude an original position just book an opposite sign simulated position.

Once the desired starting positions have been defined, run the balancer, the transferred positions will provide a good indication of the most efficient position, the process can be repeated by using transferred starting position as original position.

5. What are the Add On affecting my final total IM numbers?

The IM optimization process works with OTC base IM and Listed base IM only (no Add on).

The following add on values are then added to calculate the total final IM:

IM add-ons include:

- Diversification Add On - Diversification benefit between futures and minor currency swaps will be limited via an Add On.
- PM Add On - applied to margin savings as result of the Portfolio margining. The charge is a percentage of the savings in basic Initial Margin. This Add On is applied only if listed positions are balanced to Swapclear accounts.
- Liquidity Add On – this Add On is charged for concentrated risk positions. This is calculated based on 2 quantities:
  - IMM1 : Captures the total IM breaching the liquidity thresholds. When members are margining listed accounts, the IMM1 will be calculated on total IM of listed and OTC accounts.
  - IMM2 : Captures the concentration risk for listed and OTC trades

    - Outright interest rate risk: The existing SwapClear IMM FP methodology will be used to capture concentrated outright directional risks across the combined listed/OTC rates service.
    - Swap vs futures basis risk: An additional component of IMM FP will be introduced to cater for futures vs swap basis risk.
    - LCRM: Captures the concentration risk for all ineligible products for margining (Bond futures).

  Where a member has the possibility to incur both types of IMM it is typically the larger of the two that will be charged.

Further details of the individual curve concentration charge can be found on the "Liquidity Summary" tab. For a complete description of SwapClear Liquidity Add On methodology please see the document "Liquidity Margin!" that can be found on the LCH secure website.

- Basis Risk Add On –this Add On is computed based on tenor basis exposures. Further details are available on the "Basis Risk Detail" tab and in the related document, "Basis Risk Addon_TIP_v2.2.pdf."
- Unscaled Add On – this Add On is required when an VaR figure run with unscaled scenarios is more negative than the traditional PAIRS base initial margin calculation. The 5.6.0 version will load STIRS scenarios for margined STIRS trades in SwapClear account. Please also see "AddendumToPAIRS_V1.0.pdf."

7   User Support Contact

Please direct all support queries to smartsupport@lch.com

8 End of Day Reports

8.1 Swap Clear

The SMART API relies upon a number of SwapClear End of Day Reports.

Download of Reports from MemberLive is to be handled as a separate task outside of SMART tool. Members should have a process in place to download the reports required by SMART from the MemberLive website to a specific location in their organization's network. The files used in the calculation must be downloaded daily from LCH. Member Reporting and all saved on the same folder. The necessary files and their respective links are:

YYYYMMDD_REP00003 - Historic Index Rates_ 1.TXT

https://memberlive.lch.com/Reporting/Public/SwapClear/Trade

YYYYMMDD_REP00006 - Calendar_ 1.TXT

https://memberlive.lch.com/Reporting/Public/SwapClear/Trade

YYYYMMDD_REP00016a - OTC Portfolio Cash Settlement (SCM)_ 1.txt

https://memberlive.lch.com/Reporting/nnn/SwapClear/YYYYMMDD

OR

YYYYMMDD_REP00016c - OTC Portfolio Cash Settlement (Client)_ 1.txt

https://memberlive.lch.com/Reporting/nnn/SwapClear/YYYYMMDD

NOTE: Anyone of the two reports is needed to retrieve the FX rate. The reports contain information on house respective clients' positions

Alternatively

REP00018 – Daily Exchange Rates_1.TXT

https://memberlive.lch.com/Reporting/Public/Banking

NOTE: The report contains exchange rates from banking; please observe that the rates are slightly different from the rates in report 16.

YYYYMMDD_REP00079 - IM Yield Curve - Zero Yield Day 0_ 1.TXT

https://memberlive.lch.com/Reporting/Public/SwapClear/Risk/Yield Curves

YYYYMMDD_REP00079Spread - IM Yield Curve - Zero Yield Day 0_ 1.TXT

https://memberlive.lch.com/Reporting/Public/SwapClear/Risk/Yield Curves

YYYYMMDD_REP00079Tenor - IM Yield Curve - Zero Yield Day 0_ 1.TXT

https://memberlive.lch.com/Reporting/Public/SwapClear/Risk/Yield Curves

YYYYMMDD_REP00090 - SwapClear Scenario Report_ 1.TXT

https://memberlive.lch.com/Reporting/Public/SwapClear/Risk/Yield Curves

YYYYMMDD_REP00090Spread - SwapClear Scenario Report_ 1.TXT

https://memberlive.lch.com/Reporting/Public/SwapClear/Risk/Yield Curves

YYYYMMDD_REP00090Tenor - SwapClear Scenario Report_ 1.TXT

https://memberlive.lch.com/Reporting/Public/SwapClear/Risk/Yield Curves

YYYYMMDD_REP00100 - Risk Yield Curve - Zero Rates Day 0_ 1.TXT

https://memberlive.lch.com/Reporting/Public/SwapClear/Risk/Yield Curves

YYYYMMDD_REP00101 - VM Yield Curve - Zero Rates Day 0_ 1.TXT

https://memberlive.lch.com/Reporting/Public/SwapClear/Risk/Yield Curves

YYYYMMDD_REP00133 - Inflation Seasonality_ 1.TXT

https://memberlive.lch.com/Reporting/Public/SwapClear/Risk/Yield Curves

YYYYMMDD_ REP00134 - IM Inflation Curve - Par Rates Day 0_ 1.TXT

https://memberlive.lch.com/Reporting/Public/SwapClear/Risk/Yield Curves

YYYYMMDD _REP00135 - VM Inflation Curve - Par Rates Day 0_ 1.TXT

https://memberlive.lch.com/Reporting/Public/SwapClear/Risk/Yield Curves

YYYYMMDD_REP00102 - IM Sensitivity Report (SCM)_ 1.TXT

https://memberlive.lch.com/Reporting/nnn/SwapClear/YYYYMMDD

YYYYMMDD_REP00102c - IM Sensitivity Report (Client)_ 1.TXT

https://memberlive.lch.com/Reporting/nnn/SwapClear/YYYYMMDD

The equivalent report for clients would be called 102cl and for fund managers 102cf

YYYYMMDD_REP00103 - Tenor Sensitivity Report (SCM)_ 1.TXT

https://memberlive.lch.com/Reporting/nnn/SwapClear/YYYYMMDD

YYYYMMDD_REP00103c - Tenor Sensitivity Report (Client)_ 1.TXT

https://memberlive.lch.com/Reporting/nnn/SwapClear/YYYYMMDD

The equivalent report for clients would be called 103cl and for fund managers 103cf

YYYYMMDD_ REP00138 - IM Cross Gamma Sensitivity Report_ 1.TXT

https://memberlive.lch.com/Reporting/nnn/SwapClear/YYYYMMDD

YYYYMMDD_ REP00138c - IM Cross Gamma Sensitivity Report_ 1.TXT

https://memberlive.lch.com/Reporting/nnn/SwapClear/YYYYMMDD

The equivalent report for clients would be called 138cl and for fund managers 138cf

YYYYMMDD_SMART0001.DAT

https://memberlive.lch.com/Reporting/Public/SwapClear/Risk/SMART

YYYYMMDD_SMART0002.TXT

https://memberlive.lch.com/Reporting/nnn/SwapClear/YYYYMMDD

"nnn" is the generic for the Mnemonic Code for the member.

An equivalent report for clients would be call 2c and 2f

YYYYMMDD_SMART0003c/cf.TXT

https://memberlive.lch.com/Reporting/nnn/SwapClear/YYYYMMDD

Only for direct clients

8.2   Listed Rates

Listed_Position_Statement.xml

8.3   Changes in Reporting Refresh

During parallel run SwapClear reports generated from Reporting Refresh can be obtained from SFTP Test Service or MemberTestsite. Please note that the reports REP00079a and REP00100a will no longer have the "a" suffix – instead each report is prefixed by the business date for which it was generated. For further details please contact the SwapClear Client Services team.

Appendix A - Glossary of Terms

OTC portfolio   A clearing member's Over-The-Counter portfolio applicable for margining by LCH. Ltd. For SwapClear this consists of Swaps and consideration amounts.

Total portfolio   The combination of a clearing member's OTC portfolio.

Scenario   A specific yield curve and FX shift.

Scenario Worst-Case Loss   The largest loss obtained resulting from the set of scenarios classed.

Yield Curve/Zero Coupon Yield Curve   A curve showing the relationship of non-interest bearing instruments' yields against maturity.

IMMES   Initial Margin Management Event Service

PAIRS   Portfolio Approach to Interest Rate Scenarios.

Appendix B – indexConventions.csv

The contents of the indexConventions.csv configuration file is shown below. Note that this file is not part of the official API and is subject to change.

Currency	Index Name	ISDA Name	Index	Is OIS?	Is Libor Maturity Convention?	Day Count Fraction	Payment Lag	Payment Calendar	Payment Day Convention	Fixing Lag	Fixing Calendar	Fixing Day Convention	Scenario Curve Name
AUD	BBR	AUD-BBR-BBSW	BBSW	FALSE	FALSE	ACT/365.FIXED	0	AUSY	MODFOLLOWING	0	AUSY	PRECEDING	BBSW
AUD	LIBOR	AUD-LIBOR-BBA	BBA	FALSE	TRUE	ACT/360	0	AUSY	MODFOLLOWING	-2	AUSY	NONE	
CAD	BA	CAD-BA-CDOR	CDOR	FALSE	FALSE	ACT/365.FIXED	0	CATO	MODFOLLOWING	0	CATO	PRECEDING	CDOR
CAD	LIBOR	CAD-LIBOR-BBA	BBA	FALSE	TRUE	ACT/360	0	CATO	MODFOLLOWING	-2	CATO	NONE	
CAD	CORRA	CAD-CORRA-OIS-COMPOUND	OIS-COMPOUND	TRUE	FALSE	ACT/365	2	CATO	MODFOLLOWING	1	CATO	NONE	CORRA
CHF	LIBOR	CHF-LIBOR-BBA	BBA	FALSE	TRUE	ACT/360	0	CHZU	MODFOLLOWING	-2	CHZU	NONE	LIBOR
CHF	TOIS	CHF-TOIS-OIS-COMPOUND	OIS-COMPOUND	TRUE	FALSE	ACT/360	2	CHZU	FOLLOWING	-1	CHZU	NONE	TOIS
CZK	PRIBOR	CZK-PRIBOR-PRBO	PRBO	FALSE	FALSE	ACT/360	0	CZPR	MODFOLLOWING	-2	CZPR	NONE	PRIBOR
DKK	CIBOR2	DKK-CIBOR2-DKNA13	DKNA13	FALSE	FALSE	ACT/360	0	DKCO	MODFOLLOWING	-2	DKCO	NONE	CIBOR
DKK	CIBOR	DKK-CIBOR-DKNA13	DKNA13	FALSE	FALSE	ACT/360	0	DKCO	MODFOLLOWING	0	DKCO	PRECEDING	
EUR	EURIBOR	EUR-EURIBOR-Reuters	Reuters	FALSE	FALSE	ACT/360	0	EUTA	MODFOLLOWING	-2	EUTA	NONE	EURIBOR
EUR	EURIBOR	EUR-EURIBOR-Telerate	Telerate	FALSE	FALSE	ACT/360	0	EUTA	MODFOLLOWING	-2	EUTA	NONE	
EUR	LIBOR	EUR-LIBOR-BBA	BBA	FALSE	TRUE	ACT/360	0	EUTA	MODFOLLOWING	-2	EUTA	NONE	
EUR	EONIA	EUR-EONIA-OIS-COMPOUND	OIS-COMPOUND	TRUE	FALSE	ACT/360	1	EUTA	FOLLOWING	0	EUTA	NONE	EONIA
GBP	LIBOR	GBP-LIBOR-BBA	BBA	FALSE	TRUE	ACT/365.FIXED	0	GBLO	MODFOLLOWING	0	GBLO	PRECEDING	LIBOR
GBP	SONIA	GBP-WMBA-SONIA-COMPOUND	WMBA-COMPOUND	TRUE	FALSE	ACT/365.FIXED	0	GBLO	FOLLOWING	0	GBLO	PRECEDING	SONIA
HKD	HIBOR	HKD-HIBOR-HIBOR=	HIBOR	FALSE	FALSE	ACT/365.FIXED	0	HKHK	MODFOLLOWING	0	HKHK	PRECEDING	HIBOR
HKD	HIBOR	HKD-HIBOR-HKAB	HKAB	FALSE	FALSE	ACT/365.FIXED	0	HKHK	MODFOLLOWING	0	HKHK	PRECEDING	
HKD	HIBOR	HKD-HIBOR-ISDC	ISDC	FALSE	FALSE	ACT/365.FIXED	0	HKHK	MODFOLLOWING	0	HKHK	PRECEDING	
HUF	BUBOR	HUF-BUBOR-Reuters	Reuters	FALSE	FALSE	ACT/360	0	HUBU	MODFOLLOWING	-2	HUBU	NONE	BUBOR
JPY	LIBOR	JPY-LIBOR-BBA	BBA	FALSE	TRUE	ACT/360	0	JPTO	MODFOLLOWING	-2	JPTO	NONE	LIBOR
JPY	TONA	JPY-TONA-OIS-COMPOU	OIS-COMPOUND	TRUE	FALSE	ACT/360	2	JPTO	FOLLOWING	1	JPTO	NONE	TONA

		ND											
NOK	NIBOR	NOK-NIBOR-NIBR	NIBR	FALSE	FALSE	ACT/360	0	NOOS	MODFOLLOWING	-2	NOOS	NONE	NIBOR
NZD	BBR	NZD-BBR-FRA	FRA	FALSE	FALSE	ACT/365.FIXED	0	NZWE	MODFOLLOWING	0	NZWE	NONE	BKBM
NZD	BBR	NZD-BBR-Telerate	Telerate	FALSE	FALSE	ACT/365.FIXED	0	NZWE	MODFOLLOWING	0	NZWE	NONE	
PLN	WIBOR	PLN-WIBOR-WIBO	WIBO	FALSE	FALSE	ACT/365.FIXED	0	PLWA	MODFOLLOWING	-2	PLWA	NONE	WIBOR
SEK	STIBOR	SEK-STIBOR-SIDE	SIDE	FALSE	FALSE	ACT/360	0	SEST	MODFOLLOWING	-2	SEST	NONE	STIBOR
SGD	SOR	SGD-SOR-Reuters	Reuters	FALSE	FALSE	ACT/365.FIXED	0	SGSI	MODFOLLOWING	-2	SGSI	NONE	SOR
SGD	SOR	SGD-SOR-VWAP	VWAP	FALSE	FALSE	ACT/365.FIXED	0	SGSI	MODFOLLOWING	-2	SGSI		SOR
USD	LIBOR	USD-LIBOR-BBA	BBA	FALSE	TRUE	ACT/360	0	USNY	MODFOLLOWING	-2	USNY	NONE	LIBOR
USD	FEDFUND	USD-Federal Funds-H.15-OIS-COMPOUND	H.15-OIS-COMPOUND	TRUE	FALSE	ACT/360	2	USNY	MODFOLLOWING	1	USNY	NONE	FEDFUND
ZAR	JIBAR	ZAR-JIBAR-SAFEX	SAFEX	FALSE	FALSE	ACT/365.FIXED	0	ZAJO	MODFOLLOWING	0	ZAJO	PRECEDING	JIBAR