

Real-time Risk Management for CCPs

Real-time Risk Management for Central Counterparties

1 Introduction

“Doing the right thing is more important than doing things right.”

Peter Drucker

Applying this concept to a margining model could lead to an interesting argument on the relative importance of speed or accuracy. A margining model could follow one of two approaches:

- Doing things right: Compute margins very accurately employing an elaborate margining process, which would necessarily restrict the frequency of margin computations. Or,
- Doing the right thing: Compute margins with some approximations, but much more frequently.

The first approach, which would be the intuitive choice and is also the normal market practice, may not always be the right one. Margin computation involves elaborate computational processes and hence, heavy computational load on the margining system. In some cases, it may be more efficient for a margining model to use some approximations in favour of speed and frequency of margin computation.

A Central Counterparty (CCP) is an organization that clears trades done by its members, thereby becoming a seller to every buyer and a buyer to every seller. A trade entered between A and B gets novated into two trades; A vs. CCP and CCP vs. B. For members, one of the key benefits of having a CCP is the reduction in counterparty risk due to the replacement of various counterparties for their outstanding trades by one highly-rated counterparty, the CCP. For a CCP, non-fulfilment of the obligation by either A or B (due to their default) would require it to cover such positions by way of a purchase or sale in the market. This could potentially expose it to the market fluctuation between the time of the trade and its settlement. To safeguard itself against such market risks, a CCP collects margins from its members, in addition to employing other safeguards and measures.

Significant intraday changes in members’ open positions as well as in security prices have an important influence on the amount of margins which a member would need to deposit with the CCP. It has also been observed that the build-up of members’ open positions tends to be higher during volatile market periods. Hence, apart from the risk management model itself, frequency of margin computation becomes an important

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factor in determining the level of protection which a CCP derives from its margining model. This paper makes the case for a real-time risk management system for CCPs and shows how such a risk model helped SIS x-clear in achieving a high level of confidence in its risk management system during periods of market stress.

SIS x-clear, the Swiss CCP

SIS x-clear acts as a CCP for both SWX Swiss Exchange and SWX Europe, the London-based pan-European stock exchange. SIS x-clear employs a real-time margining model, based on the industry-standard Value at Risk (VaR) methodology and is probably the only CCP which computes its margins on a real-time basis.

2 Margining model of SIS x-clear

SIS x-clear runs a real-time margining model. Margins are applied at the level of open positions for a clearing account. All unsettled trades on a member's clearing account are summarised per ISIN and currency (of trade) into one position called the open position. Hence, a clearing account would have one open position per traded ISIN. Open positions are computed real-time as trade or settlement information is received. The figure below gives a high-level overview of the processes involved in the risk management system.

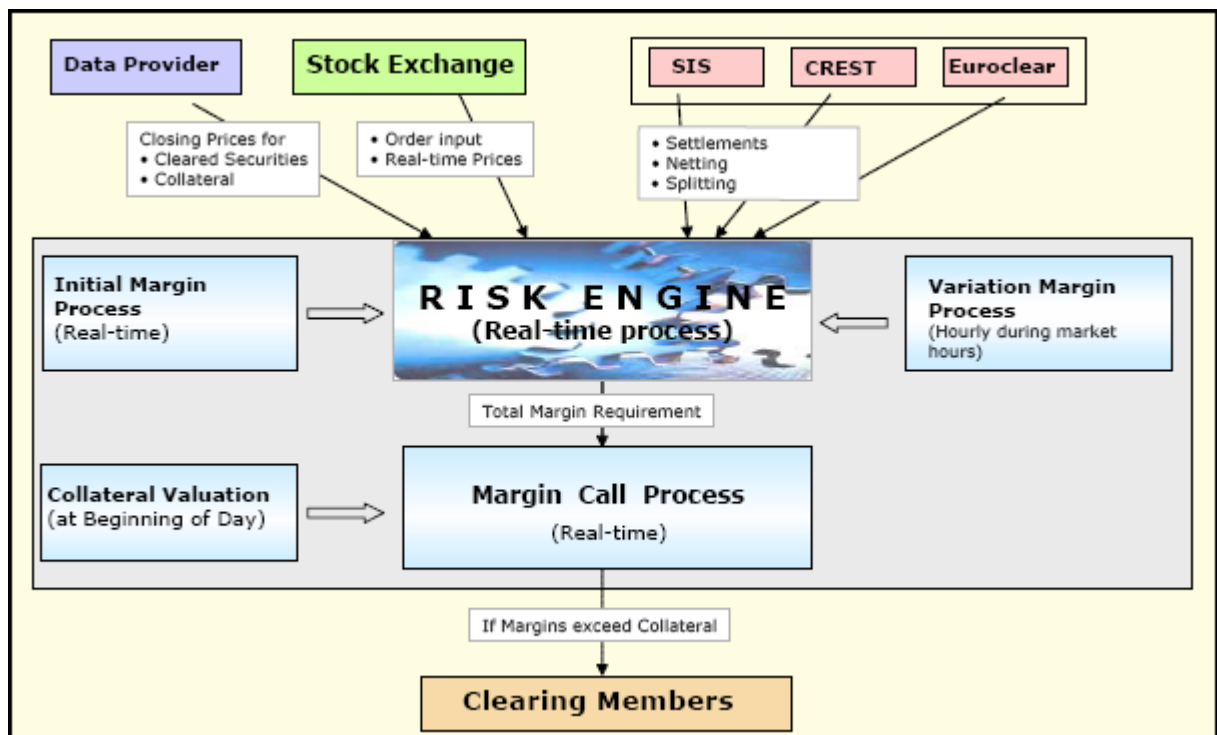


Figure 1: Overview of SIS x-clear's Risk Management system

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2.1 Initial margin (IM)

The initial margin is a CCP's estimate of the market risk inherent in a clearing member's positions. In the event of a member default, the initial margin collected from that member is the first and key line of defence available to offset the costs to the CCP of settling the defaulter's open positions for which it assumes legal responsibility. Hence, initial margins are designed to cover the CCP for the market risk it becomes exposed to for the time period between the last margin cycle prior to a member's default and close-out of the defaulting member's unsettled positions by the CCP.

By its very nature, initial margin computation is a subjective process and involves making assumptions about the likely volatility in the market price of the securities comprised in a member's open positions. Initial margins are also a function of the level of protection which a CCP would like such margins to achieve. The level of confidence which CCPs aim for from the initial margins is normally in the range of 95 to 99%. Level of confidence implies the percentage number of instances when margins collected are expected to be sufficient to cover the market risk due to a potential default. The initial margining system of SIS x-clear is built for a 99% confidence level with a two-day holding period. Hence, it is expected that the hypothetical close-out losses would not exceed computed margins, 99% of the times.

Real-time IM system of SIS x-clear

Initial margin¹ is computed real-time for every change in a member's open positions, which could happen due to a cleared trade on the exchange, or the settlement of an unsettled trade. The process involves periodically computing the VaR for each cleared security and grouping securities in risk buckets depending on the VaR of each security. Initial margin is then computed for every change in a member's open positions by applying intra-bucket and inter-bucket offsetting coefficients. The IM computation process consists of two distinct sub-processes:

- Periodic process (usually at end of week) comprising computation of security-level VaR and formation of risk buckets.
- Real-time processes of computing initial margin at the security level followed by bucket-level and member-level computation, by applying intra- and inter-bucket offsetting coefficients.

Margins within a risk bucket are netted using the intra-bucket offset coefficient. Overall initial margin for a clearing member is the sum of bucketwise initial margin, less the inter-bucket margin offset (arrived at by applying the inter-bucket offset coefficient). Based on a backtesting process, SIS x-clear's risk committee determines the intra-bucket and inter-bucket offset coefficients.

¹ For a detailed description of SIS x-clear's margining model, refer to SIS x-clear's Service Description; <http://www.ccp.sisclear.com/ccp/xcleardienstleistung.pdf>

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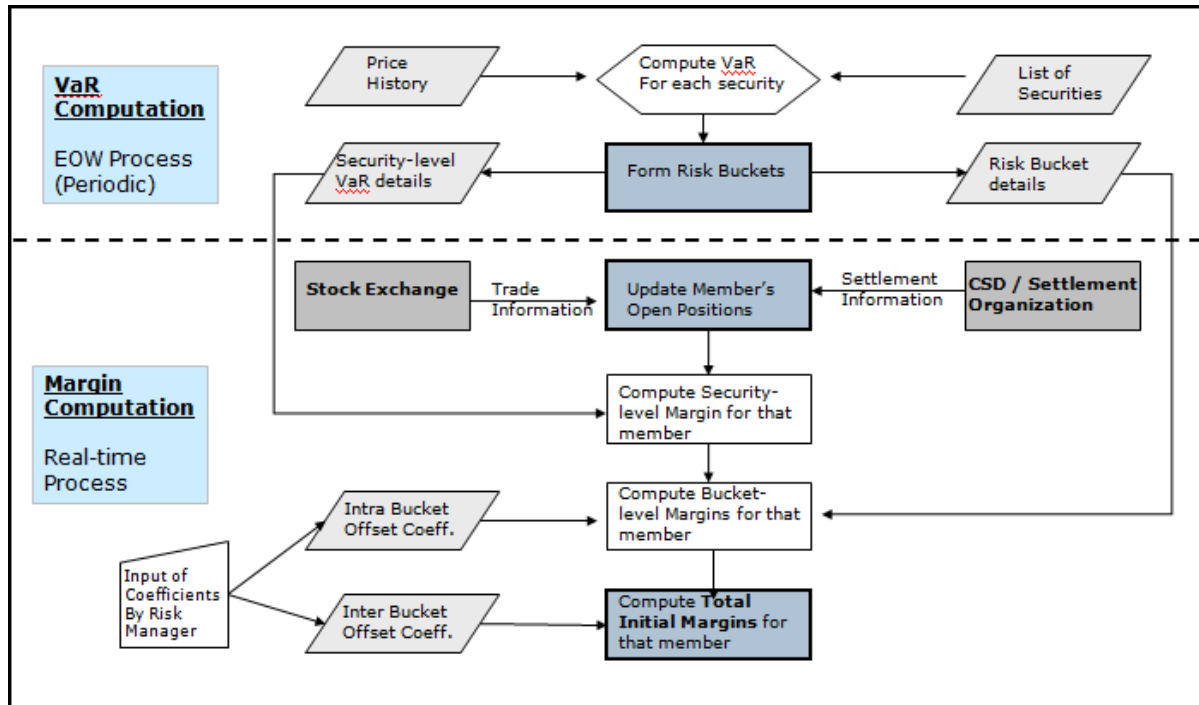


Figure 2: Overview of SIS x-clear's real-time initial margin process

2.2 Variation margin process of SIS x-clear

Variation margin (VM) is the mark-to-market amount for a clearing member's open positions. SIS x-clear collects variation margin to protect itself against losses already suffered by a clearing member's portfolio of unsettled trades. Collecting variation margin ensures that the market risk in a member's open positions remains 'current' as past losses would have been accounted for by variation margin.

Variation margin process of SIS x-clear

SIS x-clear has a flexible VM process, which is presently configured to run once every hour during market hours. The risk engine is capable of running VM cycles even more frequently, should it become necessary. Real-time security prices are received from the stock exchange during the trading day, while closing prices are received from a data provider and used during the end-of-day processing.

It has been observed that most CCPs compute variation margin (or mark-to-market margin) once a day, during the overnight cycle, with the possibility to run another cycle intraday. This means intraday losses on members' positions are often left uncovered during the greater part of a day and collected during the next margining cycle. By definition, initial margin has to cover the market risk for the duration between the last margining cycle and the time of close-out of the defaulting member's positions. On the other hand, variation margin is an objective figure of actual profit/loss a portfolio has incurred. Hence, it would be beneficial to apply variation margin as frequently as

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possible. A near real-time collection of variation margin reduces the 'load' on the initial margin model, as otherwise, initial margin has to provide cover for a longer duration. The figure below explains the importance of frequent variation margin computation.

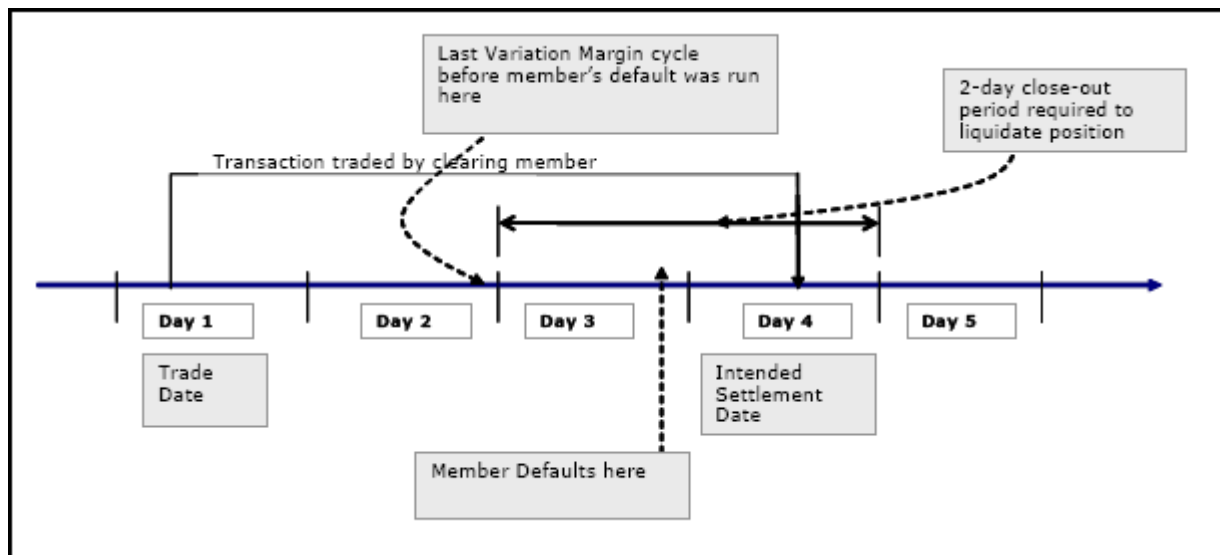


Figure 3: Importance of frequent variation margin cycles

3 Initial margin model: trade-off between speed and accuracy

The design of any margining model should weigh the level of accuracy required vis-à-vis the speed and frequency with which margins can be computed. The Basel II Capital Accord, for example, specifies that a VaR-based model could be used to reflect the volatility of credit exposure/collateral². For such an application of VaR, accuracy is obviously more important than speed. An accurate computation of the possible volatility of exposure or collateral at the required frequency (for instance, daily) is preferable to a computation that is more frequent, but a little less accurate. On the other hand, a different approach may be warranted in cases where the base positions on which VaR-based margins are computed, change rapidly – for example, in the case of positions guaranteed by a CCP. In such cases, the risk manager should weigh the benefits of frequent and simple computation of margins against a less frequent but more accurate model.

The risk management system of a typical CCP runs in a batch mode, computing margins once or several times a day. Such an approach would allow an accurate application of the correlation between various components of a member's positions, to arrive at the required margins. For example, in case of a VaR-based model employing the historical simulation method, a full valuation of each portfolio for the designed price

² Section 2, Overview of Credit Risk Mitigation Techniques, The New Basel II Capital Accord

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history (for instance, two years) would provide accurate margin figures. However, the heavy computational load of such a model would almost certainly preclude real-time or near real-time computations. For CCPs clearing trades with T+3 settlements, 1/3rd of a member's open positions would normally get accumulated during a trading day. In fact, trading volume and the resultant position build-up tends to be higher on highly volatile trading days. In the example of the market crash of Adecco discussed in later sections, trading volumes on that particular day spurted to about 10 times the average volume.

A margining system running in a batch mode misses two important components influencing the market risk in a clearing member's portfolio of open positions:

- Intraday accrual to a clearing member's open positions, due to trades happening on that day
- Mark-to-market losses on the entire portfolio, due to intraday market volatility

The real-time VaR-based margining model of SIS x-clear makes a deliberate trade-off in favour of speed. Rather than doing a full valuation of the entire portfolio for the designed price history, VaR for each security is computed at specified time intervals and is applied on members' open positions, with suitable offsetting parameters to take care of correlation between various securities.

Challenges in building a real-time margining system

The open position of a clearing member is the net exposure which the CCP has against that member. Open positions of clearing members constantly change during the trading and settlement window, which in the case of SIS x-clear, extends for about 19 hours per day. A typical trading day with 50,000 trades on the stock exchange would result in 100,000 cleared trades (due to novation, whereby the CCP enters the contractual chain). Combined with a similar number of settlements on any day, the number of times open positions change could easily run up to a quarter of a million. A real-time margining system would mean re-computation of margins for each such change in open positions.

Instead of calculating the VaR using full valuation of a member's open position, SIS x-clear's margining system applies previously computed security-level VaR to open positions using risk buckets with appropriate offsetting coefficients. This drastically reduces the computation load on the margining system for each VaR computation. Nevertheless, even this process repeated over several hundred thousand times in a day could add up to a very high level of load on the system. However, layered architecture and multi-thread processing capability allows SECOM to handle a high volume of real-time transactions and still achieve optimum performance.

Compared to a real-time margining model, a CCP could also weigh the option of computing initial margin using very-closely spaced IM batches (for example, an IM batch every 5 or 10 minutes). This could result in optimization of system performance

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due to the reduced computation load, but achieve a margining efficiency close to real-time margining.

3.1 Crash of Adecco in January 2004

On 12 January 2004, Adecco (part of the Swiss blue-chip SMI index) dropped by over 45% in the first 90 minutes of trading. The sell off was accompanied by heavy trading, which resulted in a huge jump in the value of open positions which clearing members built up in Adecco. Compared to about CHF 20 million of open positions at the start of the day, open positions on Adecco jumped to over CHF 250 million within the first 3 hours of trading on the day of the Adecco crash. The charts below depict the price movement as well as the level of open positions and margins on that day.



Figure 4: Share price movement of Adecco on 12 January 2004

The chart below shows the hourly change in the total margins collected by SIS x-clear on Adecco from all its clearing members. Total margin is the sum of initial margin and variation margin. Although the values of the members' open positions kept moving up throughout the trading day, margins started dropping in the afternoon due to the recovery in the price of Adecco during the later part of that day.

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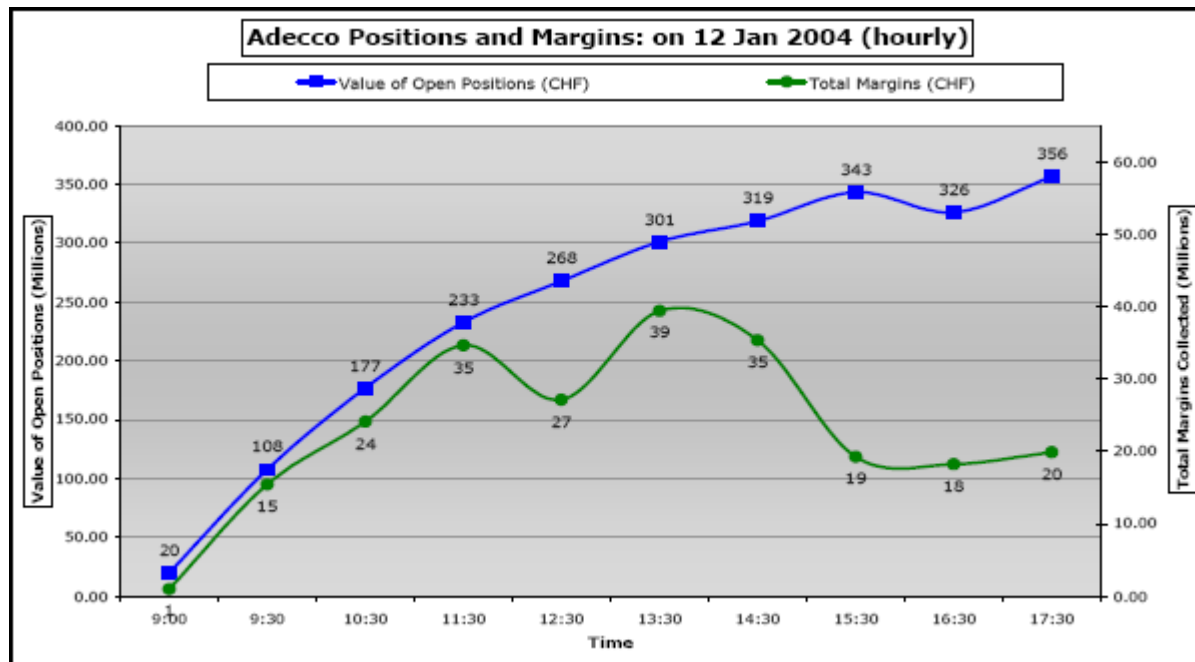


Figure 5: Hourly snapshot of SIS x-clear’s margins attributable to positions in Adecco

With a margining engine running in batch mode, SIS x-clear would have scheduled the first intraday margining cycle somewhere in the middle of the trading day. This would have meant that SIS x-clear members would have built up open positions of over CHF 250 million in a rapidly falling security, with just about CHF 2 million of margins. On the other hand, the real-time initial margining combined with closely spaced variation margin cycles led SIS x-clear to collect margins of about CHF 35 million on Adecco positions within two hours as of the market opening. Of course, there was no case of this crash leading to any instability in the market.

4 Conclusion

Two key factors influencing the level of margins computed by a CCP are the open positions which members hold and the change in market price of securities in the marketplace. The open positions which CCPs guarantee change quite rapidly during a trading day due to new trades being continually traded as well as due to settlement of existing trades. Similarly, market prices change continually and sometimes experience abrupt intraday changes. Hence, the speed and frequency of the margin computation process are far more important factors for a CCP than for other institutions – for example, computing credit risk of a portfolio of credits.

This paper makes the case for CCPs to have more frequent or even real-time margining cycles. SIS x-clear’s real-time risk management model’s performance is evaluated under stressful market conditions. The satisfactory performance of a risk management model under stressful market conditions further strengthens the argument.

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About SIS x-clear's clearing system

SIS x-clear operates its clearing system on SECOM, the SIS group's renowned clearing and settlement platform. SECOM is a cutting-edge system that links, in real-time, stock exchanges, national payment systems, depositories, CCPs and custodians worldwide, in addition to member banks and institutions. Launched in October 1993, SECOM has been continuously enhanced in cooperation with TCS/TKS Teknosoft to the financial markets' changing needs. Apart from the impressive risk management capabilities, the SECOM system enables SIS x-clear to offer other value-added features, such as optional settlement netting and free choice of settlement amongst eligible depositories.