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Restructuring securities systems processing – a blue print proposal for real-time/t+0 processing

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Restructuring securities systems processing – a blue print proposal for real-time/t+0 processing

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Abstract

Securities settlement is an area, where nobody seems to be content with the current international processing systems, but neither has a proposal for improvement emerged that has attracted common support. This paper describes a possible solution based on an international, harmonised and simplified institutional structure operating in an open real-time network structure. All deals are settled in immediate, t+0, real-time, which means that all assets and funds are delivered immediately and thereby removing settlement risk. Inter-custodian delivery problems of securities will disappear, because only securities available on investors' accounts can be settled, which continuously equals the amount on the omnibus-accounts. This will also take out the risks related to 'naked' short selling, because in most cases investors have to make securities and funds available before trading. This may divide the current market in a spot t+0 and a short term t+3 futures' market. Corporate actions can be organised in coordination and executed in synchronisation through the infrastructure network in which all custodians and registrars/CSDs participate. The paper describes the concrete new methods required (eg international custody account number system, ICAN, and DVP-codes for matching) also the probable impact of immediate real-time settlement on trading patterns, liquidity issues and risk containment. These are all areas, where the proposed new infrastructural solutions would bring benefits to the users, mainly faster/immediate delivery, less risks, lower processing costs, more competition and more efficient processing of corporate actions. Custodians' liquidity management will need to focus on the sufficiency of the real-time balance of settlement money, which might be more or less strained compared to the current situation depending on the off-setting patterns of incoming and outgoing settlements during the day. International implementation will require coordination and engagement by key players.

Key words: Securities settlement, securities settlement infrastructure, DVP processing, securities trading interfaces

Arvopaperijärjestelmien uudelleensuunnittelu – ehdotus reaaliaikaisen (t+0) järjestelmän rakenteeksi

Suomen Pankin keskustelualoitteita 7/2003

Harry Leinonen
Tutkimusosasto

Tiivistelmä

Kansainvälisen arvopaperikaupan nykyiseen selvitykseen ei olla tyytyväisiä, mutta kuitenkaan ei ole syntynyt sellaista kehittämisehdotusta, joka olisi saanut yleistä kannatusta. Tämä keskustelualoite kuvaa ratkaisumahdollisuutta, joka perustuu avoimessa reaaliaikaisessa verkkoympäristössä toimivaan yhdenmukaistettuun ja yksinkertaistettuun kansainväliseen institutionaaliseen rakenteeseen. Selvitys tapahtuu heti (t+0) reaaliaikaisesti heti kaupan jälkeen. Tämän seurauksena selvitysriski poistuu. Arvo-osuuksien toimittamisen ongelmat säilyttäjien väliltä poistuvat, koska ainoastaan asiakastileillä olevia arvopapereita voidaan selvittää, ja nämä vastaavat jatkuvasti laaritilien saldoja. Tämä poistaa myös riskit, jotka liittyvät suojaamattomaan lyhyeksimyyntiin, koska useimmissa tapauksissa sijoittajilla tulee olla arvopaperit käytettävissään ennen kaupankäyntiä. Tämä voi johtaa nykyisten markkinoiden jakautumiseen t+0spot-kauppaan ja lyhyeen t+3futuurikauppaan. Pääomajärjestelyt (esim. osingot, annit yms.) voidaan organisoida koordinoidusti ja toteuttaa synkronisesti verkostossa, jossa kaikki arvopaperikeskukset ja säilyttäjät ovat osallisina. Tässä työssä kuvataan tarvittavia konkreettisia uusia metodeja (esim kansainvälistä säilytystilinumeroa, ICAN sekä DVP-koodia) ja reaaliaikaisen selvityksen todennäköisiä vaikutuksia kaupankäyntitapoihin, likviditeettitilanteeseen ja riskien hallintaan. Nämä ovat kaikki alueita, joissa esitetty uusi infrastruktuuri tarjoaa järjestelmän käyttäjille merkittäviä etuja, kuten nopeaa ja suoraa toimitusta, entistä pienempiä riskejä ja käyttökustannuksia, aiempaa enemmän kilpailua ja tehokkaampia pääomajärjestelyjä ja muita liikkeeseenlaskijatoimenpiteitä. Säilyttäjien likviditeetinhallinnan on keskityttävä selvittelyrahan reaaliaikaiseen riittävyyteen, joka voi olla tiukempi tai löysempi kuin nykytilanteessa sen mukaan, mikä on saapuvien ja lähtevien maksujen nettoutusvaikutus päivän aikana. Käyttöönotto edellyttää kansainvälistä koordinointia ja sitoutumista.

Avainsanat: arvopaperikauppojen selvitys, arvopaperiselvityksen infrastruktuuri, toimitus maksua vastaan -suoritus, arvopaperikaupankäynnin liittymät

Contents

1 Introduction

There are continuing discussions going on regarding the need for restructuring securities settlement and trading systems, especially in Europe due to the consolidation and integration developments caused by the EMU.[1] The need for restructuring springs basically from two different development areas

– growth of global and open financial markets
– information and communication technology (ICT).

The securities processing industry is facing major changes. The infrastructure will require restructuring and implementation of modern IC technology in order to be efficient in the long run.

The development needs can be divided in four separate areas

– technical standards
– institutional structure
– settlement and trading system infrastructure
– legal and regulatory requirements.

These are clearly interdependent areas. A basic view of the institutional structure and the infrastructure is needed for the technical standards. The institutional structure and infrastructure will in general require legal support/basis.

Current national systems and infrastructures are quite far from optimal, given the new possibilities for process automation and risk containment. The support in national systems for international markets and trade is heterogeneous and generally weak and in some cases clear barriers can be found. A development according to generally accepted guidelines would be preferable. Most previous attempts have been unsuccessful eg the GSTPA initiative[2]. These have often attempted to build bridges between current systems, without major change and harmonisation efforts in the basic structures. The pressure is increasing for major changes and implementation of modern IC technology. If increased efficiency is desired, the current international non-interoperability in securities settlement processing needs to be solved. It can only be done through international standardisation and harmonisation.

Efficiency in the form of straight-through-processing (STP) can only be achieved on the global and local level if securities trading, clearing and settlement

[1] See for instance BIS(1995), ECB(2000), ECOFIN(2001), ECSDA(2001), EU Commission (2001 and 2002), Group of Thirty (2003).
[2] Lomax (2002/03).

systems are standardised using the same structural solutions. The old paper-based processing conventions need to be changed to more efficient modern network-based ICT solutions. In the current situation requiring cross-border harmonisation and profound technology changes an overall architecture is needed to bring coordination among the different sub-areas and a back-bone for the implementation project(s).

Reaching an overall efficient processing structure will be a major project, because the different sub-areas affect each other and global cooperation is needed. The national structures and systems are based on different standards and conventions. The ICT solutions employed are not interoperable. Today the legal structures vary across the different jurisdictions. An international processing structure needs a common strong and stable legal basis.

This paper focuses on the main corner stones in a standardised real-time network-based infrastructure for true book-entry securities

– common standards (addresses, matching keys and message dialogues)
– common core institutional structure
– real-time settlement processing with direct trading system interfaces and
– network solutions.

In this context, real-time settlement refers to immediate same day settlement together with the trading or very close to the trading event. True book-entry securities refer to completely dematerialised securities that are only kept as balances on securities accounts. From a technical processing point of view these accounts are in general merely one form of 'asset-currency' accounts, where each asset could be seen as one type of currency. The functions for interest-bearing instruments are very close to normal currency accounts while the equity instruments need additional functions especially for corporate actions.

The current situation gives a rare possibility for combining the development efforts in different areas and at the same creating time international standards, harmonised institutional structures and a new ITC environment. The impact of the changes on the market will be huge, but the benefits can be obtained earlier and the result will be a clear overall structure. The possibility of moving to the next generation of real-time and network-based securities clearing and settlement systems provides an exceptional opportunity to combine the two development tasks into one change process with major efficiency gains.

The general benefits of a new coherent real-time structure would be

– lower processing costs
– efficient and easy user interfaces
– more rapid processing and delivery

– lower risk levels
– improved control and resiliency.

Any effort to change the current situation will require a common blue print accepted by the major players at the global level. Global solutions, international standards and common processing conventions are the only way to interoperability and cost savings. The next generation of securities trading, clearing and settlement systems is probably around the corner and it will bring major changes to the current conventions.

This discussion paper describes a blue print for a new infrastructure based on

– common technical message standards
– a simplified institutional accounting structure consisting basically of registrars and custodians
– a settlement and trading infrastructure based on a common open network structure
– legal and regulatory harmonisation supporting the simplified institutional structure and the network-based infrastructure.

The structure of the paper is as follows. A summary chapter in the beginning gives an overall picture of the cornerstones of a new securities settlement structure and its functions. It is an introduction to the rest of the paper and highlights the main conclusions. Before the discussing the development needs in the different areas a general overview on development trends is presented in chapter 3. Chapter 4 is somewhat technical and describes the basic address, routing, matching and message standards needed in an network-based STP environment. Most of the basic technical standards can be used already in current systems in order to improve STP capabilities. Chapter 5 describes alternative institutional structures and their impact on the settlement processing. The paper is focusing especially on making the settlement process more efficient and the alternatives for settlement mechanisms are described in chapter 6. Real-time settlement brings new possibility for trading interfaces and these are described and assessed in chapter 7. The liquidity management, risk issues and trading patterns will change profoundly in a global real-time environment. The probable impact and emerging new conventions are discussed in chapter 8. The network based solution provides new efficient tools for corporate actions, which are today a most resources consuming business area. These are presented in chapter 9. Chapter 10 deals with governance issues and chapter 11 with authority and regulation issues. Views on implementation issues and next steps can be found in the last chapter. The three first appendixes contain detailed descriptions on proposed technical standards. The fourth appendix is a comparison of the proposed settlement model and the

twenty recommendations of the Group of Thirty. The last appendix contains a list of abbreviations used in the paper.

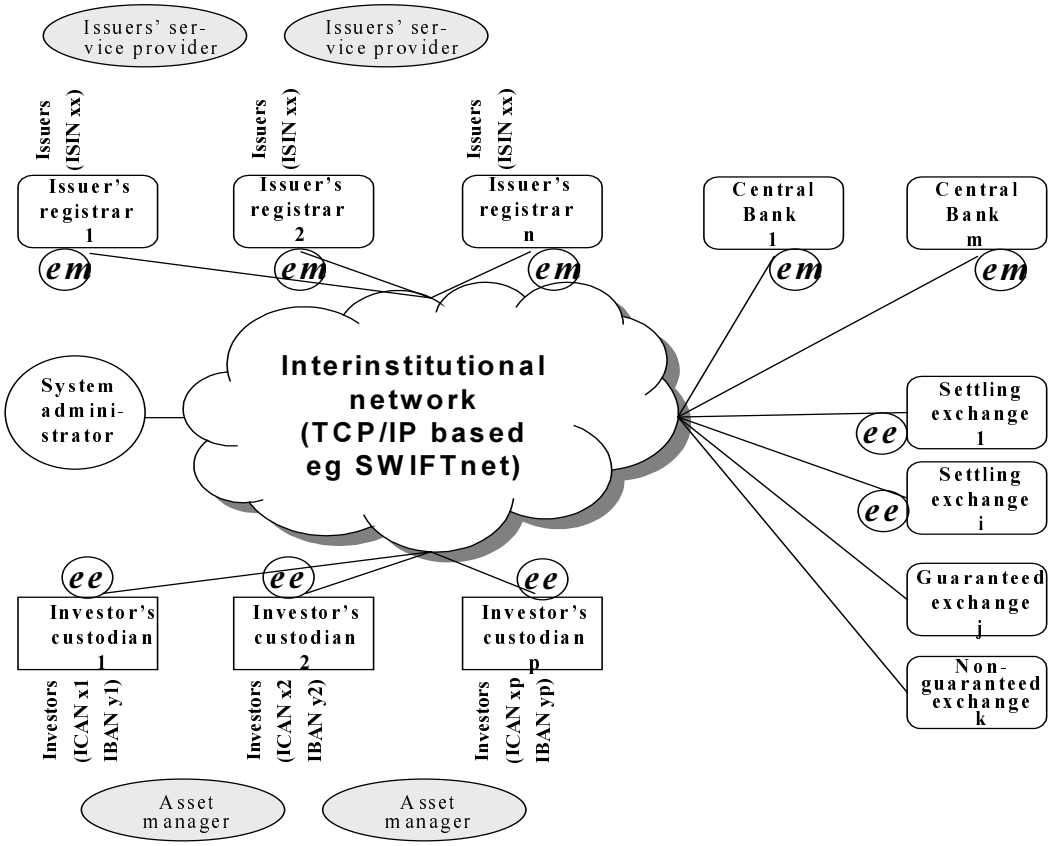
The aim of this paper is to be an input in the development discussions and to point out new possibilities and especially the need for making a general overall assessment and restructuring effort in this area in order to create a new efficient and common infrastructure. It tries to give an overall view of a possible future system structure and the general impact of network-based real-time solutions. Detailed alternative solutions are proposed and assessed for essential identification standards and processing conventions. The paper is deliberately thought-provoking and it questions and challenges some of the current beliefs and standpoints on which the current securities processing is based. All comments on these issues are welcomed and will be used for further analysis and improvements/refining of the presented ideas/solutions.

2 Summary

The objective of this chapter is to provide an overview of the content of the paper and the proposed network-based real-time settlement structure and its probable impact on market, settlement and trading conventions. The details and the reasoning behind the changes and the proposals are presented in the following chapters. The changes will be profound and a rough overall picture will probably make it easier to follow the more detailed presentations.

Simplified institutional structure. The current institutional structure in international securities processing is very complex and needs to be simplified in order to facilitate efficient processing. Today there are too many layers and too many types of institutions in the process. This increases the number of processing phases and delays the process of final settlement. It also introduces a large amount of settlement and credit risks into the process. The proposed simplified structure would only include four types of institutions as direct participants in the core infrastructure: investors' custodians, issuers' registrars/CSDs, central banks and exchanges. (Investors could use asset managers, brokers etc as before but they would be acting on behalf of the customers and would not be part of the core infrastructure for securities settlement. In the same way issuers could use service providers for issuing services that registrars/CSDs are not providing, but the service providers would be acting on behalf of the issuers and with a mandate given to them by the issuers.) A common dedicated and secure Internet type (TCP/IP) network will connect the direct participants in the core infrastructure with each other. The overall structure of the network-based infrastructure is presented in figure 1.

Figure 1. **The overall structure of the network-based securities processing infrastructure**



Custodians. Custodians are keeping investors' securities accounts. They will generally also keep customers' money accounts. This will require a banking license in order to assure the proper management of customers' money and securities accounts. The investors would be free to use any custodian they wish. All custodians will be required to use the standardised interface into the common network. They can themselves decide based on customer service considerations, which securities they are willing to keep in custody. For each type of security kept in custody the custodian will have an omnibus-account and direct relationship with the registrar/CSD for that specific security (ISIN). The omnibus-account will mirror the amount of securities kept on individual investors' accounts. The custodians will be in charge of DVP transfers among their investors ie internal transfers within the same custodian. These transfers within the same custodian will not affect the omnibus-accounts with the registrars.

Registrars/CSDs. Registrars /CSDs are responsible for monitoring that the amount of issued securities are exactly the same as registered by the custodians. The total amount of securities assets on the omnibus-accounts of the individual custodians must at any moment correspond exactly to the total issued amount. The

issuers have to choose one registrar/CSD for introducing new securities to the market. In a completely open structure the issuers are free to choose among the available registrars/CSDs and also to change the registrar used by moving his business to another registrar. Each specific security (ISIN) would be tied to one specific registrar at a time. This registrar would be in charge of all intercustodian transfers (both FOP and DVP) for this specific type of securities, which would have to be registered on the corresponding omnibus-accounts. A special license would be needed for providing registrar/CSD services and the companies would be required to fulfil international minimum standards.

Central banks. Central bank money is the preferred settlement asset for important interbank settlements. Current settlement systems also utilise private clearing bank money for interbank settlement. This has even been the only possibility for international settlements due to restrictions in the cross-border access to central bank money. In order to promote the use of central bank money in international securities settlements central banks should also grant access rights to foreign custodians, registrars and settling exchanges. Central banks would thereby get a central role in the intercustodian securities settlement process. The money leg in securities settlements needs to be streamlined, because in order to facilitate DVP between custodians these should have access to a common clearing bank. Concentrating the money liquidity in one account will decrease the demand for liquidity. International financial markets operate also in many currencies, which will require special attention.

The intercustodian settlement mechanism. When securities are transferred from one custodian to another a settlement mechanism is needed to update the transfer on the omnibus-accounts of the custodians at the same time as the money legs are settled on the money settlement accounts. The intercustodian settlement can be done using centralised mechanisms or decentralised mechanisms or through a combination, where the securities leg is centralised but the money leg is using a decentralised mechanism. The completely decentralised approach is found to be the most efficient in a large network with higher volumes (the decentralised settlement modules are denoted *ee* and *em* in figure 1). In a decentralised approach the central bank and registrars omnibus accounts are distributed to the custodians inside secure servers. The central bank money and security assets are transferred directly bilaterally between the custodians, where the distributed central bank and omnibus accounts are updated. The assets are attached as digital encrypted ‘stamps’ to the transfer messages. There will be centralised control function but not centralised processing of each transfer. Distributed settlement makes it possible to maximise the benefits of a network-based system structure.

Exchanges and trading. Trading can be done bilaterally (over the counter or otherwise) or using exchanges. Three general types of exchanges can be identified depending on the degree of certainty in completing the deals: non-guaranteed exchanges, guaranteed exchanges and settling exchanges. The non-guaranteed

exchanges can be compared to open auctions, where the buyer/seller will only be able to find out after the deal whether the other party can/will finalise the deal. In the case of a guaranteed exchange the direct participants have agreed on rules that make them responsible for fulfilling deals that has been introduced to the exchange via them. The participants can use different methods (eg reservations by earmarking and forced borrowing of assets) towards the investors to ensure their ability to fulfil the orders. Still, there will always remain a risk in guaranteed exchanges that in special circumstances some deals have to cancelled, because the guarantees were not sufficient or not functioning in the given time frame. The settling exchange will settle the deals as part of the trade. The settling exchange will take temporary possession of the assets for the trading period, which ensures immediate settlement for each deal. The buyer has to attach money to his order and the seller has to attach the securities to his order. The exchanges need to provide standardised interfaces for the custodians and registrars in order to facilitate STP.

Infrastructure network, messaging standards and security. The infrastructure network is the back-bone of the system that connects all participants. It should be based on Internet technology ie a TCP/IP network. This makes it possible to connect all participants directly by real-time end-to-end connection from process-to-process. There is no need to store and forward messages as in old paper-based batch conventions. SWIFTnet is the most probable candidate for transporting the bulk of messages. However, parallel solutions could be an advantage in order to maintain competition and reduce the dependence on one service provider. The ISO150022 message standards gives a good basis for further development. It is proposed that the encryption and identification of participants rely on PKI (public key infrastructure)-solutions. All participants use the same electronic standards in the network, so all interfaces will de facto be network-based remote access interfaces independent of the geographical distance.

Asset accounts and account identifier ICAN. Dematerialised securties are kept in custody accounts. The basic book keeping processes of securities accounts are very similar to normal deposit accounts. The accounts will have a balance and transactions increasing or reducing the balance will be reported in a statement of the account. The investors will probably have a main account, which will be divided into sub-accounts for each type of securities defined by the ISIN (International Securities Identification Number). The main custody account number is proposed to be identified by an international custody account number (ICAN). The introduction of a common custody account number is one of the prerequisites for straight through processing (STP). It will be the basis for routing asset transfers directly between investors' custody accounts. Payments will most likely be routed using the corresponding international bank account number convention (IBAN), which is in the implementation phase. (International account identifiers for routing money and securities transfers are as important as global

telephone numbers for routing efficiently telephone calls or short messages between mobile telephones.)

Matching and reference codes. In order to match DVP (delivery versus payment) transactions automatically the both legs need to carry a common code to connect the payment leg and the corresponding securities transfer leg. A new DVPC, delivery versus payment code, is proposed for this purpose. A similar FOPC, free of payment code, is proposed for identifying free of payment transfers. Both DVPC and FOPC codes are also important for investors using automated portfolio management systems, because these facilitate automated reconciliation of orders, confirmations and statement of accounts etc. An audit trail code is proposed for identifying each transaction in the securities settlement system. The audit trail code is called SATC, securities systems audit trail code, and its main purpose is to identify confirmations or other answers to original transfers among participants in the infrastructure as well as investigations at later stage. In order to facilitate anonymous trading interfaces a special exchange deal identification code (EDIC) is proposed, which would disguise the true ICAN account numbers behind the orders. The standardisation of these kinds of basic identifiers is a prerequisite for straight through processing.

Increased efficiency in corporate actions. The proposed direct relationship between registrars and custodians gives the opportunity to 'broadcast' corporate action messages directly to the custodians eg report ownership per a given point in time. Using the international account addresses, ICANs and IBANs, facilitates direct routing of new shares, dividends, interest and other actions affecting investors' accounts without delay and manual interventions. Corporate actions will be the area that will benefit considerably from the simplified institutional structure and common standards.

The impact of real-time on trading conventions. Real-time immediate settlement will mean that the selling investor will receive the money practically immediately after the trade. In the same way the buying investor will receive the securities immediately. In order to make immediate settlement possible it will in practice require the buyer to put up the money together with the order and the seller to put up the securities. Settlement could also be delayed as in current systems until a given number of days after the trade. Given the possibility for immediate settlement most investors would probably prefer it over delayed settlement in order to get immediate title to the assets, contain settlement risks and reduce float. A market based on delayed settlement may prevail, but it would probable develop towards a short-term futures market. Positions in this short term (three to five day) market could be covered during preceding spot days. Real-time settlement will also be more efficient when using modern IT technology. It will be hard to find advantages in delayed spot-market settlement, once immediate settlement systems are in place. Therefore the volumes will most probably move rapidly to the faster alternative once it is available.

The impact of real-time on liquidity management. In a real-time environment customers and custodians need to have the securities and money available, when the trade is agreed, because otherwise the settlement cannot be successful. Customers cannot therefore practise ‘naked short-selling’. All orders must therefore be secured beforehand with at least loan contracts. This will ease the custodians’ liquidity management tasks considerably, because custodians will always be able to meet the need for settlement assets in securities. The balance of the omnibus-accounts will always equal the total balance of the individual investors’ custody accounts. The liquidity management will focus entirely on the settlement money management. The custodians have to ensure that the central bank or other settlement bank account continuously contains enough liquidity for all transactions. Incoming and outgoing transactions will net over time, but imbalances in the flow will require attention. Bad liquidity management will result in delayed customer settlement, which can, if persistent, effect the company image of the custodian. This will also reduce the need for a central counter party (CCP), because money liquidity can be acquired from the intraday money market and central banks.

Risk considerations. Immediate DVP settlement in central bank money will reduce and almost remove settlement risk. The risk of unsettled trade will be detected immediately and correcting action can be taken before there are significant changes in the market. All involved parties can calculate with real balances instead of estimations for future settlement moments. Operational risks will also decrease when malfunctions can be spotted immediately and the systems contain automatic reconciliation and error detection methods. Standardisation and direct interfaces between infrastructure participants will also help to reduce operational risks, when everyone has a clear picture how the systems functions and in which phase the processing of each transaction is at any moment.

Structural impact on governance and competition. The proposed network-based model is based on an open and competitive structure. The registrars will compete for issuers and the issuers can choose among registrars/CSDs based on service content and pricing. In the same way investors can choose among competing custodians. No CSDs will be in a monopoly situation. The exchanges will be independent from CSD and customers can choose among available trading mechanisms according to need and preferences. The infrastructure network will need a network administrator and standardisation body but these centralised (monopolistic) tasks can be kept to a minimum. With an open network-based infrastructure the governance and insufficient competition problems of current ‘silos’ and private monopolies can be avoided.

Benefits. The main benefits will be lower costs, more rapid processing and reduced risks in securities processing. This may sound too good to be true, but the reason for these benefits stems from the fact that current practices originally built for paper-based processing are outdated. Modern IC technology brings new

possibilities, which will produced major benefits when implemented efficiently. However, this requires restructuring of the processing chain. A comparison could be made to Internet, web-based solutions, email on other systems based on modern ICT solutions. The benefits of these systems would not have been possible without restructuring the service according to a network concept.

Implementation issues. Some of these proposals can already be implemented in the current systems eg account number and matching code standards. SWIFTnet already exists and need only to be employed as a true real-time network. Changing the institutional structure to follow the two-level approach needs political will. However, this could be realised in a step-by-step process, starting with given markets and coverage expanding bit by bit. Settlement mechanisms and trading interfaces will need technical developments based on common standards. This could also be achieved by a step-by-step implementation in certain areas, but it will require that all participants in that area are simultaneously ready for the new interfaces.

The preceding paragraphs aimed to give an overview of the analysis in the following chapters, where the reasoning behind these statements will be given.

3 Background and development pressures

Before going into the details regarding proposed new structures and processing practices the background and development pressures behind the changes are analysed. There are also delaying and hindering factors. The impacting factors can be divided into three major groups: technical, market-based and political.

3.1 Technical development factors

Electronic book-entry will be the future format for all types of securities. Securities will be electronic commodities, which from a technology point of view will be very similar to different currencies. Custody systems will keep securities accounts stating the ownership of different electronic assets. Completely electronic registers and processing will be significantly more efficient than purely or partly paper-based solutions.

Technical standardisation is the basic requirement for international processing systems and interoperability. The internet/email standards show the benefits of truly international common standards. Common technical standards for securities will make it possible for all software providers to develop systems that can be used in every country and by all investors. (Compare eg with the email and word processing software systems.)

Information and communication technology developments can also be utilised efficiently by the securities industry. The internet-technology provides efficient possibilities for direct real-time end-to-end connections between all participants in the industry. The old processing convention inherited from paper-based systems has been batch oriented. Modern technology makes real-time and transaction-based processing more efficient. However, this will require re-engineering of the legacy systems. The international flight-ticketing system is a good example of global standards and network connecting a large number of clearly defined entities.

Electronic customer interfaces to securities services can already be found in some countries, but there are no general standards. There will be increased pressure to create electronic interfaces between investors' and asset managers' portfolio management systems and custodians' custody systems.

Electronic security technology has advanced, especially in the field of pubic key infrastructure (PKI). In areas where monetary values are at stake, good electronic protection, encryption and counterparty identification is required. Electronic based systems need new types of security features. Properly designed new decentralised systems will be much more robust than traditional centralised systems.

The technical coordination effort needed among a large number of participants will be a major obstacle for rapid progress. Participants with batch-based legacy systems have to move to real-time systems before they can function as a participant in a network-based real-time environment.

Current domestic standards vary and are non-interoperable. Current systems have generally not been designed for global electronic interfaces, but for domestic paper-based processing. Different kinds of extra features have been introduced in the domestic systems to support international traffic. However, these are not very efficient, due to their character as additions to a domestic structure. Agreement also has to be reached on all the technical standards that need to be implemented, which is often a slow process when many participants are involved.

3.2 Market-based development factors

Globalisation is a general trend in all areas, but especially in the financial markets. Investors with different backgrounds are interested in making investments in assets belonging to different local markets/areas. Issuers want to reach all potential investors efficiently.

Harmonisation is the basic requirement for international markets and there are today many efforts in this direction. However, the pace has not been rapid.

Decentralisation and reduced economies of scale are consequences of implementing new low cost IC technology. In the paper-based environment and batch-based IT systems, economies of scale were significant. The internet-world changes the situation; eg any company can afford to buy an email mailbox software and emails are so cheap to transfer and process that they are regarded as non-cost items. The same scenario can be foreseen for securities processing related systems. Processing securities electronically is just sending messages/transfers between different secured and supervised asset accounts/mailboxes maintained using software that could be mass-produced for international usage.This will turn the current trend of monopoly consolidation towards competitive decentralisation based on common standards.

Speed and efficiency are basic customer requirements that current systems have difficulties in providing. Delivery times of t+3 and even t+5 are common while t+1 has been put up as a target for future years using current processing conventions. The t+1 target has proven to be difficult to reach. However, with modern technology it will be easier and more efficient to go directly to t+0 real-time processing. Immediate settlement will free customers' settlement capital and reduce their settlement risks. Some market participants have questioned the need for speeding up settlements, stating that a status quo is acceptable and new

investments are not necessary.[3] However, if there would be an efficient competing real-time t+0 infrastructure available, the customers would use this solution for sure. The situation would be comparable to email and telephone service markets, where today there is no demand for delayed services (eg emails delivered after three days).

Competition is increasing in the securities markets among exchanges, settlement systems, custodians and other service providers due to cross-border services. There is also an increasing number of new entrants in the market utilising modern technology. Maintaining a competitive environment is preferable over a consolidation process leading to monopoly/oligopoly structures when viewed from the perspective of investors and issuers as well as the whole economy.

Consolidation and market dominance have been major development trends during the previous decade of increasing cross-border securities markets. There is a natural interest for large players to secure a continuation of this trend.

Electronic risk controls need to be built into the systems, because in a real-time environment, which handles massive volumes, manual interventions and controls are too slow. In a real-time world the settlement risk will generally disappear as will the asset availability problem. All transactions can be processed in DVP mode with immediate finality. The main focus will be on payment liquidity and operational risks. The issues in operational risks will shift from individual transaction related risks to ICT system processing errors and system abuse.

Habitual changes take time. All involved in securities processing are accustomed to current practices. Although the email type of modern direct electronic interfaces are more convenient, more efficient and can be made more secure than conventional methods, many users still prefer the old type of paper confirmations, telephone and fax connections etc. However, the Internet generation grows constantly. Changes especially radical ones, require crossing barriers. Large changes imply costs that normally cannot be covered immediately.

Float and free (intraday) credit have been the privilege of some of the intermediaries and participants in the market. They will probably be reduced considerably in a new real-time based infrastructure and thereby reallocated to the investors and issuers.

Liquidity requirements will change with the move to real-time settlement and banks have to focus on maintaining enough intraday reserves for covering payment legs. The transaction flow will be bi-directional and thereby lead automatically to off-setting transactions. However, occasionally there can be outflows that will require special attention.

[3] Charteris (2001) p. 8–9.

3.3 Political development factors

Political integration is advancing. Especially in Europe there is political pressure for integrating the financial structures. The same can also be seen on the global level in the work of BIS/IOSCO and the Group of Thirty.

Authority power and involvement to solve market failures and inefficiencies have lately become if not popular at least possible. This might be the most efficient way to reach agreement in the market, especially in cases where it is important to choose one given alternative (eg standard) among similar competing solutions, but where the private sector has clear difficulties in reaching agreement within an acceptable timeframe.

Market place and national interests have resulted in different kinds of 'protectionistic' reactions trying to steer settlement volumes into 'preferred' systems or keep them in the current system. A network-based solution would be more 'democratic' and open, giving everyone fulfilling the stipulated common requirements the same opportunities. This will be of interest for some parties while others see it as threats to their current positions.

Some intermediaries (systems and service providers) will become obsolete or their business area will shrink in a new global and simplified structure eg links between different national systems. These intermediaries will probably have an interest in delaying developments.

Legacy systems have been major investments that have not yet paid for themselves. Most of these systems will become outdated with the new structures. Service providers have to invest in new real-time solutions and interfaces. Parties will have different views on the correct timing depending on their own investment situation.

Legal barriers are common and they will be difficult to remove. Legal structures vary a lot and there are partly conflicting legal conventions. In conflict and bankruptcy situations the ownership rules must be clear and binding. The responsibilities of service providers and customers have to be defined for different kinds of error situations. The minimum common requirements for participants in securities processing need to be harmonised. A global system will need global acceptance of the legal basis.

Truly global systems will require international oversight and supervision. Current authority structures based on national mandates need to be transformed to international cooperation and international bodies in order to be able to cope with the challenges posed by international processing and settlement systems.

Personnel consequences and costs of change will be significant. The back-office processing work will be almost completely automated. Most of the routine customer service eg transaction/order input will also be automated. Personal assistance will mainly be needed only in asset management and advisory services.

The required monitoring and control of new automated systems can be maintained by a small number of controllers/supervisors.

Network externalities in settlement and payment systems place new conventions/proposals in a 'chicken or egg' type of situation, in which it is difficult to gather the initial volumes needed to overcome the introductory threshold.

A wide political commitment is needed to overcome the initial barriers for building a new efficient, truly global and harmonised/standardised securities processing infrastructure. The pressure for this change will be stronger the more delayed developments are and the more outdated the available solutions will be. Building new infrastructures have generally relied on wide commitment, but there are also examples of separate individual developments that have got such market response that these have become de facto standards and infrastructures in a short time frame, eg Internet and emailing.

4 Common standards

The presentation and analysis of the detailed proposals starts with the common standards, because these would be beneficial irrespective of what kind of institutional structures and processing mechanisms are in place.

The standards needed in a securities processing infrastructure can be divided into internal system standards and external customer standards. The internal system standards define the data and procedures used between the system/infrastructure participants. The external customer standards define the communication between participants and their customers (ie investors and issuers) and other external parties (eg different authorities). In a network-based environment all interfaces and communications will be electronic. For customers not interested in direct electronic interfaces some participants will naturally provide service based on traditional interfaces. However, most of the customers will probably change to Internet-based connections during the next couple of years eg in Finland 80 percent of all sell and buy orders are already now placed directly by customers via Internet. The common standards make STP possible from end-customer to end-customer. The external customer standards must be in line with the internal system standards.

In a real-time environment the process will be based on individual transactions. To batch transactions would delay processing. Therefore the common standards should support transaction based processing although batch-based processing could be provided in the transition phase.

4.1 Internal system standards

There are four general areas of internal system standards that need attention: addressing routines, matching routines, message dialogues and identification/ encryption/security procedures.

4.1.1 Addressing routines

The core element in a network and message processing system is the addresses and routing procedures. All entities/objects in the system must have clear addresses/identifiers and the routing procedures should be able to transfer the data automatically to the right address. An efficient securities settlement system needs following address/identification standards

- BIC (Bank Identifier Code)[4] for identifying each participant in the network/system
- ISIN(International Securities Identification Number)[5] for identifying each individual type of securities in the system
- IBAN (International Bank Account Number)[6] for identifying all accounts through which payments are made
- ICAN (International Custody Account Number) for identifying each custody account in which book-entry securities are kept
- SATC (Securities' systems Audit Trail code) for identifying each transaction in the system.

BIC, ISIN and IBAN are international ISO-standards. ICAN and SATC are new proposals for addressing standards made in this paper (see appendix 1 for detailed descriptions).

Each investor would have one or more ICAN(s) identifying his account(s) with a given custodian. Each custody account could contain one or more types of securities identified by the ISIN according to customers' and/or custodians' preferences. The ICAN standard could be very similar to the IBAN standard. As it is a new proposed identifier, which does not need to have legacy burdens, it could be structured more efficiently than the IBAN standard that has old national burdens. One possibility is also that all kinds of accounts are identified by the same account identifier (eg IBAN or ICAN) the difference between deposits and securities accounts will be minimal in the book-entry environment, but generally these are kept in different internal IT systems by the banks.

Cross-tabulating tables are required from which the account keeping bank for every IBAN and the custodian of every ICAN can be found. Generally banks would also be custodians. A hierarchical structure within the IBANs and ICANs minimises the tables and makes cross-tabulating more efficient. A table for finding the issuing institution and the basic data for each ISIN is also needed. In order to clearly identify custodians and registrars/CSDs special identification numbers are proposed CIN =custody identification number and RIN =registrar identification number.

The SATC transaction identifies each transaction in the system. It provides an audit trail for each transaction so that its path through the system can be followed in both directions during the processing and afterwards for control purposes.

[4] ISO 9362 standard and used for addressing in the SWIFT network.

[5] ISO 6166 standard for unique identification of securities.

[6] See ECBS web-site for details.

4.1.2 Matching routines

Securities processing contains matching procedures in almost all phases. Investors have to match orders against confirmations and deliveries. Custodians have to match customer orders with system transactions. Settlement providers have to control the DVP-process by matching transaction pairs so that DVP requirements are fulfilled. Automatic matching and reconciliation requires clear, unambiguous and standardised matching identifiers. Currently the matching routines are based on comparing a number of data fields and a possible reference ID, which is not standardised.[7] This results in inefficient and incomplete matching. Errors are also more difficult to detect immediately when some of the fields are diverging or there are transactions with coinciding matching fields.

The following new matching codes are proposed

– FOPC (Free-Of-Payment remittance Code) for matching FOP transactions especially in customers' systems (deliveries with orders etc)
– DVPC (Delivery-Versus-Payment Code) for matching the two legs of DVP transactions both in the settlement process and customers' systems
– EDIC (Exchange Deal Identification Code) to support anonymous trading.

In order to make STP possible on an international level the matching code practices should be globally common.

The FOPC, free-of-payment remittance code, is used to identify free-of-payment transactions especially in customer systems. FOP-transfers resemble much normal credit transfers ie they are transfers of an amount of securities from one custody account to another identified by the ICAN. The remittance code will follow the transaction all through the system so that the receiver can consolidate automatically the reception in his system. The FOPC would generally be agreed upon between the investors. There is only a need for this code to be unique per pair of investors. See appendix 2 for detailed presentation.

The DVPC, deliver-versus-payment code, is used to identify the two legs of paid securities transfer and thereby enable simultaneous and interconnected transfers of the two legs. Institutions (CSDs, registrars and custodians) responsible for executing the DVP-processes need to be able to recognise both legs and to verify that the deliveries are as agreed and acceptable to both parties. Therefore the sellers' securities transfer messages need to include information on the expected payments and the buyers' payment messages need to include information on the expected securities deliveries. The DVPC identifier will also make it possible for the investors to identify the payments or securities transactions on the (electronic) statements of accounts, receipt confirmations etc.

[7] See eg ECSDA (2002 Feb) p. 19–22.

These codes need to be globally unique for each pair of transactions. The DVP-transaction dialogue would consist of a securities transfer message identifying the corresponding payment transfer and its value through the DVPC identifier. In the same way the payment transfer message will include the DVPC identifier and securities amount for finding the matching securities transfer and verifying that the transferred values are agreed. See appendix 2 for detailed presentation.

The EDIC, exchange deal identification code, is used to identify exchange traded transactions, their possible sub-parts and to make trading partners anonymous. When a deal is made via an exchange an identifier is needed that connects it to both the seller's and buyer's original orders. The sellers and buyers would want to remain anonymous in the trading process, which can be accomplished by interchanging the original ICANs/IBANs for one-time pseudo-ICANs/IBANs, which can be decoded only by the proper custodian. The EDIC will contain these one-time pseudo-ICANs/IBANs. There will generally not be a match in volume between each order and the exchange deals. The trading partners are not demanding/supplying the same quantity and therefore a sub-part identifier within the EDIC is needed to distinguish into how many parts the original order has been split. See appendix 2 for detailed presentation.

4.1.3 Message dialogues

In a securities trading and settlement infrastructure three different general type of messages are needed among the participants of the system

– transfers of book-entry transactions and payments
– trading orders
– corporate action messages.

The new ISO15022-series[8] of securities messages generally covers the needs of securities transfers and trading messages well. However, these could even be further simplified if the addressing and matching codes described in the preceding sections were implemented. The DVP-messages should also include information on the expected deliveries in the opposite direction. In a real-time end-to-end STP process the message dialogues (the message and its response) should stretch between the initiating participant and the receiving participant without interruptions caused by possible intermediary participants and centres. The heart of a real-time process is in the message dialogue. The processes in two different IT-systems communicate with each other through the network and the tasks are accomplished and final once the dialogues end. Both systems have processed in

[8] See eg the web-site www.iso15022.org.

synchronisation and the end result is in balance. For example in a real-time end-to-end DVP-transfer both the payment and the securities balances have been debited and credited in the proper way both on the seller's and buyer's accounts as well as on the intercustodian settlement/omnibus accounts both for money and securities. The current typical store-and-forward messages need to be modified to real-time dialogues over a TCP/IP-network[9].

The ISO15022 standard does not clearly distinguish between internal system messages and customer interface messages. It would be good to make a clear distinction, because the customer service type of interfaces are generally different from interfaces between infrastructure participants.

The development needs in the ISO15022 messages and structures can mainly be found in the area of corporate actions. By using IBANs and ICANs actions like interest payments and dividends can be automated. The issuers also need to get updated lists on the owners of the securities. In a real-time system this information can be retrieved by the custodians and sent to the registrars/issuers' service providers with very little delay. Each issuer would need corporate action support by its registrar, for receiving and sending corporate action messages to the custodians for actions in the custodian systems or to be passed on to the investors. Information concerning approaching corporate actions eg new issues, delistings, de-issues, mergers, exchanges would be 'broadcasted' with a suitable lead-time before the cut-off time to each custodian carrying the securities in question. One basic requirement for issuers is also to retrieve ownership listings especially on shares.

4.1.4 Identification/encryption/security procedures

The values transferred in securities settlement systems are so huge that exceptional strong security procedures are needed to protect the system. All participants must be recognised without doubt. No transactions may be repudiated or forged. The system is as weak as its weakest link.

The public key infrastructure (PKI) is suitable for identifying participants in a system and encrypting the messages. PKI can support efficiently direct bilateral communications in a common network. The PKI system requires a trusted certification authority that introduces new members to the systems, maintains the public key tables and gives certificates to the participants.

[9] Internet-type of networks are based on the TCP/IP protocol. Sometimes these are also referred to as IP networks. These can be open networks as the Internet or closed internal eg company wide networks or dedicated networks for given user groups as in the case of SWIFTnet the TCP/IP network of SWIFT.

The security of SWIFTnet is based on PKI and gives means of securing direct bilateral communication between participants. If the security requirements are seen to be so high that one layer of PKI hand shake is not enough then another layer could be used employing another CA authority in addition to the network provider, for example central banks.

4.2 External customer standards

There are three basic categories of external customers using the securities settlement infrastructure: investors, issuers and authorities. Investors and issuers often use service providers like asset managers, investment banks etc to get an easy interface to the securities market. All of these customers need their specific standardised interfaces to the system.

4.2.1 Investor interfaces

There are several information flows between investors and their custodians/asset managers, which would benefit from international standards. The information requirements are clearly defined and mostly very stable. It is only a question of reaching agreement on these standards. At best these standards would make the e-interface with investors and asset managers resemble structured emails (XML-based messages)[10] which everybody could use directly in their internal IT systems in STP-mode. The IT providers of portfolio management software would have an incentive provide these interfaces as part of their products. The JPEG, TIFF and GIF standards for electronic pictures/images can serve as an example of standards that has gain support by most picture processing system providers and are therefore available in digital cameras, PC imaging software, DVD recorders etc. The same will probably happen once good customer standards for electronic securities transfers are adopted.

Basic customer standards are needed for

- sell and buy orders
- securities transfers (FOP and DVP)
- transaction confirmations/receipts
- portfolio/account statements
- collateral messages (post and receive)

[10] XML (Extensible Markup Language) is a method to create common formats including both the data and the format information. See www.iso15022.com site for implementation for securities processing.

– corporate action information and responses
– ownership limit, insider, etc flags
– taxation statements.

The customer/investor would have an electronic interface with a proper electronic customer identification procedure through which the customer would be in contact with his custodian. The palette of standardised messages should be built up gradually starting from those with the largest cost saving potentials. These standardised XML-messages need to have a basic common structure and the common data elements should have the same definitions and appearance.

It is also typical that in addition to the basic standards messages service providers/custodians have an interest to build added value services for their customers, which will require special messages, which will be difficult to standardise.

4.2.2 Issuer interfaces

The issuers will also need electronic interfaces in order to automate the processes eg dividend and interest payments, new issues and ownership information retrieval are examples of issuers services and corporate actions for which automation and standardisation would imply considerable cost savings. For instance using IBANs for dividends and interest payments all through the system would simplify these processes greatly.

Basic issuer interface standards are needed for

– new issues
– redemption, delistings, de-issues
– dividend, interest and other payments
– ownership listings with contact details
– corporate action information messages.

Automation of the corporate action processes is clearly lagging behind and have not received the same attention as trading and settling.

4.2.3 Authority interfaces

Lately the discussion regarding authority involvement has focused on counter terrorist measures and abuse of insider information. Authorities need also to be able to control the internal risk positions in the system and thereby help to reduce systemic risk. Although paying tax is not popular it can be more or less efficient.

The more resources taxation procedures require the more taxes are needed in order to attain the same total net amount. Taxation systems vary internationally and therefore procedures supporting different taxation approaches will be needed. This is also on area, which would benefit through proper automation.

Increased authority cooperation is needed on the international financial market. Any standards will need authority support. A heterogeneous authority stance will delay developments. Especially the technical interfaces used and required by central banks and supervisors are in a central position. The settlement media used and required by securities settlement systems are most often central bank money. The central banks thereby become both participants/service providers and authorities in the system. In addition to that central banks are also often in a customer position regarding monetary policy transfers.

The authority interfaces need to be fast in the real-time environment. Real-time systems will require real-time monitoring in order for the monitoring to be effective. Authorities will need immediate information of liquidity problems, malfunctions etc in order to be able to provide assistance when required.

5 Simplifying institutional structures

In a real-time environment the institutional structure need to be very straightforward and clear in order to support end-to-end dialogues. Every participant type has to have clearly defined tasks and every member in the group should perform its tasks according to common conventions and standards. The processes in the real-time process are immediate and there are no possibilities for stopping the process in order to search among alternatives by manual or semi-manual routines. The different IT systems communicate directly with each other to perform the necessary tasks. The current quite complicated institutional structures need to be simplified and harmonised based on the requirements in real-time processing and the possibilities given by modern IC technology. Concretely this implies that the number of hierarchical levels of service providers need to be reduced and that unnecessary intermediaries should be removed in order to establish an efficient structure.

5.1 General objectives and characteristics of an efficient infrastructure

An efficient settlement infrastructure should fulfil following general objectives and requirements

- openness and non-discrimination by providing access to everyone fulfilling neutral access criteria
- transparency regarding rules, prices, costs and operations
- standardisation of interfaces, rules, processing conventions and core data content
- promotion of competition between institutions and service providers within the infrastructure
- high operational reliability
- low operational and settlement risk levels
- cost efficient transaction processing
- efficient and automatic user interfaces
- scalability according to varying needs
- development flexibility for future change requirements
- international interoperability.

These are partly conflicting objectives and risk and efficiency factors have to be balanced against each other. Global standards and international interoperability

must have high priorities, in order to reduce the numerous domestic non-interoperable solutions and facilitate convergence towards a harmonised solution.

5.2 Basic functions in securities processing and the impact of real-time processing

In securities processing the following key functions can be distinguished

- registrar ie keeping track of issued securities, issuing and de-issuing securities as well as providing other issuers' services eg corporate actions. The main task of the registrar is to control that the total amount of issued securities corresponds exactly to the total sum of securities held in custody on behalf of the investors. The registrar can control the situation at the investor level, by keeping investor accounts, or at the custodian level by keeping omnibus-accounts. (The term registrar is preferred over CSD, central securities depository, because depository refers to paper securities dematerialised by depositing them in a depository)
- custodian ie keeping track of individual investors' ownership of securities, transferring securities in a secure operation from investor to investor as well as providing other investor services eg asset management. The main task of the custodian is to keep track of individual ownership records/accounts correctly. All transfers of ownership need to be initiated by the investor customers of the custodians.
- inter-custodian settlement system/method ie transferring assets and money between different custodians and this will be reflected in the registrars' and central banks' books
- exchange ie providing trading services and a market for securities.

These functions present a somewhat simplified structure compared to the one described in the BIS and BIS-IOSCO reports[11] in which in addition to CSDs there are ICSDs (International Central Securities Depositories) and in addition to Custodians there are Global custodians. Both ICSDs and Global custodians can be seen as components needed in the current non-interoperable international structure. If traditional CSDs and custodians were equipped for international service and barriers hindering this are removed, then the need for these special types of intermediaries will disappear. Among the BIS components is also the CCP (Central Counterparty) the need for which will be discussed in the chapter covering liquidity issues.

[11] BIS (1995), BIS/IOSCO (2002).

The securities account keeping structures have a depth and width dimension. With depth is here understood as the number of layers of (omnibus-)accounts that are kept before reaching the accounts of the final individual investor. For example in a one-layer approach investors have accounts at the CSD/registrar level, while in a two-layer approach the investors have accounts with custodians who in turn have 'omnibus' accounts with the CSD/registrar. Each CSD/registrar creates a hierarchical accounting/system 'tree' with its custodians. The width dimension refers to how the different accounting/system trees relate to each other. In a 'narrow' structure the securities can only be transferred among a small number of custodian belonging to the same tree. In a 'broad' structure the securities can be transferred among different trees and between a larger number of custodians. Even if the different accounting/system trees would generally use the same standards, the processing could be quite separate or have a high degree of interoperability. This could be compared with the narrow situation in the credit card industry where Mastercard, VISA, Amex etc are using the same general standards but have completely separated processing systems. On the other hand in many countries the ATMs are often interoperable and connected to many card issuers, thereby showing a broad structure.

The depth and width dimensions should not be confused with the terms vertical and horizontal consolidation. Vertical consolidation refers to the organisation/separation of the registrar, inter-custodian settlement system and trading platform. Horizontal consolidation refers to merging different accounting/system trees into one larger single accounting/system tree eg merging on a national level the bond system with the equity system. The width dimension describes the extent of interoperable but separate accounting/system trees.

5.3 The depth dimension of the accounting hierarchy

The one-layer approach is used in some smaller countries/markets eg the Nordic countries. The CSD keeps record of the individual investors' ownership and agents, not custodians, introduce all transactions to the CSD. This is possible in small environments, but on a global level it would not be possible to have one central site keeping track of all individual investors' accounts. The one-layer approach is much simpler to control and supervise than a multi-layer structure. The internal risk controls and funds securing financial stability have to be mainly only at the CSD level. The investors' transfer orders are input via agents having proxies given by the investors. The licensing requirements for agents need not to be as heavy as for independent custodians. The CSD can solely control that the volume of issued securities matches to the volume of securities kept on investors'

accounts. Technically real-time processing in t+0 is easy to implement in a one-layer approach, because all accounts are kept in the same IT system/site.

In a two-layer approach independent custodians keep track of each individual investor's ownership. On the registrar/CSD level there are only omnibus-accounts for each custodian stating how much of a given type of securities in total is kept in custody by each custodian. The registrar keeps track and control that the securities kept by the custodians add up to the total issued. The custodians keep track what is kept in custody by each investor adds up to what is totally allocated at that moment to that custodian. In a two-layer approach the control of the volume of securities in the system is divided between the registrar and the custodians. The licensing and supervising/control requirements on custodians has to be demanding to secure that all the necessary controls are in place in order to avoid different kind of mismatches in the account keeping and to be able to cover the financial losses of any errors. The securities processing system is a closed system and all errors are traceable and generally correctable without loss, but in some cases due to exchange rate fluctuations, bankruptcies etc losses may incur. One risk that needs special control attention is insider abuse at custodian level, whereby securities might be overissued within one custodian by reporting wrong figures to the registrar. This is the reason why a banking/credit institute license is generally required for custodians in a two-layer system. Technically real-time processing in a two-layer structure requires to support synchronised processing by at least three different participants in the system at the same time (registrar omnibus-account system, sending custodian and receiving custodian custody systems) utilising an interconnecting real-time network.

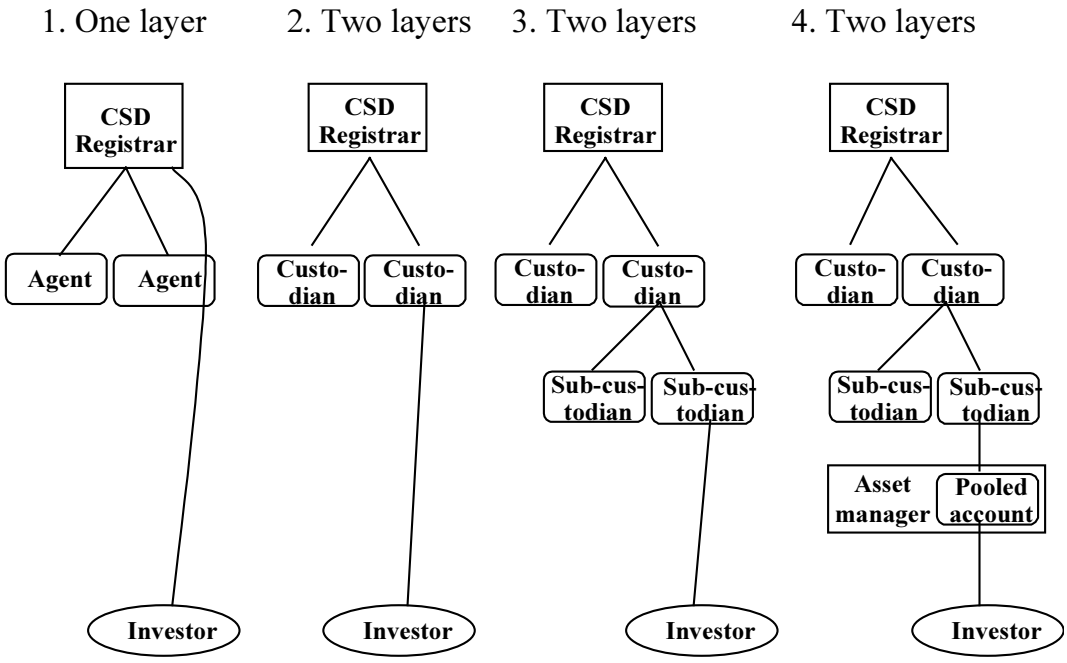
In a three-layer approach the third layer eg sub-custodian will move the control of individual investors' account one further step from the registrar/CSD and create a new layer of omnibus-accounts. When transfers are made between investors using sub-custodians belonging to different custodians five different systems will be involved in the transfer (sending sub-custodian, its custodian, the CSD, the receiving sub-custodian's custodian and the receiving sub-custodian). This is currently often the situation in global transfers and sometimes even a fourth level can be found. The risks in long chains are increasing, the efficiency is low and it is difficult to control the overall process. For real-time processing the structure should be as flat as possible and a two-level structure seems to be the optimal.

It is currently also possible in some systems to add a type of additional semi-layer by introducing pool accounts for investor groups for example through asset managers. These are not different from the normal investors' accounts from technical point of view. However, they complicate corporate action processes, because the true investor information cannot be reached and established. Automating corporate action processes will require harmonised information about the true investors at the custodian level. Investors using this possibility are facing

additional risks, because the asset managers managing these pool accounts are generally not supervised as thoroughly as proper custodians. It also makes different types of authority controls more difficult when the investors become anonymous behind a pool. Criminal/terrorist transfers, tax evasion, and insider information abuse will be more difficult to trace. When anonymous accounts are not allowed in the banking system for these reasons, the same reasoning should also restrict the usage of anonymous and pool accounts for securities. The custodians should know their customers in the same way as banks are obliged to know their customers.

The deeper the structure the more difficult it is to know who the rightful owner for the securities is at a given moment. The deeper the structure the more difficult it is also to establish the liable party for possible errors in the accounts and how these should be corrected. Figure 2 is giving some examples of the depth of structures. These will be even more complex when the width dimension is added through different kind of links established by intermediaries like global custodians as described in the next chapter.

Figure 2. **Some examples of alternative 'depth' structures**



5.4 Interoperability and the width dimension of the accounting hierarchy

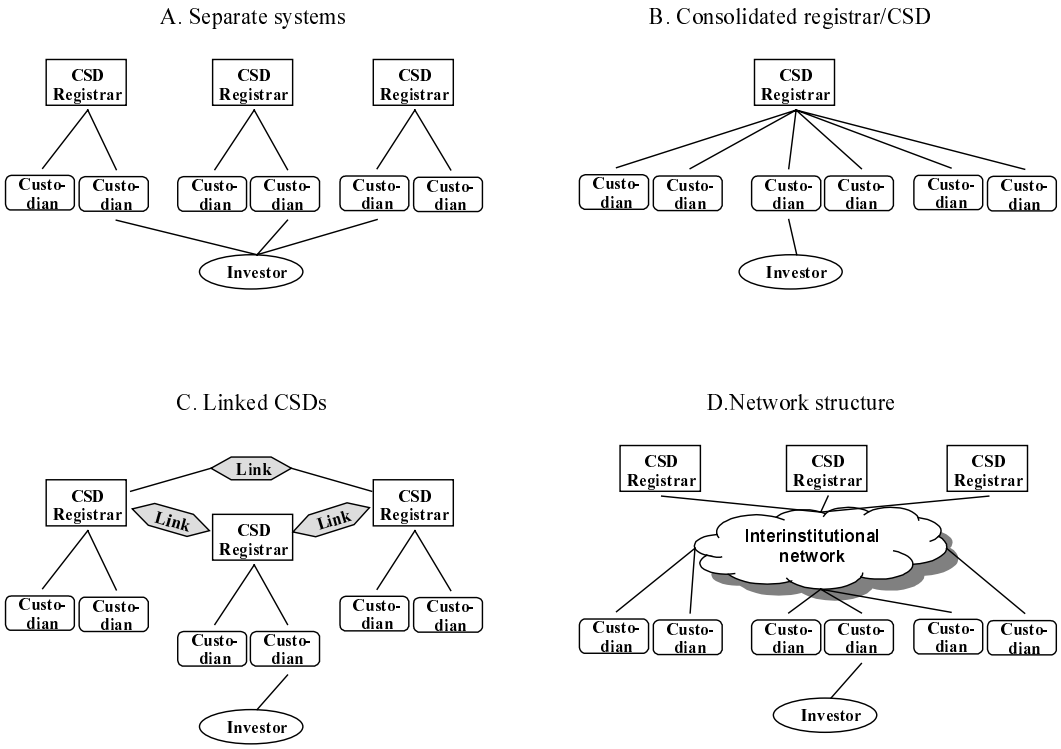
Originally securities markets where mostly national. There were restrictions on investing and issueing on foreign markets. (Most countries have abolished these restrictions, but some still remains, eg the CSD for equity issues is often required to be the national CSD.) National markets built their automated systems using national standards. This has led to a situation of non-interoperable accounting/system trees. Securities that are issued in one system have generally to be processed and kept in custody in that system. In order to overcome this restriction different kinds of links have been established whereby securities can be transferred from one tree to another. ICSDs have built this kind of possibility in order to serve the international investor community.

There are four general options or models available for investors to access securities in foreign accounting/system trees

- separate systems, ie different custodians for different accounting/system trees (figure 3A)
- consolidated CSD, ie same custodian when the issuing and central register tasks have been consolidated to one global registrar/CSD, which would mean that there is only one accounting tree (figure 3B)
- linked CDSs, ie same custodian because there are inter-system links on the registrar/CSD-level, which support transfers of securities between accounting/system trees ie the same securities can be held in different trees (figure 3C)
- network structure, ie same custodian which accesses relevant accounting/system trees through standardised interfaces in a network environment, the accounting trees will overlap at the custodian level (figure 3D).

The different interoperability/'width' models for securities' accounts kept in a two-layer structure are depicted in figure 3 (settlement and trading systems/methods are described in the following sections). In a one-layer structure the custodians would be replaced by agents acting as an interface channel to the one-layer CSD system, when the CSD is not itself providing an end-customer interface.

Figure 3. **The different interoperability/'width' models in a two-layered institutional structure**



Separate systems. Requiring the investors to open accounts with custodians in the different interesting markets/system trees complicates the situation for the investors. They will have problems in moving the liquidity from one system to the other. There is no interoperability in the system. If the different systems use common standards the situation will become more convenient for the investor, but he has still do business with a number of custodians. Separated systems are clearly separating the market according to CSDs. Legally this model is simpler because every system follows its national jurisdiction.

Consolidated CSD. Consolidating the registrar/CSD tasks to one global institution would technically be a possible solution, but probably politically impossible. It would also reduce the competition in the market, because the sole registrar would have a monopoly. The similar monopoly situations that have existed at the national level have generally been operated as public sector or non-profit making mutual organisations. There is a risk that the current European consolidation trend will result in a private monopoly/duopoly that will be difficult to control. It will be politically difficult to determine the 'home country' for the consolidated CSD. It would need a 'home jurisdiction', which would govern the legal basis of the system.

Linked CSDs. There are currently different types of links between different systems. Two CSDs can have direct links between each other, through which some of the securities issued in one system can be transferred to the other system. The custodians in the other system will then be able to keep the transferred securities in custody and process them. Interoperability has been attained by making links from the main CSD to sub-CSDs. There are considerable restrictions of interoperability in this link-based model, because any transfers between the system trees involved has to be made via the main CSD and sub CSD, two different settlement and custodian systems. Therefore these links are generally FOP transfer based, through which securities are transferred for trading and settlement into the other system. Using links in a real-time t+0 environment for DVP-settlement would increase the number of intermediaries and the process would be more difficult to control. This means in practice that in a real-time model these accounting/system trees would process the given parts of each issued security separately and FOP transfers would be used, as currently, for transferring the securities to the right system. In fact this model is also increasing the depth dimension by adding the sub-CSD between the original issuing CSD and the end-investor. This model generally splits the market into sub-markets. The result can even be market domination, due to the network effects. Investors would prefer the larger CSDs that thereby attract more securities and grow into a de facto monopoly or oligopoly. In order to serve their customers the custodians have to connect to many CSDs using different interfaces if these are not standardised. The investor also has to decide in which accounting tree/CSD environment to keep the securities to have the best trading possibilities. This may result in frequent FOP-transfers between different systems to reach the right market. The inter-CSD links in this model need to be technical efficient and legally strong. These links need to be strongly supervised in order to ensure that the issued volume of securities will match what is in circulation. There must also be clear rules for compensation if one of the sub-CSDs or sub accounting/system trees creates a mismatch generating losses. In order to function technically in a real-time environment, common international message and processing standards are needed between the issuing main CSD and sub-CSDs. The legal structure could in this case follow the national jurisdictions, with extensions to incorporate international links.

Today some of the issued securities can be transferred from one accounting/system tree to another via different kinds of indirect links eg global and local custodians. The transfer is indirect between the systems and involves custodians in one or both systems, but often without direct CSD involvement. Legally these kinds of links are generally weaker than direct links. They are also more difficult to supervise and control. The main CSD has less control over the situation in the other accounting/system trees. Consolidating the total volume of securities in circulation is not possible. The responsibility in possible over-issue situations will be difficult to solve. In technical terms the use of indirect links will

increase the number of intermediaries. To maintain these links in real-time will be very difficult already for DVP-transfer transactions but especially for corporate action type of processes.

Network structure. Today an embryo for a full network structure can be seen in situations where custodians have remote access relations with foreign CSDs. However, these relationships are still clearly seen as domestic and foreign. The standards for (remote) access to registrars/CSDs are not standardised and the foreign custodians have to adapt to the standards of each CSD. In an efficient network structure each registrar/CSD would comply to international standards and the custodians would find it easy to open connections to new registrars. There would be few or no differences compared to accessing the domestic CSD. Instead of having registrar/CSD omnibus-accounts with only one registrar the custodians would keep omnibus-accounts with those registrars that issue securities that the customers of the custodian find interesting investment objects. Technically this model would be the easiest of the four alternatives to establish in a real-time environment using current modern telecommunication offerings. Each registrar/CSD would have a somewhat larger but still manageable number of custodians. In the same way the custodians would have relationships with a number of registrars/CSDs, but the standards and conventions would be identical. Only the individual securities processed with the different CSDs would vary. (In the link approach the custodian has omnibus accounts for the chosen securities with one intermediary CSD. While in the network approach the same omnibus accounts would be directly with the issuing CSDs). This model would stretch over a number of jurisdictions. These should have extensions to cover the situation with foreign/remote custodians and investors. This model creates a network of overlapping and competing accounting/system trees.

Current market developments seem to maintain and develop all of these alternatives. Investors open relationships with foreign custodians. CSDs do consolidate rapidly especially in Europe. Different kinds of links are established in growing numbers between different CSDs. Custodians also increasingly open remote access interfaces to foreign CSDs. It cannot be efficient in the long run to maintain four different solutions for the same problem. It would be efficient to move to one preferred solution.

The network structure is the most open structure of these alternatives. It supports competition both among registrars/CSDs and custodians. It is also a technically the most efficient alternative in a large network when it is implemented using modern communication technology.

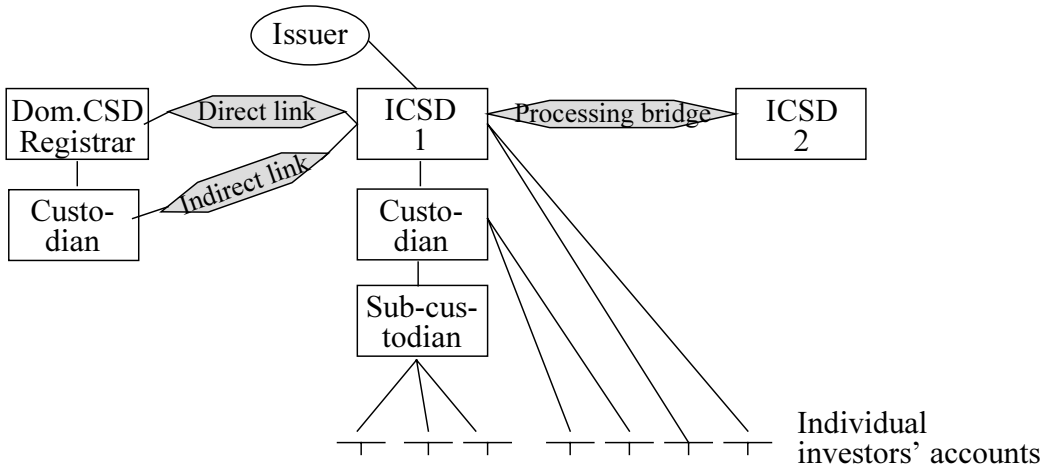
5.5 The current international and ICSD structure

The European ICSDs (International CSDs ie Euroclear and Clearstream) have been a market response in order to support international financial markets. Securities have been transferred and issued in an 'international' accounting tree in order to permit international investors to trade and settle. The ICSDs have limited the securities they support to the most important in the global wholesale market and to interest bearing instruments. The ICSDs have used different methods to accomplish this, which means that their structures do not follow the pure CSD-custodian structure described earlier. Using the terminology of this chapter the situation can be described as follows. One of the ICSDs is functioning, at least partly, with a banking license and not a CSD license. The ICSDs are partly using a one-layer structure and partly a two-layer structure or even more layers. They are thereby offering direct investor custody services in competition with the custodians in their system. The ICSDs are partly functioning as main CSDs for international bond issues and partly as sub-CSDs for other CSDs. They employ the link-model to transfer securities between different systems. Some of these links are based on direct links and some are based on indirect links. Consolidation of national systems into the original ICSDs has brought about a new network-type of structure between some national CSDs and the ICSD. A limited network can also be seen between the two European ICSDs. Thus there is no pure structural model in use by the ICSDs, but different models are used in an overlapping fashion. See figure 4.

The basic ICSD systems are batch based and run in deferred mode. However, currently the ICSDs are planning or starting up real-time t+0 services within the ICSD. These services will initially support the separate system approach in a one-layer system, ie accounts within the same ICSD and the first services are FOP-transfers and securities lending. DVP-services are in the pipeline.

The ICSDs are using largely commercial money for settlement of the money leg. This has often been the only solution because few international participants have access to central bank money in all settlement currencies. Settlement in different currencies will also make settlement more complex. These issues are discussed further in the chapter on liquidity issues.

Figure 4. **The current ICSD structure**



The global financial market will also need efficient international bridges among all main markets: the European, the Japanese and the US as well as other markets. Currently securities are moved between these markets by global custodians using for example depository certificates. This is making foreign securities available in new markets, but it is still maintaining market segregation. Settlement can generally only be made for those securities that have been transferred to that market. In order to establish an open international market legal and technical harmonisation are needed between the markets. Existing bridges need also to be enlarged to cope with increasing volumes efficiently. Also equity-based instruments need to be supported and the corporate action processes need to be automated eg the use of deposit certificates is a strong barrier for STP in corporate actions. This will require a well-defined international structure.

The ICSDs have used existing possibilities to bring international services to the market. In the next phase a more structured approach is needed, which brings together domestic and cross-border securities services to one common service approach.

6 Simplifying settlement processing

The transfers of book-entry securities resemble normal payment transfers. Values are moved from one account to another account. The accounts between which transfers are made must be holding the same type of securities or currency. The money account structure is generally a two-level structure. Customers have accounts with banks and banks have accounts with a settlement bank (generally the central bank) for interbank settlement. Intrabank payments are just booked between the accounts in the bank in question, while interbank transfers require net or gross bookings also at the settlement bank level. In a two-layer securities processing environment the situation is the same. Intracustodian transfers involve only that given custodian, while intercustodian transfers require registrar/CSD involvement and updating of omnibus-accounts. (In a one-layer approach there would not by definition be any intercustodian transfers, because everything is contained in the same system and agents input transactions.)

Efficient implementation of IBAN (International Bank Account Number), ICAN (International Custody Account Number), ISIN (International Securities Identification Number) and DVPC (Delivery Versus Payment Code) is the prerequisite for process automation. In order to support interoperability each accounting/system tree should use the same standardised identifiers.

DVP (delivery versus payment) is more common in securities processing than PVP (payment versus payment) is in pure payments processing. Payments are generally only made as one-legged credit transfers between two accounts, which resemble FOP (free of payment) transfers of securities. The need for DVD (delivery versus delivery) will probably also increase over time as a method to collateralise loans of securities. The DVP, PVP and DVD transfers require that the two legs of the transfers are synchronised and dependent on each other.

Intercustodian FOP transfers involve in a two-layer model three parties ie sending custodian, receiving custodian and the registrar. DVP/DVD transfers will involve three to six parties depending on whether the pair of customer accounts are kept with the same custodians/banks and whether the registrar is the same for the two types of assets. DVD transfers will require involvement of two registrars if the securities in question belong to different accounting/system trees. DVP transactions involve one registrar and one central bank if central bank money is required for intercustodian settlement. The situation will be much simplified if customers are required to keep both sending and receiving accounts (ie the money and securities accounts) with the same custodian/bank. However, this will require the custodians to have a banking license (or similar license) in order to provide deposit accounts for the payment legs. This would generally reduce the number of involved parties to four or three for DVP-transfers.

Real-time t+0 processing would be transaction based. Any kind of batching would delay processing. It would also complicate DVP/DVD processing, because instead of just dependent pair of transactions, batches would be dependent on all the individual DVP/DVD-pairs in the batch. Real-time transaction-based processing will reduce the need for netting and clearing functions found in the current settlement systems. In a real-time t+0 systems all transactions are booked gross and immediately. The intercustodian transfers are just booked directly for each transaction on the omnibus accounts with the registrar.

The liquidity demand in real-time t+0 systems will be discussed in chapter eight, but it is perhaps good to point out now that investors need to have the assets available at the accounts when the settlement process starts. Settlement will be delayed/queued if the investor lacks the assets to be transferred. Investors can and should borrow missing assets, if they want to finalise the deal with immediate settlement. Custodians might borrow the assets, especially money, but then they will take a customer credit risk. These credit decisions and transfers should be seen as separate processes.

RTGS-processing is often deemed to be more liquidity consuming than net processing. This depends on how well incoming and outgoing transfers are in balance, because opposite real-time transactions will continuously offset each other. This issue will be analysed in chapter 8.

Real-time t+0 processing will require the facilities of the custodians, registrars/CSDs and central banks involved to be interoperable in real-time as well as the network between the parties. The real-time process consists of a process-to-process dialogue between these different systems. The intercustodian settlement process can be implemented through many different models. Main types are centralised, decentralised or mixed models.

Trading has been done in real-time for a long time, but settlement has been lagging behind (three to five days) mainly due to technical problems. One of the reasons for developing immediate settlement facilities is to bring trade and settlement into synchronisation. The deals can thereby be immediately made final. Trade interfaces will be discussed in the next chapter.

True real-time interfaces makes intersystem synchronisation easier and it is established on transaction level. Batch systems have the general problem that there is only a given number of settlement cycles available during the day. Therefore one system has always to be the last one for the day and therefore unable to make transfers to any other system.

6.1 Centralised intercustodian settlement

In the centralised inter-custodian approach each inter-custodian transfer is processed by the registrar/CSD. In the real-time environment there would not be a separate securities clearing and settlement system (SCSS) layer, because there would be nothing to clear and net. The settlement process would be a part of the omnibus-account system of the registrar/CSD. The core function is the updates made to these omnibus-accounts by each transaction.

In the centralised settlement system, intercustodian FOP transfers will consist of a transfer order from the sending custodian to the registrar/CSD, which will debit the sending custodian's omnibus account with the transferred amount of securities and credit the receiving custodian's omnibus account. After this the transfer order can be passed on the receiving custodian and a confirmation can be sent to the sending custodian. This will be a very straightforward process, when ICANs are properly implemented and standardised messages are used.

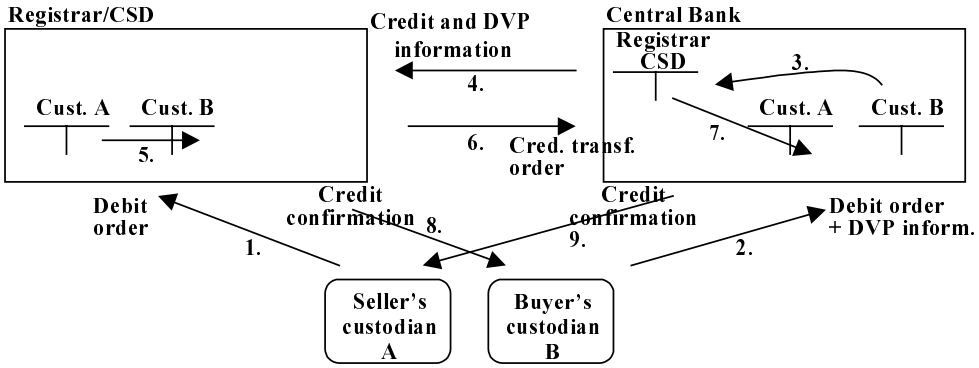
The DVP transfers need a connection to the central bank when settlement in central bank money is required. Central bank money is preferred in order to reduce interbank/intercustodian settlement and systemic risk. In what follows, the basic message flows are first described in a pure central bank settlement environment. The issues regarding multiple settlement banks and multi-currencies are discussed in the end of the chapter.

There are three different centralised central bank interface models available for DVP transfers

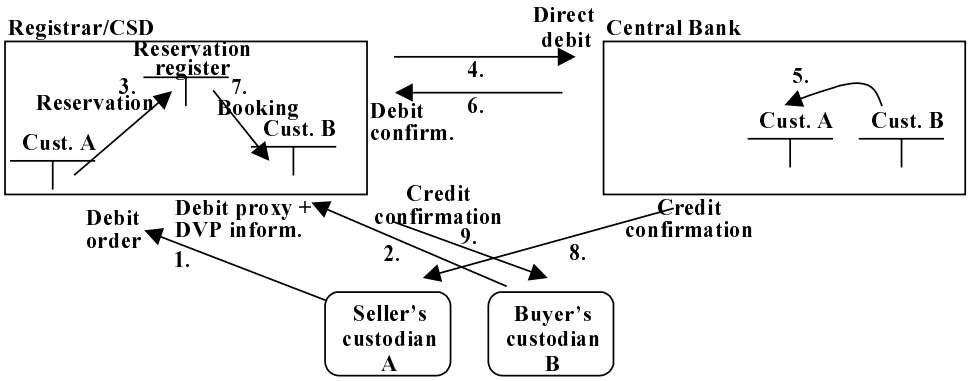
– credit transfer based
– direct debit based
– intraday central bank money account in the registrar system.

Figure 5. **Centralised settlement flows**

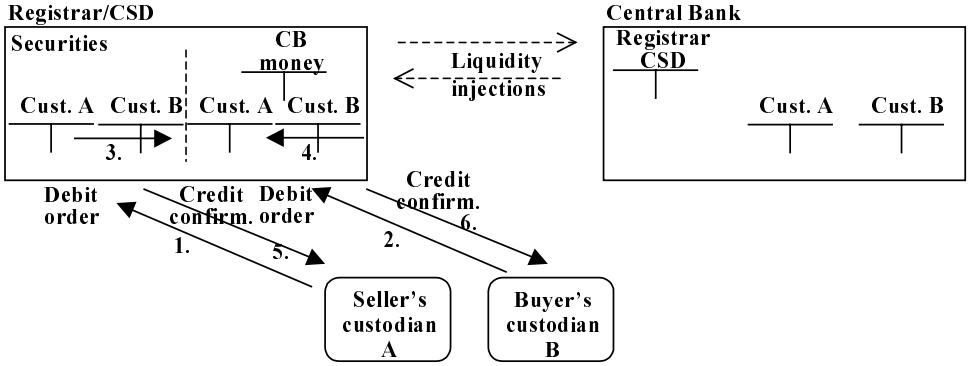
A. Transaction based credit transfer model



B. Transaction based direct debit model



C. Autonomous intraday central bank money model



In the credit transfer flow the seller's custodian initiates the DVP transfer by sending its order to the registrar/CSD, while the buyer's custodian is assumed to send its order to the central bank, which forwards it to the registrar/CSD after making the credit transfer to the CSD account. The CSD checks that the DVP requirement is fulfilled, by matching the orders (using the DVPC-identifier), it makes an internal securities transfer on the omnibus accounts and sends a credit transfer order to the central bank for crediting the seller's custodian's account.

The registrar sends a confirmation to the buyer's custodian and the central bank sends a confirmation to the seller's custodian for the whole transaction chain. This model requires six intersystem legs and three internal transfers. The central bank is required to pass forward the relevant information regarding the securities leg. See figure 5A.

In the direct debit flow the custodians send the transaction information to the registrar/CSD, which first makes an internal conditional reservation in order to secure the settlement of the securities leg. Then it sends a direct debit order to the central bank and has to receive a confirmation for it from the central bank. When the confirmation of successful direct debiting is received the registrar/CSD can book the reserved securities. The difference compared to the credit transfer model is that the buyer's custodian is sending a debit proxy to the custodian instead of a credit order to the central bank. The central bank just processes payment information and is not required to transfer securities' information. In order to reduce the possibility of mistakes and abuse of the direct debit proxies, encrypted proxies for each transaction could be used that verify to the central bank that the proxies have been originated by the buyer's custodian. These would be an encrypted field following the message from the buyer's custodian to the central bank. The number of intersystem messages is six and internal steps are three. See figure 5B.

In the intraday central bank money account alternative the custodians have a special intraday central bank money account with registrar/CSD. The registrar has the central bank money in custody during the day. It is only in custody in the same way as all the other assets in the registrar/CSD system eg book-entry central bank certificates. At the beginning of the day custodians makes a general money transfer in the central bank system to the registrar/CSD account in the central bank system. The sum will be available after that in the custody accounts for central bank money at the registrar. The registrar is responsible for controlling that the total amount of central bank money in the internal custody accounts matches what is available in total in the real central bank account. Custodians can import or export central bank money during the day according to their needs. At the end of the day the money on the registrar/CSD account is transferred back to the custodians central bank accounts according to the end-of-day status at the internal custody accounts in the registrar/CSD system. This model makes transaction based processing necessary only in the registrar/CSD system and the central bank interface is just needed for intraday money injections and repayments. The central bank money accounts used in the transaction process will be internal in the registrar/CSD system. This model has therefore also been called 'autonomous' use of central bank money. The transaction-based intersystem messages are four in this model and there are only two internal transfers See figure 5C.

However, it should be mentioned that there are conflicting opinions whether this autonomous model could be defined as using central bank money. It has also been considered to be a secure form of commercial bank money because the custodian-level accounts are kept outside the central bank's internal accounting system. However, this model does not contain any bank risk for the CSD compared to the situation when it is based on purely private bank money. In the pure commercial money case the CSD would have accounts with a number of banks to which the payments for the money legs would be transferred for autonomous settlement within the CSD. The CSD would thereby have a bank risk as long as the commercial money is kept on the CSD account. The custodians would also face interbank/custodian risks.

The same models can also be used for DVP/DVD transfers between two different accounting/system trees and registrars. The number of transaction legs will then increase. Which of the two registrars/CSDs involved, is the one controlling the DVP/DVD-process should also be determined.

Other models are also possible, but these will just add some extra legs and controls. For instance in the credit transfer models the buyer's custodian could also send an initiating message to the registrar/CSD in order to avoid the need for the central banks to transport the necessary securities information. However, this would make it necessary for the registrar to process and match three messages for the DVP-process and the credit transfer would need to have some identifier in order to connect it to the other messages.

Today different centralised models are in use. If centralised models were preferred then harmonisation would make current systems more efficient. The custodians interface would, in that case, be the same in all CSD systems and with all central banks.

A comparison between the credit transfer and direct debit models shows that the models are equally efficient, when the number of transfer messages and processing stages is calculated. However, the credit transfer model requires the central bank to pass the DVP and securities information from the buyer's custodian to the registrar/CSD system. If the interface to the central bank is to be a pure payment linkage, then the direct debit model is suitable. The direct debit model could become more interesting if the number of DVD transfers increases, because then DVD and DVP transactions would be initiated in the same way ie. directly to the registrar/CSD, which would be more convenient for custodians. In the credit transfer model the buyer's custodian may have a better control over the liquidity situation, because it is sending a credit transfer to the central bank instead of being dependent on direct debits initiated via the registrar. The liquidity demand will be the same in both models, when the process is rapid, because the central bank money will only be booked on the CSD account momentarily.

A comparison of the autonomous intraday central bank money model with the other models shows that this model is clearly more efficient when the number of

transfer messages and processing stages is calculated. It involves just one centralised system in the transaction based processing, which decreases the real-time processing requirements on the central bank system. However, it will split custodians' liquidity into different pools, which increases the liquidity management work and can lead to frequent intraday liquidity transfers between the systems. The number of liquidity pools will be dependent on the number of registrars/CSDs using the autonomous CB money approach. This is not a barrier when liquidity and collateral is sufficiently available. From the custodian's point of view the autonomous model is more convenient for securities transfers because the whole process requires only transaction level interfaces with the registrars/CSDs. DVD and DVP transactions would also be processed using identical methods. In general in real-time transaction based systems it is important to reduce the number of participants, messages and processing stages, which makes the autonomous model technically more suitable than the other centralised models. However, legal and supervisory means are needed to protect the central bank money that has been transferred to custody of the registrar against potential risks due to its position in the registrar custody.

The models described assume that the custodians have both the securities and central bank money available separately. One possibility would be that the buyer's custodian would use the customer's securities to be received as collateral to receive additional central bank liquidity. It would complicate the process by conditional credit inquiry and collateral pledging. The credit extended would not completely cover the money settlement needed due to the central banks' haircut requirements. It is also only the securities with good credit ratings that are accepted as central bank collateral. If customers' securities are given as collateral for custodians' (central bank) credits, then the customers' will face additional bank risks. See further analyses in the chapter 8 on liquidity and risk issues.

6.2 Decentralised intercustodian settlement

In decentralised intercustodian settlement systems the transaction based processing is distributed to the custodian level. The custodian systems interact directly with each other in an inter-custodian settlement dialogue. The centralised entities have a controlling function, but are not involved in processing individual securities transfers. This would simplify the settlement process compared to the centralised alternatives. It would especially make transaction processing more efficient, because this is conveyed directly between the custodians involved. The main bulk of messages will flow directly between custodians. A network will be required for transporting inter-institutional messages.

Each custodian will have a secured distributed settlment module that is keeping track of the total amount of assets distributed into its custody ie the balances of the omnibus accounts. This module is a distributed part of the registrar's/CSD's omnibus account system and the central bank's RTGS account system. This secured module contains the basic account information needed for intercustodian transfers. The custodians are also keeping accounts themselves for the total volume of assets in their custody. These secured modules have to be seen as an additional measure to ensure that the omnibus accounts are correct and synchronised. They have to be well secured so that nobody is able to tamper with the content. When assets are transferred from one custodian to another transfer messages will include encrypted electronic stamps containing the values to be transferred, which can only be decrypted and confirmed by the receiving custodian's secured module. This decentralised settlement model has been called e-settlement[12]. This settlement model is currently in prototype phase. The basic idea of the settlement model is to support efficient settlement in a decentralised real-time network ie the expanding Internet type of networking.

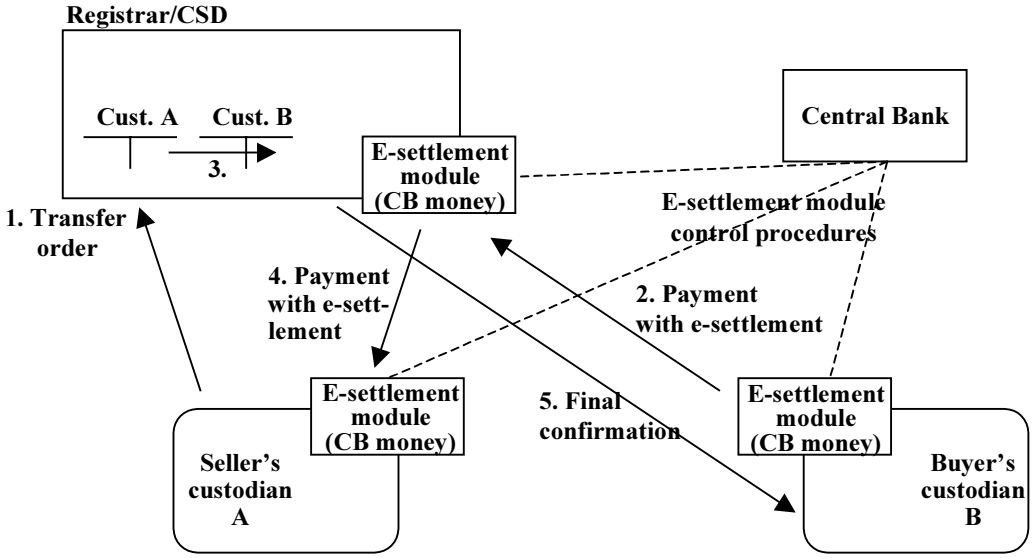
It may be helpful to visualise these distributed settlement modules, which are server-type computers, as automated central bank branches, keeping the central bank settlement account of the custodian/bank. It attaches a digital encrypted central bank draft as the cover transfer for each payment sent to another module (automated central bank branch). In the same way the omnibus-accounts can be visualised as being kept by decentralised automated branches of the registrar/CSD. A more thorough description can be found in appendix 3.

Decentralised settlement in securities processing can be used for all assets (complete decentralisation) or just for the payment legs (central bank money decentralisation). These alternatives are depicted in figure 6.

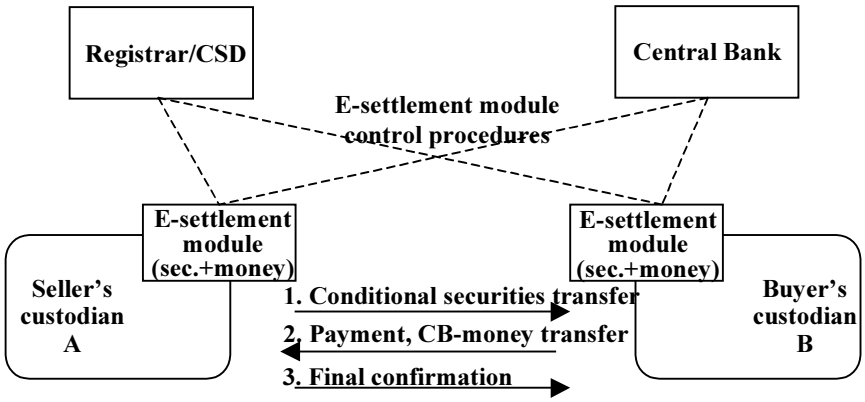
[12] Leinonen – Lumiala – Sarlin (2002).

Figure 6. **Decentralised settlement flows**

A. Centralised securities transfer with decentralised central bank money



B. Completely decentralised model



In the model with centralised securities transfer and decentralised central bank money settlement, the registrar/CSD will have an e-settlement module along with all custodians. All payment legs are made as transfers between the e-settlement modules containing the decentralised settlement balances of central bank money for each custodian and registrar. The registrar receives a DVP transfer order from the seller's custodian and a matching payment to the e-settlement module/balance from the buyer's custodian. The securities' omnibus accounts will be updated after which the payment will be made using e-settlement from the registrar's module to the seller's custodian's e-settlement module. A confirmation on the securities transfer is sent to the buyer's custodian. The registrar has the central bank money in custody in its e-settlement module just for the short time period need to establish the DVP transfer. This payment model is comparable with the

centralised credit transfer model, the only difference is that the central bank accounts are decentralised to 'automated branches' instead of being kept centralised in the central bank. (Figure 6A)

In the completely decentralised model both the securities and central bank money is in e-settlement format. A DVP transaction is initiated by transferring the securities with an e-settlement stamp from the seller's custodian to the buyer's custodian using the e-settlement modules containing the omnibus-accounts and central bank account. After receiving the initial transfer the e-settlement module of the buyer's custodian produces a combined e-settlement stamp for the payment transfer and the confirmation of the received conditional securities transfer and sends the payment message to the seller's custodian. The e-settlement module of the seller's custodian can now book the transfers as final and sends a final confirmation to the buyer's custodian, where the pending transactions can be booked as final. In order to reduce custodians' customer risk customer accounts should be debited before intercustodian transfers are made and customers' accounts should be credited only after the intercustodian transfers are final. (Figure 6B)

Decentralisation of the settlement process is simplifying the real-time message dialogues. In the complete decentralisation model only three messages and two sites are involved in the transaction level processing. The e-settlement modules are tightly integrated into the securities settlement systems and network access platforms used by the custodians.

In the model using only decentralisation of central bank money, four messages and three sites are needed. The interesting benefit of this model is that it solves the liquidity splitting problem of the autonomous centralised model. The liquidity will be transferred to the registrar/CSD just for the DVP control and after that returned to the custodians in the same way as in the centralised credit transfer model. It is legally a credit transfer model of central bank money, although the automated central bank branch will be situated in the IT premises of the registrars and custodians. Any settlement money received by the custodians can directly and freely be transferred as part of another transaction to any other registrar/CSD or bank. Decentralisation of central bank money thereby supports competitive registrars/CSDs without putting a strain on the liquidity resources.

6.3 Multiple settlement banks and multi-currency issues

Real-time gross settlement, independent whether immediate or deferred to future days, will require that the real-time accounts of the participants are with the same settlement bank or within the same system of settlement banks eg TARGET type of network of central banks. The registrar/CSD responsible for the DVP process must be able to transfer the settlement amount between the custodians' settlement money accounts. Central banks have invested in real-time based systems ie RTGS, but these seldom provide international interfaces. There are some private real-time interbank-systems (eg Euro1), but generally private international payment systems are slow.

TARGET is a good example of central banks providing a network, which could be used for intercustodian settlement. In principle the custodians and registrars could have accounts with any of the Eurosystem central banks and the settlement amount could be transferred to the central bank account in any of the other central banks in the system. However, there are currently technical and political limitations, which hinder practical implementation. Regarding the credit transfer model, central banks are using different user interfaces and are not generally providing standardised facilities for transporting information on securities as part of the payment messages. Custodians need to transmit this information separately, directly to the registrar/CSD. Direct debit models are used domestically by some central banks in the TARGET system, but there are no standardised solutions and especially not between central banks. Neither are there any encrypted proxies following the direct debit messages that would ensure the central bank that the individual debits made by the registrars/CSDs are accepted by the participants. The autonomous model of central bank money is used in some countries. This model would be easy to implement already today, because the requirements on central bank services in order to make settlement transfers are very low. The services needed in central banks are already in place. However, this model has not got general acceptance as qualified central bank settlement money. The decentralised models are yet just prototypes and lack general acceptance. There are also political barriers due to different participant policies. Registrars and CSDs, especially ICSDs, are granting access for foreign participants, while central banks generally grant only access for participants having a domestic license (or EU/EEA-wide in the EU/EEA-area). International investment markets will require cross-region services as ICSDs have clearly recognised. As long as central banks are limiting the access of foreign custodians to central bank systems, ICSDs and foreign custodians are constrained to use commercial settlement banks in order to support international settlements.

International settlement using commercial settlement banks will encounter the same practical problems as in the case of central bank settlement. If only one bank

is used as a settlement bank then all participants of the securities settlement system have to have accounts with that specific bank. If there are many settlement banks in the system, then there has to be some kind of network and inter settlement bank transfer mechanism for transferring money between the different settlement banks and accounts. Private settlement banks are more risky than central banks. One way to reduce the risk has been to establish 'narrow' banks[13] with low risk profiles and specialised in inter-bank clearing/settlement. The ICSDs have partly combined these options by becoming settlement banks themselves. It could also be seen as an autonomous use of private settlement money. Custodians have money accounts with the ICSDs and the ICSDs are acknowledging some international banks as account banks through, which money can be transferred to the internal settlement money accounts. The ICSDs need then to be able to move money between the external accounts, when somebody wants to withdraw money from an internal account via an external account (route), which lacks sufficient funds. The same kind of constructions can also be found at the domestic level in countries where the CSD/settlement mechanism is using private money. The use of credit transfer or direct debit based solutions seems to be rare for private money. One reason is probably the lack of real-time based interbank solutions. These are currently not available on the international level and international payments are very slow, which makes the autonomous model the only one available for DVP in private money. International real-time interbank credit transfers and direct debits are the basic requirements if these models are to be used for securities settlements.

The international multi-currency environment adds one more dimension. The same securities can be traded in many currencies other than the original issuance currency. The deals have to be struck in one given currency, which is generally determined by the exchange. The settlement mechanisms should preferably be able to cope with many currencies. Investors would then have the freedom to choose exchanges without currency barriers. The custodians would make the necessary currency transformations and deals based on investors' orders. When the deal has been struck in a given currency the buyer's custodian has to deliver that currency. The number of currencies supported by given custodians and registrars is a service level question. Custodians and registrars supporting a wide range of currencies would probably attract more investors and issuers. In order to promote efficiency the technical interface standards in the different currency areas should be standardised.

[13] Narrow banks are legally defined in some jurisdictions, while in others it is just a market convention. Narrow banks are mainly maintaining deposits or clearing accounts with positive balances. They are strongly limiting their credits to none or against very safe collateral. Generally the deposits and clearing balances are covered by liquid funds on central bank accounts or other safe and liquid investments.

In order to support real-time settlement in central bank money central banks need to improve and standardise their services and grant access for international custodians and registrars/CSDs. Commercial systems need to improve service speed and standards. Global standards would also facilitate efficient multi-currency settlement. In order to be efficient the intercustodian/bank money settlement alternatives need to be streamlined and reduced to a very low number of parallel options.

6.4 Choices related to system dimensions

At present the securities settlement and processing systems are mostly specialised according to market segments. Shares and interest instruments are processed in different systems. Blue chip and other high liquidity papers have their own systems. Special systems eg ICSDs service international markets, while most domestic markets have their own systems. Wholesale and large value items are often processed separately from retail transactions. In some environments central banks and/or other public service providers have a central role in securities processing, both the payment and securities legs, while in other environments the systems are based on private ownership.

When restructuring the settlement processing the following choices therefore have to be made

– instrument type based versus combined processing of all instruments
– separation of wholesale and retail processing versus combined processing
– private versus public systems
– international versus national processing.

When combined processing of all instruments is the objective then special attention has to be paid to the additional features required for equity instruments. It should be noted that in a standardised real-time environment it will be easier to provide these services together in the same system(s).

Retail processing will require a focus on efficiency for mass volumes. An efficient retail capable system will lower the transaction costs for all kinds of transactions. Decentralisation is especially efficient in retail processing.

There seems to be a trend towards decreased public involvement in securities processing. On the other hand, the preference for using central bank money as settlement money especially in systemically important systems has lately been emphasised. The market seems to search for the right balance in this area.

The legacy systems are mostly developed for national processing. Should the division into national and international systems be maintained or should all

national systems start to develop international communication features? It is difficult to find good arguments for maintaining purely domestic systems in an increasingly international business-area.

The international common future for all investor types seems obvious. It can be compared to the international flight ticketing system that has developed over the years, which is able to service all customers independent of location, size, passenger type, carrier, plane type etc. The new securities settlement processing systems need to be designed to promote a development towards a general and common international settlement process.

7 Trading platform interfaces

Before the settlement /transfer of assets occurs, some kind of trade deal has been agreed. In order to reach straight-through-processing the interfaces between trading platforms and settlement systems must be automated and standardised. In a real-time environment, settlement would generally occur immediately after the agreement. The benefit of improved settlement speed will be that investors' ownership portfolios will continuously show the situation after the most recent deals made. There would generally not be a book of confirmed but unsettled deals reaching over a number of days, although sometimes there could be delays of some minutes between trade and settlement finality. Errors and non-deliveries would be detected immediately and corrective actions could be made at once. The immediate settlement will probably have fundamental effects on trading conventions. Automation will reduce the number of intermediaries and immediate settlement will change short selling patterns. This chapter analysis the need for developing automated interfaces between trading and settlement systems and how immediate settlement will affect trading conventions.

7.1 Trading and exchange models

Deals can be made bilaterally, OTC over the counter and on different multilateral trading platforms ie different kind of exchanges. In the past decade a number of alternative trading systems (ATS) has emerged as an answer to investors' search for rapid and low cost trading systems.[14] The basic features of these new exchanges are network based automated interfaces for order input/routing, a trading engine for automated trade execution and automated post-trade output distribution. The trading engine can use different kind of mechanisms for executing the orders eg auction, cross-matching, dealer-driven, quote-driven algorithms. In a real-time environment the mechanisms will mostly execute trade on a continuous basis. However, the trading process could take some time, because at the desired prices demand and supply will not always match.

In a perfectly standardised world all types of trading platforms would use the same standardised and automated interfaces for receiving orders and for informing about agreed deals. From the settlement system point of view the trading systems can be divided into four different general trading models: bilateral direct trading, non-guaranteed exchanges, guaranteed exchanges and settling exchanges. This classification allows distinction according to the certainty of the deal and the order/trade information routing. These classifications should be seen as general

[14] Korhonen (2001).

covering all kind of traditional and modern exchange and auction based systems. The main alternatives can be described as follows:

a) Bilateral direct trading includes all sorts of direct contacts between two investors where they agree on a given deal. Most of the OTC trade would fall in this category. This can be done in a number of different ways also including different kinds of electronic buy/sell boards. There are no firm guarantees that the deals will be kept. Each customer will introduce the agreed transaction to the system via its custodian caring for the assets. When a DVP identifier match is found between the custodians involved the deal is processed. If no match can be found in a given time frame, the deal has to be checked and eventually cancelled. Bilateral trading therefore contains an amount of delivery risk, the amount of which depends on how well the counterparty is known. See figure 7A.

b) Non-guaranteed exchanges will get buy and sell orders from investors, asset managers, dealers, custodians etc. Once a deal is agreed the information with the right matching codes is transferred to the custodians. There are no controls to ensure that the investors have the assets available and there are therefore no guarantees that the deals will be kept. Also in this case, a no-delivery situation will lead to cancellation of the settlement instruction after a given time. Non-guaranteed exchanges therefore contain delivery risks. See figure 7B.

c) Guaranteed exchanges will get buy and sell orders via the custodians, which have got them from the investors or their representatives. The custodians have agreed to guarantee the orders executed in these exchanges. The custodians can use different methods to ensure that the investors are able to meet their obligations eg earmarking the assets on the accounts as reserved for guaranteed exchange trading or keeping assets for forced securities borrowing/lending. Orders will be sent to the guaranteed exchanges including a time limit for trading. If the orders have not been able to strike a deal within the given timeframe, they will be returned to the custodians and the earmark will be removed. Any deals reached will automatically be transferred to DVP transactions, which are using the exchange codes as DVP identifiers. Because of the earmarking and/or other guarantees rapid settlement is possible once the deal has been agreed. See figure 7C.

d) Settling exchanges will get buy and sell orders via the custodians with the assets digitally attached. The exchange can be seen as a temporary custodian for the assets. If no deals can be found in the given time frame the assets will be returned. If deals are struck then the exchange performs the DVP process, the assets change owners and are returned to the appropriate new custodians

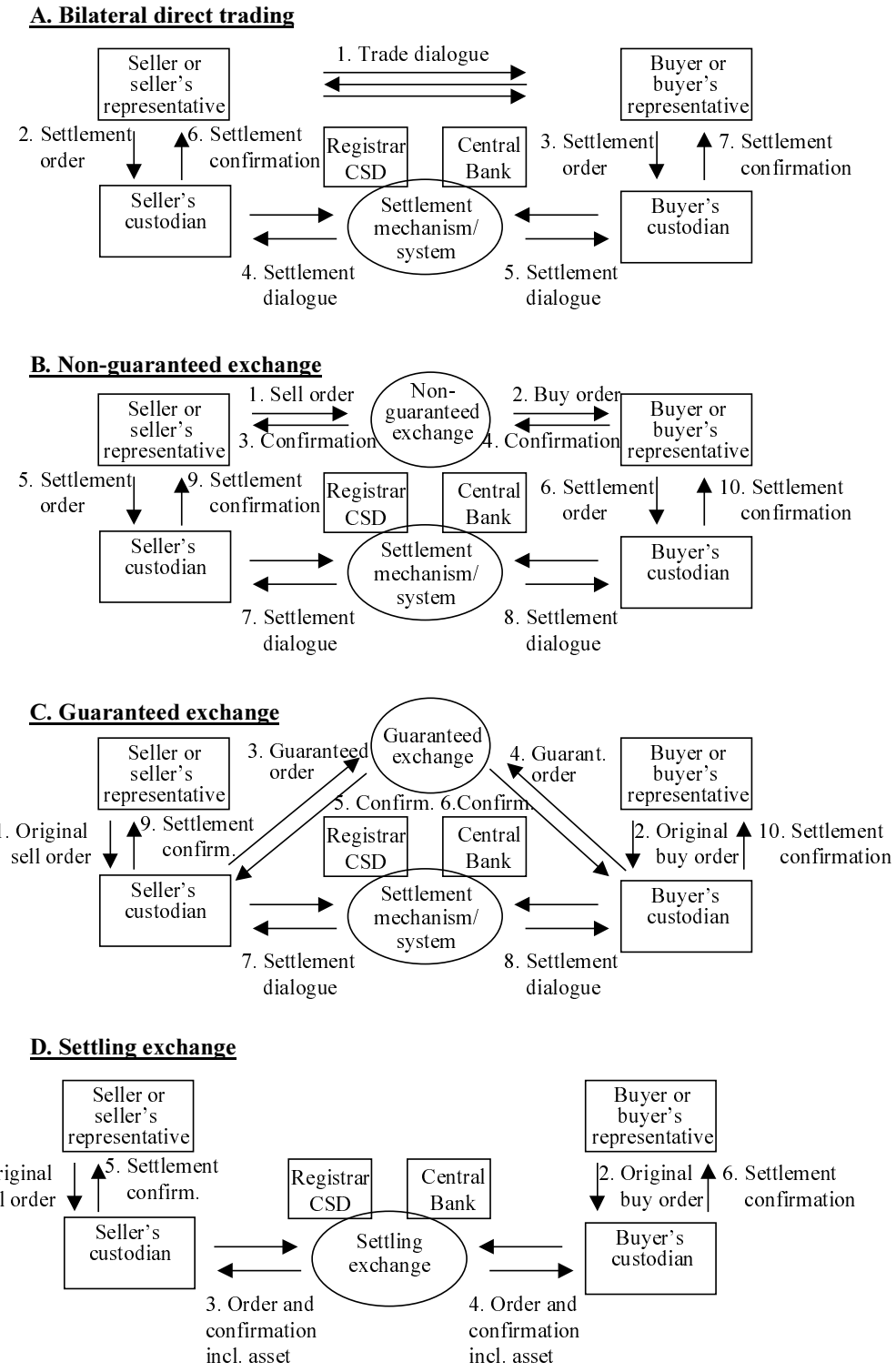
and booked on the investors' accounts. The exchange codes are used for identifying the proper custody accounts. Figure 7D.

The settlement mechanism is assumed to be one of those described in the previous chapter. Both centralised and decentralised approaches would be possible. In all models a decentralised structure will reduce the centralised processing requirements, the number of institutions involved and the messages between them. In a large real-time environment a decentralised solution would be technically more efficient due to the reduced number of connections.

In bilateral deals, non-guaranteed exchanges and guaranteed exchanges the trading process is separate from settlement and the interface to settlement systems is via the custodians. In the case of a settling exchange, the exchange itself takes part in the settlement process. In order to do so it has to have a settlement account relationship with the central bank(s) and omnibus-accounts with registrars/CSDs carrying the securities traded in the exchange.

The difference in the message flows between these models is which entity is presenting the orders to the exchange. However, the main differences in these trading models are the amount of delivery risk and the communication efficiency ie the straightforwardness of the process. Bilateral trade is efficient when investors know each other and interfaces are automated using ICANs, DVPC identifiers and standardised messages. The settling exchange will have an advantage in the straightforward process and secured delivery. The non-guaranteed and guaranteed exchanges conform more closely to the current exchange trade conventions, which means that these models could serve as an interim solution before moving completely to settling exchanges. In an open exchange and settlement structure all different models can operate in parallel. The market demand will eventually decide what type of exchanges will survive.

Figure 7. **Alternative real-time trade interfaces**



7.2 Impact on trading conventions

Moving to real-time immediate settlement processing will probably change investors' preferences regarding the way exchanges operate. Current exchanges can mostly be labelled as non-guaranteed or partly guaranteed exchanges. Settling exchanges are currently not available. In the current environment the institutional members in the exchanges are most often bound by the rules of the exchanges to ensure by some means that the investors can meet their obligations. Because settlement is done generally at t+3 or t+5 there is time to arrange for loans of securities etc to correct any shortages. Sometimes settlement is also postponed.

In a real-time t+0 settlement environment postponement will be clearly noted as a settlement failure leading in most cases to cancellation of the deal. Securities lending, only after the deal, is probably not a rapid enough solution. The shortage of assets will immediately be apparent and will delay the process. This will probably increase the demand for guaranteed and settling exchanges in which all orders can be settled at once. Bilateral trading will probably still be in general use, because there is trust between investors who continuously make deals with each other. Especially DVD type of swaps and security loans will probably be made mainly based on bilateral agreements.

In a real-time environment 'naked' short selling will probably not be popular, because it will lead to delayed settlement and eventually cancellation of deals. However, it will be possible in bilateral trade and free exchanges. Investors that wants to be sure of receiving the traded assets will probably prefer guaranteed or settling exchanges. A free exchange, where customers are frequently withdraw their obligation to settle, will probably be rapidly out of business. Investors that want to sell short therefore have to borrow the securities needed before trading them. These limitations on 'naked' short selling will reduce market risks and distortion.

Immediate settlement will reduce the possibility of putting the same securities for sale on two markets at the same time. The investor has to decide where to try to strike the deal and on which terms. If no matching buyer is found through that channel within a given timeframe, the investor can move the order to another market.

The most significant difference in trading will be that investors can only sell assets that they control (own themselves or have borrowed) and they can put the orders to only one market channel/exchange at a time.

7.3 SPOT versus future (t+3/t+5) markets

The immediate settlement will bring a true t+0 spot market. It may be that there will still be a demand for deferred settlement based on current t+3 and/or t+5 timetables. The real-time t+0 systems would easily be able to accommodate deferred settlements, which makes it possible to serve both spot and a short-term future markets in parallel. The spot markets would then provide a possibility for rectifying any lack of assets before the t+3/t+5 markets need to be settled.

The requirement on available assets could thereby be relaxed for the short term t+3/t+5 markets to be comparable with the requirements on long term futures markets. The clearing and matching routines could follow that of the general futures markets. However, the processes in the derivative and future markets would also benefit from introducing account addresses (ICANs), matching codes (DVPCs) and transaction identifiers (SATC) for automating the confirmation and clearing processes.

7.4 Impact on investors' and intermediaries' roles and tasks

Active investors will mainly use electronic interfaces with their custodians in future. Orders, confirmations, statement of accounts etc will all be electronic and easy to use in self-service, both for wholesale and retail investors. When the customer interfaces are standardised customers' portfolio programs also will support electronic interfaces to the custodians. Custodians will probably also provide added value services eg different asset management support through these interfaces. For a considerable part of the investors these will be sufficient services.

Some investors want to use specialised asset management services. There could be different types of proxies, which grant the asset managers varying rights to act on behalf of the customer. Some customers may want to give the asset managers complete control and responsibility for managing their portfolios while others are only seeking for advisory services. However, to ensure correct corporate action processes the ownership should be registered correctly.

Mutual and other type of asset funds as well as investment companies are particular types of investors. They are on the other hand large institutional investors having large portfolios in the system. At the same time they can also be issuers of securities to be registered in the system. However, technically they will have the same kind of custodian accounts as other investors and the same kind of issuer relationship as other issuers, when issuing securities. Most funds are generally only keeping the ownership registrations in their own books.

The general trend is that electronic interfaces reduce the role and tasks of intermediaries. Internet in particularly has increased customer direct bookings with hotels, communication operators, tour organisers etc for example. The role of travel agencies is diminishing. Customers can be directly in contact with original service providers. The same trend will most probably also be seen in the securities processing environment. The role of asset managers will thereby change more towards advisory services, when customers contact custodians directly. However, some customers will still use asset manager services as before, especially those, whose strategy has been to outsource portfolio management.

ATS (alternative trading systems) and ECN (electronic communication networks) are examples of the trend towards reducing the number of intermediaries. Standardised custodian-to-exchange interfaces will probably intensify this trend. The need for brokers and dealers will decrease when the exchanges are automated. There will be difficulties for intermediary brokers and dealers to show that they can bring added value upon the automated exchange process that would justify their costs.

For market makers immediate settlement will change their way of operation. Every deal should be settled at once, which means that they have to have funds and assets to back up their trade continuously. They will not be able to get free intraday credits on the spot market. The consequences of the change are difficult to forecast. The need for intraday funds will increase the costs for market making, but settlement certainty reduces risks. The need for market maker interventions could also decrease if the automated trade interfaces increase direct trading. On the t+3/t+5 market they could operate as traditionally, but it is difficult to predict how the markets will split over time between spot/t+0 and t+3/t+5 markets.

Although, there will most probably be extra change-over costs, the system automation and reduction of non-contributing intermediaries will in the long run benefit investors considerably.

8 Liquidity, credit, collateral and risk issues

The major change when going from the present securities settlement conventions to real-time t+0 is that a sufficient amount of liquidity must be available continuously. This will both simplify and complicate liquidity management. In a t+3 and t+5 environment one has to anticipate and calculate the results of traded but not settled trading days. This introduced uncertainty, but also a possibility of correcting the liquidity position before the settlement day. In a t+0 environment, settlement is only possible if the liquidity is available now. Liquidity management will focus on the current balances, which will be continuously stated by the system. The main difference for the custodians will be that they will always and continuously be able to settle the securities' legs, because the balances on the omnibus accounts will always match with the total sum of the individual investors' assets. In a t+0 real-time environment custodians' liquidity focus will be just on maintaining enough (central bank) money for the payment legs.

The day-level accounting was the only one practical in the paper-based and physical transportation environment. Although the systems have been IT based already for a while, the old legacy of day-level routines is predominant. The situation has changed step-by-step and in an incongruent way. Trading systems are mostly real-time based while the settling systems are still day-based. The pressure to change the clearing and settlement systems into the real-time environment as well will continuously increase. Technically this need not to be a significant change. However, politically and for market operations it means significant new business conventions and operational models in order to control the liquidity balance continuously.

8.1 Intraday liquidity

Currently liquidity is still mostly managed on an end-of-day basis or at least most intraday transactions are known in advance in RTGS and continuous net settlement systems (eg Euro1 and CLS). Most of the current major settlement transactions are determined one or two days ahead or even earlier. Securities settlement still operates dominantly on a t+3 or even t+5 basis. In a t+0 environment new transactions with a major liquidity impact could be decided during the day by customers/investors/depositors or by the banks/custodians themselves. The banks/custodians have to manage their liquidity position on a continuous basis.

An intraday liquidity market will probably emerge, which will be used to even out the liquidity movements during the day. On the other hand the intraday liquidity market could also increase the fluctuations especially in temporary crisis

situations. The intraday market will probably increase the transaction flows in securities settlement systems in the form of intraday repos, intraday securities loans, swaps etc. With an emerging intraday market an intraday interest rate will also probably arise and thereby an economic incentive for intraday trading, which in turn will increase the transaction volumes.

8.2 Liquidity demands on securities and money

The difference between money and securities can clearly been seen in liquidity and intraday credit requirements. Custodians cannot affect the quantity of securities. This has always to be the total sum of securities of their customers. In a real-time t+0 environment it will therefore always be possible for custodians to make the securities transfers in the intercustodian settlement system. Investors and custodians cannot be allowed to make transfers resulting in negative balances, because this would imply increase the amount of securities via unauthorised issuing. This implies also that transactions derived from 'naked' short selling bilaterally or through free exchanges cannot be accepted for settlement in a t+0 environment. Custodians can only start the settlement process when there are securities available and as a result custodians will not face liquidity shortage for securities' balances.

Regarding money deposits, banks have generally more customer deposits than available central bank funds, ie reserve requirements are well below 100%. Central bank money liquidity could become a problem when there are concurrent large outflows, eg the customers of a custodian are mainly on the buying side. The custodian can in most cases get more (central bank) money liquidity on the market from interested creditors/banks with a surplus of central bank funds or directly from the central bank. The ultimate solution will be that intercustodian payments and settlement transfers are queued and delayed whenever custodians lack settlement money liquidity. However, real-time liquidity problems should not be overemphasised. The real-time process will be continuously off-setting incoming and outgoing payments, custodians' settlement account balance will show a continuous net balance instead of a end-of-day balance. On markets where real-time t+3/t+5 settlement has previously occurred on gross-basis the process will just move from day t+3/t+5 to t+0. The effect on the balances will be the same, but just shifted some days earlier (given that the trade to settle would remain the same). Large investors especially are mostly just shifting their portfolio content so for every sell order there will be corresponding buy orders and vice verse and the liquidity effect will be very small. The trade will probably also become more even in an immediate t+0 environment because investors would not be able to take

'naked' short selling positions. Customers need to have both securities and money available on their accounts.

8.3 Intraday credit and collateral

Because the money liquidity must be sufficient continuously in real-time settlement, intraday credit will be needed to even out occasional variations by investors and custodians. Collateral will be needed to guarantee loans. The custodians/banks have to place some of their investment portfolio in assets that can be used for collateral purposes.

There is a major difference between money and securities that affects custodians' collateralisation possibilities. Customer deposits are kept on the balance sheets of banks while customer securities are only kept in custody and therefore outside the balance sheet of the custodian. In case of a bank/custodian bankruptcy the deposits would be at risk while the ownership of the securities would be unaffected. If this principle is followed the custodians cannot use customers' securities as collateral for central bank money or other types of intraday liquidity. This would endanger the ownership of the securities. In order for the custodian to use customers' assets for collateral purposes customer approvals are needed.

There are different legal variants on collateral. The main variants are pledge and repo based collateral. Technically the collateral rights need to be acknowledged somehow in the system. In the pledge model the collateralised securities would remain on the accounts of the original owner and pledged to the person/institution receiving the collateral. The original owner is just transferring the collateral rights, which means that the pledged securities cannot be used by anybody for trading as long as they are pledged (if not replaced with other securities). However, they will stay on the books of the original owner and all other rights eg related to corporate action will be in force. This will require features in custodian systems to establish, remove and maintain pledges according to the legal requirements. In the repo model the collateralised securities are generally transferred with all rights to an account of the collateral receiving customer. If there were restrictions in the repo-based collateral convention on how the securities may be used, for instance in trading and how corporate actions are applied, these would need general guidelines and legal support at the international level as well as technical support. In the repo alternative, the transfers could take the form of DVP transactions combining the loan with the collateral.

In order to support real-time settlement processing central banks' intraday liquidity and collateral processes need to be rapid and automated. Central banks

will be the main source for intraday liquidity, when central bank money is used as settlement media.

8.4 Trading and intraday risks

Immediate settlement will reduce settlement risk considerably. There will not for instance be any possibilities for intervening bankruptcies between making and settling deals. Everyone will know their real-time positions. All loans, money or assets, will be recorded transparently and on a gross basis. There will not be any hidden credit positions in net settlement processes.

Market and re-trading risks will also be reduced with immediate settlement, because non-deliveries and cancellations will be detected immediately. The probability for large losses when deals have to be renegotiated will decrease, when non-deliveries are detected immediately and correcting deals can be made before there are significant changes on the market. The situation improves especially in systems currently accepting 'naked' short selling and where the situation will not be revealed until 4–5 days after trading. Some of the current systems may even contain significant amounts of systemic risk. If one participant is not able to meet its obligation it could also affect other participants. In a situation of general financial stress this could enlarge the stability problems due to contagion effects

In the real-time t+0 environment custodians will always be able to meet the securities transfer demand for intercustodian settlement, because they cannot start the settlement process without being able to debit customers' securities accounts. Custodians will also reduce their risks when they are thoroughly ensuring that customers have the assets and funds available right from the time when the customer orders are sent for processing in guaranteed exchanges.

8.5 The development of settlement systems and liquidity demand

The securities clearing and settlement systems seem to be undergoing a development from deferred end-of-day net settlement systems to deferred real-time systems and hybrid versions leading to deferred central counterparty settlement and resulting in true real-time t+0 settlement. These developments have been reactions on finding an improved balance between reducing risks and maximising the number of settled deals.

Deferred end-of-day net settlement was the traditional clearing and settlement convention for many decades. All traded transactions were netted per participant

and asset type by the end of the day. Each participant delivered and received the net difference. This arrangement was working quite well as long as everybody was able to match all transactions and deliver the net differences. This was generally the case as long as the volumes were low, the number of participants was limited and trading was confined to one auction type of instance during the day.

However, new solutions were needed with the increase of the turnover on markets from the 1980s onward and the longer trading hours. Trading became terminal based and continuous in many places. Short selling became frequent. The matching rules did not keep up with the developments. The result was that in the net settlement systems some important parts of the transaction flows could not be settled at the prescribed net-settlement occasion. The orders did not match or participants could not always deliver. The net settlement could not be performed on the total transaction flow, because the totals did not match with each other and with what the participants could deliver. The deferred mode of settlement gave some possibilities for borrowing missing assets before the actual settlement process, but all problem situations could not be avoided. The finality of the net settlement became endangered and systemic risk was imminent. The net settlement total had somehow to be rewound and unmatched transactions had to be discarded.

Deferred real-time gross settlement was introduced in the next step as the method to find out, which transactions could be settled and which had to be moved to the next day or completely discarded. The process was transferred to transaction level in order to settle deals with finality one by one. The actual settlement duration time period is also longer (often at least the business day) compared to instant-based end-of-day net-based systems. A RTGS process that continuous for a whole business day makes it possible for the participants to provide more assets during the day through intraday or long-term credits. However, pure gross settlement had difficulties in handling gridlock generated, for example, by short selling positions where different buy and sell transactions should be matched.

Deferred real-time hybrid systems were the next type of systems, which included different type of gridlock resolution methods. Groups of transactions can be settled using partial netting algorithms. Most of the current securities settlement systems seem to belong to this category. The hybrid RTGS systems have the gridlock resolution mechanisms limited by participants' security balances per type of securities. It can resolve most gridlock situations, but not clear delivery shortages, by for example automated lending.

Deferred central counterparty systems (CCP) seem to be the next proposed solution in order to cope with delivery shortages. The CCP will be the intermediary counterparty in all transactions. All transactions can be netted against the CCP. In most proposals the CCP could provide credits in different

assets against collateral or out of pre-deposited buffer funds. The CCP structure is thereby able to settle a large part of those transactions that a deferred RTGS system would discard. The CCP can exchange asset shortages against surpluses or force credit from available funds to fill the shortages. However, the CCP will be facing settlement, credit and market risks for which it has to have sufficient reserve funds.

In a true immediate real-time t+0 settlement system trading and settlement are both real-time based during the trading day. The problem caused by 'naked' short selling will disappear. The liquidity demands will focus on money assets, because custodians will have sufficient securities available all the time. The custodians will go to the central bank or the market to find the money liquidity to fill possible shortages. The immediate real-time environment will not need CCP for the securities, but a functioning intraday market for settlement money. The liquidity demand will focus on money assets and central banks will be able to provide liquidity against top-rated collateral. The intraday market between custodians would probably also accept other collateral, but with a credit risk mark up. Netting money legs or other gridlock resolution algorithms would also be a technical possibility in real-time t+0 systems. Transactions of a custodian with liquidity problems would be queued and waiting for incoming payments or netting possibilities. However, it would delay settlement and would be directly visible to the investors. A custodian that has to delay its investors' transactions frequently due to liquidity problems would probably lose some of its customers. There is therefore a clear incentive for custodians to support a functioning intraday money market.

9 Corporate actions and similar processes

Corporate actions are an area with a number of events that would need good and standardised system support to achieve straight through processing. In a real-time environment it is especially important that the corporate actions are performed at the right moment for the right owner. To reach the right owner the registrar/CSD and custodians has to cooperate to distribute issuers' corporate actions to the present owners. Clear interfaces and responsibility divisions have to be drawn up. The tasks can be split in different ways and sometimes even alternative solutions could work in parallel eg dividends could be paid via the custodians to the investors or directly by the issuer's registrar/CSD to the investors by stating the right IBAN account number.

The basic requirement is that the custodians can provide an updated ownership listing from its files per a given moment. The registrar/CSD for a given security (ISIN) would 'broadcast' corporate action messages to those custodians that carry the security in question. For example if a list of current shareholders is needed, the registrar would send out with a given lead-time an inquiry stipulating for which moment the listing should be made. Each custodian having this security in custody would report the ownership per this moment, within some minutes after the moment. These listings giving the basic ownership data (name, address, customer type, bank account IBAN etc) can be forwarded by the registrars to the issuers for their use eg convene to general meetings, report distributions, offerings, dividend payments. This information should be standardised in all systems.

For all corporate actions there need to be a synchronisation method that secures that all custodians are undertaking the tasks and reports based on the same situation ie no duplications or omissions. In a 24/7-environment there are no clear calendar-based day-breaks, but the reporting/settlement breaks have to be made in real-time. Before performing any corporate action a synchronisation settlement break has to be made for that particular security (ISIN). This kind of global system need also to choose a given internal time standard that everyone will follow (eg GMT) in order to synchronise actions.

The interest bearing instruments have less corporate actions type of events than the equity instruments. However, the same methods/messages can be employed eg paying interest or dividends have much in common. For all kinds of payments, it is important that investors provide the bank account numbers (IBANs) to which these kind of payments should be forwarded and the custody numbers (ICANs) to which any changes in the securities ownership should be made. These kind of transactions can then be made directly to the investor's account by the registrar/CSDs or indirectly registrars/CSDs paying/transferring lump-sums to custodians based on their balances, which will be forwarded to the

investors by the custodian. All kind of payments, dividends, interest, capital repayments, compulsory redemptions should be made using account number standards. Stock distributions, eg bonus issues, compulsory conversions, rights issues, sub-divisions/splits, should be done using ICAN identifiers. Straight-through-processing becomes a reality when registrars can use directly IBANs and ICANs for these kind of transfers.

Processing models should be designed for the common corporate actions eg

– introductions
– new issues
– delistings and de-issues
– mergers, acquisitions and exchanges
– split-offs and spin-offs.

Corporate actions are a very complicated area. It would be important to get the most common actions streamlined and harmonised in order to support straight through processing. Corporate actions are currently probably the most inefficient part of securities processing. The many layers and non-harmonised conventions makes it difficult to ensure that the processes are made correctly particularly in special circumstances. The timing between different systems can already today be problematic when there are technical delays or other unplanned interventions.

Due to the direct access between the registrar/CSDs and custodians in a network-based systems, the corporate actions can be coordinated better and customers payments and securities transfers can be efficiently processed using proper account numbers ie IBANs and ICANs compared to current batch-based environments with many layers and synchronisation problems.

10 Intersystem competition and system governance

Intersystem competition and proper system governance seem to be the best way to ensure efficient system structures that have a built-in force for continuous development. In the rapidly changing environment the securities settlement infrastructure need to be continuously adapted to the new circumstances.

Centralised trading and settlement platforms carry significant economies of scale and network effects. The fixed costs of centralised investments and operations can be divided over a larger number of transactions. Platforms with a larger number of participants will attract other participants, because of the better possibilities for trading and settling. This has previously led to consolidation on the domestic level and currently it continues on the international level especially in the euro-area.[15]

In addition to the consolidation trend, a privatisation trend can be observed. Previously mainly government owned settlement systems has become completely or mostly privately owned and user association type of organisations has become limited or listed companies for example in the Nordic countires. Public good- and cooperation-based institutions have thereby changed to profit driven companies.

There seems currently to be a trend towards so called 'silo' structures where one exchange and CSD are tied together so that the securities kept in a CSD is mainly only traded on one exchange platform. This has often been done by enforcing restrictive standards, rules, technical barriers and/or access criteria.

The result of these trends has been that an increasing part of the securities trading, clearing and settlement systems are in monopolistic positions, which can be abused by owners that just have profit maximisation interests. The result according to classical economic theory will be higher prices, lower volumes and less interest in investment/innovation than in the optimal competition situation. Consolidation and standardisation of systems will reduce costs and therefore also have positive effects. There are two general ways to reduce the negative impact of consolidation and private monopolies; maintaining end-user power and competition.

In the securities trading and settlement system the investors and issuers should be regarded as the ultimate end-users. In addition there are different kinds of intermediary service providers like asset managers that can be seen as users of the system. One way to increase the powers of these users would be to create user boards that could make proposals on how to develop the systems. The board could have some authority powers or public authorities with proper mandates could enforce the proposals made by the user board.

[15] ECB (2000), Lannoo – Levin (2003).

In order to promote competition between different systems general interfaces should be created between exchanges and settlement systems (registrars/CSDs) and access should be open. In an open network-based environment all participants have access to each other's services. There is competition on all levels. The common denominators are the common standards and the administrators.

Maintaining competition in trading, clearing and settlement systems requires keeping a processing structure that contains at least two parallel processing alternatives. In a hierarchical structure this would imply two parallel sets of systems and the users should divide the volumes across both systems. An example of this can be found in credit card processing systems where Visa and MasterCard are two parallel systems with partly the same owners, card issuers and merchant users, but mostly separate card customers.

Modern network-based solutions give the opportunity to increase competition without increasing processing costs. In a common standardised network infrastructure there could be a large number of competing registrars, custodians and exchanges. The network solution could give open access to different providers fulfilling the security and financial stability requirements. The investors would choose freely among custodians and would be able to move their accounts whenever they want. The investors would also decide which exchanges they want to use. The exchanges have to compete on price and service quality to attract investors. The registrars/CSDs would be competing for issuers. The issuers should be able to choose freely among registrars and also to move their current business to another registrar.

The centralised part is small in a network-based structure and consists basically of three different tasks (1) designing the rules and standards of the system and (2) administrating the network and (3) delivering the security solutions between participants. Designing the rules and standards could typically be done by a user board type of organisation assisted by a secretariat. The monopolistic area in the system would be limited to the network administration and security solutions.

To choose the right governance forms and solutions is the best guarantee for a long-run effective system structure that has an internal drive for continuous development. The main problem in payment and settlement system developments is that participants in the interbank/custodian systems have very little interest in developing common systems because the gain will generally go to the end-users and not the participants.

11 Authority control, regulatory and legal harmonisation

Financial markets are increasingly international. There are international issuers and investors in almost all countries. Securities will be issued and kept in custody in different countries. The controls, regulatory and legal requirements need to be harmonised on the international level in order to support processing efficiency.

The authorities involved are mainly

- supervisors
- overseers
- consumer protection authorities and ombudsmen
- competition authorities
- tax authorities and
- the police force.

These authorities are generally national authorities and they have seldom mandates at the international level. There is a need of a new type of international authorities or a deeper international cooperation between national authorities in order to control the global securities market and systems. The national borders will almost disappear in international network-based systems as can already be seen in current international settlement systems and especially in Internet in general.

Currently the authority views and regulations vary considerably. This is partly dependent on the national legislation and history in securities settlement. However, in an international context harmonisation is required. The cooperation among supervisors and overseers has increased.[16] However, the central banks seem to restrict central bank liquidity services to domestic banks quite tightly, which considerably limits the possibility of using central bank money for settlement of international securities transfers. The national central banks in the EU area grants access to all banks in the EU/EEA region, but not more widely. The EU-commission has devoted attention to consumer issues and market structures/competition on the EU-level.[17] The other authorities are still mostly focusing on national issues without an international perspective. Taxation seems to be an area which has got some attention but there are clear difficulties in harmonisation. Regulatory disharmonies easily create distortions in the market. The focus on terrorist actions has brought about a discussion regarding bank customer identification and banks' responsibility to know their customers. In

[16] For example the G-10/IOSCO and CESR cooperation.

[17] EU Commission (2001) and (2002).

order to hinder criminal use of securities accounts and systems, the same responsibility for custodians to identify their investor customers are needed. This would also help to restrict insider information abuse in securities trading, which seems also to be a topical issue.

The authorities and their international cooperation have a key position in creating the future standards for efficient and stable international settlement systems.

Central banks are in a key technical position in securities settlement when central bank money is used for settlement. Increase technical cooperation will be needed for streamlining technical access and standards. In an international financial market banks, custodians, registrars etc have to be able to access more than one central bank (at least as long as we have a multitude of currencies).

12 Next steps and implementation issues

New systems will not be introduced overnight, but a very concrete step-by-step process reaching over many years is needed. This cannot be achieved without large-scale common efforts. It will also require taking a long-term view for finding a comparable direct approach towards the new infrastructure level. The optimal step-by-step approach would follow this kind of overall path

- designing the overall architecture
- defining the essential addressing, messaging and networking standards
- deciding upon the network structure and solution
- building the institutional structure
- designing settlement models and trading interfaces
- implementing the new structure market-by-market.

If experience is anything to go by, an international project covering such a large infrastructure design task is very difficult to manage. The views are that divergent. The desires over timing are conflicting. The national backgrounds are very different. It would need the backing of the most important markets and all the major players on these markets in order to be successful.

Another solution would be that a few (key) players design a model for a limited market following the network design. When others can see its efficiency and benefits the new approach would catch on. This was in fact how Internet and email developed from a network among some universities and their students to a world-wide web. Even a small securities market could be the first example.

The European authorities in particular have shown an increasing interest in the securities settlement infrastructure. A good financial infrastructure has been seen as one of the cornerstones for economic growth. One possible way for a concrete build up of infrastructure would be a dialogue between the public and private sectors through which the different standards, conventions, structures, institutions, legal rules etc would grow to support a movement towards a more efficient network-based infrastructure. Changing infrastructures seem to be such big undertaking that it will require good public and private cooperation.

This paper has been an attempt to suggest quite concrete stepping stones to a more efficient securities settlement infrastructure than the current legacy systems. The solutions described and ideas presented need to be debated, assessed, criticised, improved and developed. These are not the optimal solutions, neither should they be implemented as such. The objective of the presentation has been to offer some new thoughts and an overall picture of different relationships involved and thereby to stimulate the discussion regarding infrastructure developments and

finding consensus on the issues and which then eventually would turn to concrete projects. All comments are welcome.

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The Center for European Policy Studies.

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The European Central Bank.

www.ecbs.org
The European Committee for Banking Standards (ECBS).

www.ecsda.com
European Central Securities Depositories Association (ECSDA).

www.europa.eu.int
The European Union's server. The Parliament, the Coucil, the Comission and Court of Justice, the Court of Auditors and other bodies of the European Union (EU).

www.europefesco.org
The Committee of European Securities Regulators (CESR), which have taken over the previous work of the Forum of European Securities Commission (FESCO).

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S.W.I.F.T.

Appendix 1

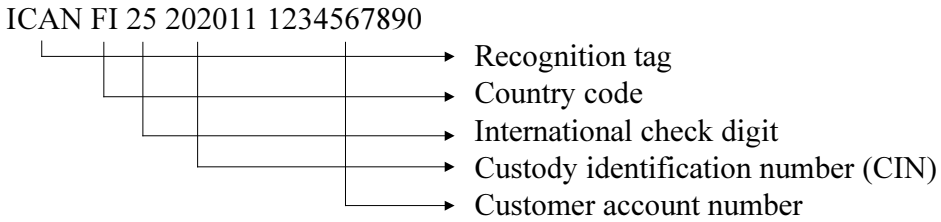
Basic identifiers for accounts, participants and transactions (ICAN, CIN, RIN, EIN and SATC)

ICAN = International custody account number

The custody accounts will need clear and standardised identifier that is used by all participants. The identifier should be structured in such way that transactions can easily be routed based on the number. Typical identifiers having these characteristics are credit card (account) numbers and e-mail addresses. IBAN is a new standard for international bank account numbers, which is not yet in general international use, but in Europe it is already widely implemented.

The IBAN identifier might also be used for custody accounts. However, it is probably at least for the time being better to separate clearly between bank (deposit) accounts and custody accounts. However, the logic could be similar. This would imply a ICAN structure as described in figure A1.1.

Figure A1.1 **Proposal for ICAN structure**



In this proposal, as in the IBAN structure, the first part defines the country (two digit ISO code) to which the custody account belong. The next two digits are international standardised check digits. In the IBAN code the rest is completely based on national choices. When creating a new international standard from scratch it could, however, be good to create a clear numeric custody identifier for the custodian as one of the key participants in the system, which could be called CIN (custody identification number). The proposed custody identifier resembles the bank identifier number in debit/credit card systems. Each custody would get at least one specific identifier. This would facilitate finding the name, network address and other important information as well as routing the transactions in the network. A general index file would be needed with the information on all distributed CIN identifiers. The customer/investor account number can follow the internal numbering systems of the custodians.

Institution identification numbers,

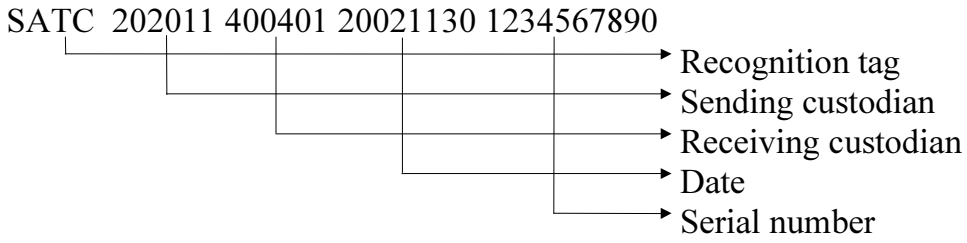
CIN=Custody identification number,
RIN = Registrar Identification Number and
EIN=Exchange identification number.

In the same way as the CIN identifies custodians the RIN would identify registrars/CSDs. The EIN= Exchange identification number would identify the exchanges. All identifiers would have the same six digit format and together they constitute the institution identification numbering system. The identifiers would have own slots of the overall number space. For example CINs could be in the slot starting with 1 to 4 while the RIN numbers would start with 5 or 6 and the exchange identifiers EIN would start with 7 or 8. All securities defined by the ISINs would have to have one and only one RIN to which they are attached at each moment. This would leave 9 for settlement banks if needed.

SATC = Securities' systems Audit Trail Code

The transactions in the system would also need clear identifiers so that they could be followed through the system. This audit trail type of code could be called SATC (Securities' systems Audit Trail Code). In a network system all transactions are sent from one participant to another. The sending participant is therefore in the best position to create the individual identifier. The detailed SATC structure proposal is described in figure A1.2.

Figure A1.2 **Proposal for SATC structure**



Each transaction SATC would include the CINs of the sending and receiving custodian, which clearly defines where the transaction was created and where it was delivered. The date and serial number given by the sending custodian identifies each transaction on the individual level. The serial number can be

created according to the conventions used in the sending system. When the messages are sent to/from registrars the CIN number would be replaced with the RIN number and in the same way EIN numbers would be used in messages going to exchanges.

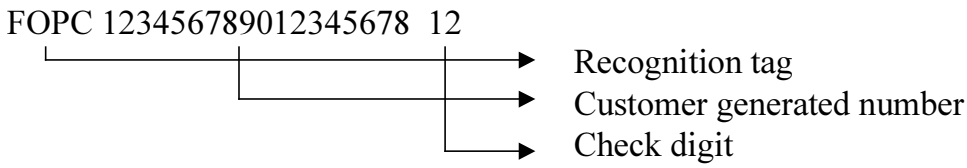
Appendix 2

Matching codes (FOPC, DVPC and EDIC)

FOPC = Free of Payment remittance Code

In FOP (free of payment) transfers it is only the receiving investor that needs a code for matching the transaction against the internal files once it have passed through the system. The sending investor, asset manager etc attaches the agreed code, FOPC (free of payment remittance code), to every FOP order sent. It will just pass through the securities settlement system to the receiving investor. The FOP structure can therefore be very simple as described in figure A2.1.

Figure A2.1 **Proposal for FOPC structure**



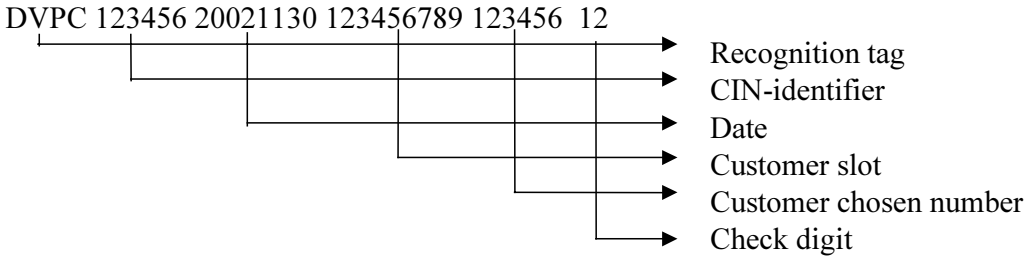
The customer can generate a suitable number based on their internal references. This number has a check digit, which help to verify the correctness of the code when transferred from one system to another. Custodians need just to check the check digit in the entry phase and pass it through to the receiving investor.

DVPC= Delivery versus Payment matching Code

In DVP (delivery versus payment) transfers the securities settlement systems have to be able to identify and match two dependent transfers and verify that the expected deliveries in both directions are as the buyer and seller have agreed. The code, DVPC (delivery versus payment matching code), should be designed in such a way that there will not be any other pair of transactions having the same code and thereby potentially messing up the matching process. The DVPC codes will be generated in bilateral trading, free exchanges and guaranteed exchanges. It must be introduced identically into the system both in the securities transfer starting point and payment transfer starting point. Every exchange will have an EIN number that can be used with a date and serial number to create individuality. The same idea could be used for bilateral trading when each custodian is pre-assigning number slots for their investors to be used together with the CIN

number of the custodian. In bilateral trading the trading partners should agree which number of the available would be used.

Figure A2.2 **Proposal for DVPC structure for bilateral trade messages**



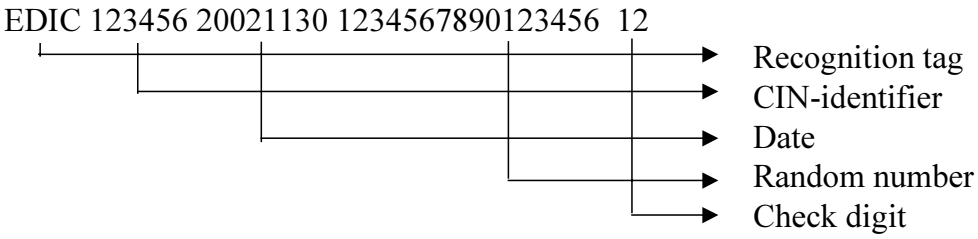
The customers would in bilateral agreements decide whose CIN-identifier and customer slot would be used eg by using those attached to the party delivering the securities with the lower ISIN number. The exchanges would use their own EIN-numbers. The customer and exchanges has to ensure that they do not duplicate the serial part.

The essential idea of the matching DVPC code is just to create a definite and positive way to identify pairs of DVP transactions. In the intra-custodian case the custodian will be in charge of the DVP process. In the inter-custodian case it is the responsibility of the registrar/CSD. Settling exchanges are again managing the DVP process as part of the trading process. Both buyers and sellers have to inform what they will be delivering and what they expect in return. The custodians, registrars and settling exchanges have to ensure that the information in the two matched DVP transactions is identical on this point. This will also help to find out the reasons for possible non-deliveries or errors.

EDIC = Exchange Deal Identification Code

Large investors do not generally want the market to know about their investment policy and changes in it. If the ICANs of such investors would be used directly in transfers a larger number of market players/participants could be able to get information about the deals made by these investors. This could distort market behaviour and increase the abuse of one type of insider information. In order to limit such possibilities the true ICANs could be disguised by pseudo-ICANs called EDIC (exchange deal identification code). The custodian of investor creates a directory with one-time only EDIC codes that refers the original ICAN. It is then just the custodian systems that have knowledge of the true ICANs and identity of the investors sending orders to exchanges.

Figure A2.3 **Proposal for EDIC structure**



The essential difference of the EDIC compared to the ICAN is the random number to disguise the investor and the date to create a large enough random number space. EDICs would be used when customers stipulate it.

Appendix 3

Description of a decentralised settlement system

The e-settlement method was originally developed for distributed settlement using central bank money[18]. It is still in the prototype phase and not yet in production use. The method is general and can therefore be applied in the securities processing environment just for payment legs or also for securities. Technically the processes of central banks controlling issued central bank money are very similar to those of registrars controlling issued securities. Decentralisation is the main feature creating benefits in network based systems.

The traditional clearing and settlement methods have been centralised. All accounts and transactions have been gathered to a centralised system (eg RTGS, net-settlement LVPS, ACH) for settlement individually or in batch. Securities has in the same way been settled centrally in different kinds of securities clearing and settlement systems. The basic difference with the network-based e-settlement model is that

- the working accounts are distributed to the participants IT-sites close to the participant's processing system
- the cb-money and securities' omnibus accounts are in hardware secured systems delivered by the administrator/central bank/registrar and could be seen as automated branches of the central bank/registrar
- the interbank/intercustodian cover for a transaction follows the transaction as an encrypted digital stamp that could be compared to eg the old way of attaching central bank draft to a bunch of paper credit transfers
- all transactions can be finally completed in real-time by sending the transactions accompanied by the electronic stamp and receiving a positive confirmation. For DVP-transactions there will be two interrelated transactions and one confirmation needed.

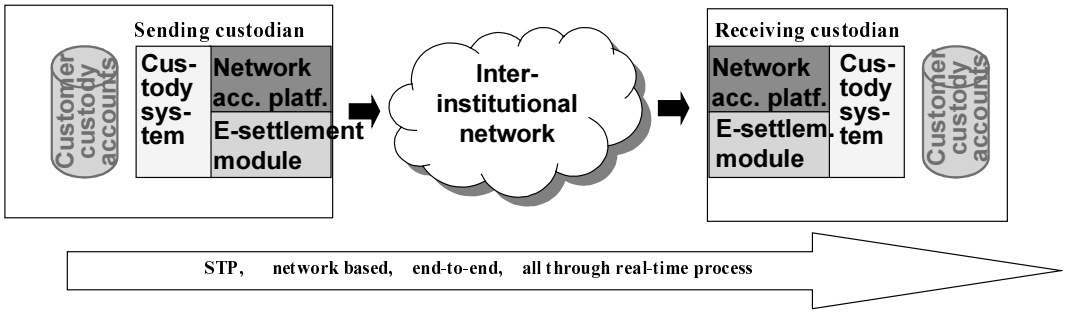
The e-settlement method is described in detailed in the discussion paper from the Bank of Finland together with the prototype description. Therefore only an overview is given in this paper in order to present the general functionality of the model.

All participants in the system will be connected to each other via a secure Internet type of network (TCP/IP) eg the SWIFTnet and every participant will have an extended e-settlement module (ee) as described in the general figure 1 in chapter 2. The extended e-settlement module includes the settlement facility both

[18] Leinonen, Harry – Lumiala, Veli-Matti – Sarlin, Riku (2002).

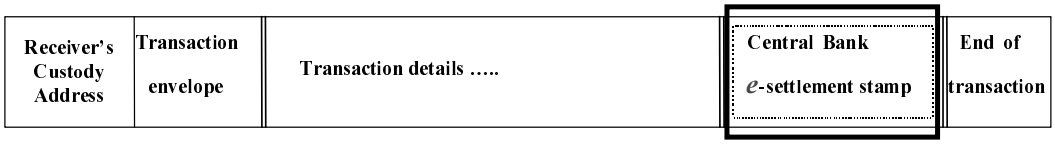
for central bank money and securities. Registrars and central banks have e-settlement modules with monitoring capability (em). The e-settlement modules will be connected with automated interfaces to the payment-, securities processing and deposit/custody systems of the banks and custodians see figure A3.1. If the SWIFTnet were used, the modules will be connected to SWIFT's normal network access platform ie the CBT (customer business terminal system).

Figure A3.1 **The e-settlement modules are integrated into the payment and securities processing systems in custodians' and banks' systems**



The e-settlement stamps will be part of the normal transfer messages as electronic stamps. They are encrypted and cannot be opened by any other device than the receiving e-settlement module or the central bank or registrar to which the electronic asset belongs. The stamps can be added to normal SWIFT messages, see figure A3.2.

Figure A3.2 **The e-settlement stamp is an encrypted part of the normal transaction messages**

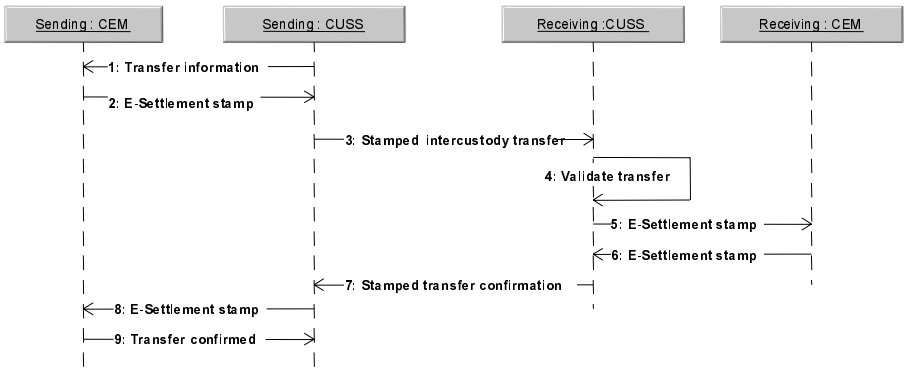


The security in the process must be on high level. All transactions and information are encrypted using secure methods and algorithms. The system consistency is monitored by continuous reconciliation at bank level and regular consolidations at registrar/central bank level. The e-settlement modules are protected by hardware level security and continuous monitoring by the system administrator. High availability is secured by mirroring all important parts. A distributed system is therefore more resilient than centralised systems because technical problems hit only small parts of the system at the same time.

E-settlement FOP-transfers

Intra-custodian FOP transfers could in a decentralised system be made by transferring directly the book-entry securities values from senders' accounts identified by ICANs to the receivers' accounts. The FOPC identification codes will facilitate customer reconciliation. Inter-custodians FOP transfer will employ the e-settlement modules as described in figure A3.3. The sending custody system (CUSS) will ask for an e-settlement stamp from its e-settlement module (CEM). The total amount of securities of this type held by the sending custodian as recorded in the module will be reduced by the amount to be transferred. The e-settlement stamp is attached to the transfer message (normally a SWIFT-message) from the sending custodian to the receiving custodian. The receiving custodian will validate the message and present it to its e-settlement module for approval after which the customer custody account can be credited with the received securities. The transfer is now final and irrevocable. A confirmation message is sent to the sending custodian, which will present the confirmation to its e-settlement module, which will record it as a final and irrevocable transfer.

Figure A3.3 **The normal FOP-process between to custodians**

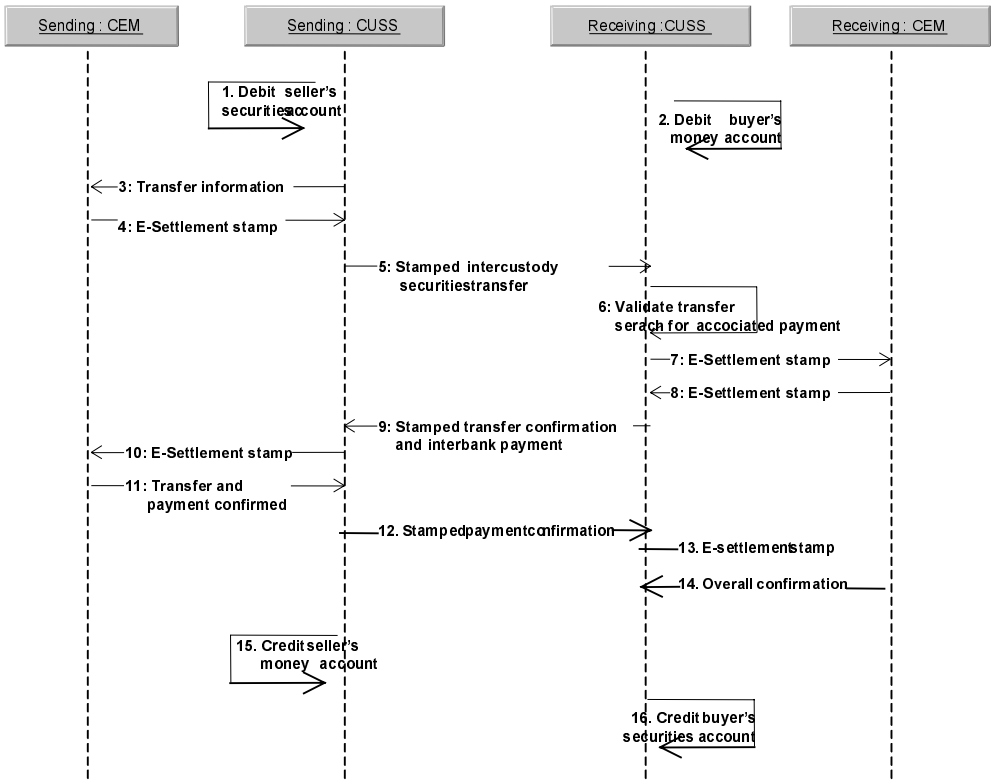


E-settlement DVP transfers

Before the intercustodian process begins, the custodians have debited investors' accounts to ensure the availability of the assets to be transferred. In and e-settlement based system the inter-custodian DVP transfers will be started by the securities sending (seller's) custodian by sending the securities transfer message with the e-settlement stamp to the receiving custody stating the agreed DVPC code. Upon reception the receiving (buyer's) custodian will validate the message

and search for the associated payment order with the given DVPC identifier. It will then confirm the reception of the securities and ask from its e-settlement module a stamp for the payment and the confirmation for the received securities. Both the securities transfer and payment is still pending final confirmation and finality. The confirming payment message is sent to seller's custodian, which present the payment and securities confirmation to its e-settlement module. Upon the confirmation by the e-settlement module the transfer becomes final and irrevocable and the payment can be credited to the seller's account identified by the IBAN. A confirmation is sent to the buyer's custody which will confirm the transaction chain and the pending securities can be credited with finality to the buyer's account identified by the ICAN (see figure A3.4).

Figure A3.4 **The normal DVP-process between to custodians**



In the described DVP-process it has been assumed that investors' money accounts are kept with the custodians. This would be the normal situation when the custodian is a bank/credit institution keeping deposit accounts. If this is not the case the process becomes somewhat more complicated because the buyers have firstly to transfer money from their banks to intermediary accounts by their custodians. This transfer would be done using the e-settlement method but without a DVP mechanism. The DVP mechanism is only connected to the final transfers between custodians. The situation will be the same if the seller wants to transfer

the received payment from the custodian to a bank account. This will be an additional independent transfer after the DVP-transfers between the custodians.

Generally one of the legs in a DVP-process will be a payment leg. However, the model is very general and it could as well make a DVP-transfer between two securities accounts eg different swap deals. For a securities swap it has to be determined, which custodian starts the transfer dialogue.

Delays and abnormal situations

There can be delays in all IT system due to bad telecommunication lines, systems are down etc. The messages in the dialogues need to be resent if no answer has been received within the given time-out parameters. After a given number of trials the system administrator will be alerted in order to find and fix the problem. If some participant has problems that cannot immediately be solved, it will be put into 'stop-sending' mode and other participants will be informed by the administrator in order not to send transactions in vain to that address.

Especially in the DVP processing where two separate transfers has to be introduced to the custodians by two different customers or customers' representatives there will probably be some delays between the different steps. The security transfer messages may have to wait for the associated payment message to be introduced. It could therefore be good to agree on a predefined short introduction time given to all participants. (How short this timeframe will be can be determined based on practical experiences, but in a real-time environment it would probably be more in the range of tens of minutes than several hours. It could also be agreed separately by transaction.)

Abnormal situations can come about due to bad data. Account numbers are not correct. DVP-codes do not match. The transaction details securities type, money or securities value do not agree. This would result in cancellations of the transactions and steps done will be reversed. The same would also happen, if one of the custodians have to conclude that one of the customers cannot deliver the asset or the payment within the given timeframe.

There might also be IT based errors eg participants are not recognised due to addressing errors, PKI- and other encryption keys might become mixed up. A participant's IT site might be completely destroyed for instance by a fire and there is a urgency to revert to the back up site. These are all errors that will need the system administrator's immediate attention. A network-based system is generally more robust and resilient in abnormal situations. Data redundancy will make it possible to patch destroyed parts. Other entities can take up the load of non-functioning entities. The important difference compared to centralised systems is that in decentralised internet-type of systems the single point of failure risks can be reduced significantly and errors affect only limited parts of the network.

Appendix 4

Comparison with the twenty recommendations of Group of Thirty

The Group of Thirty has made a list of twenty recommendations for creating a strengthened interoperable global network, mitigating risks and improving governance. Because it is a good check list for any proposal for new settlement infrastructures a comparison is done below between these recommendations and the proposals in this paper.

Recommendation	**Assessment**
1. Eliminate paper and automate communication, data capture and enrichment	Fulfilled
2. Harmonise messaging standards and communication protocols	Fulfilled (use of ICANs and IBANs are central new conventions)
3. Develop and implement reference data standards	Detailed proposals are made for an efficient reference system for all participant groups (eg FOPC, DVPC and EDIC identifiers)
4. Synchronise timing between different clearing and settlement systems and associated payment and foreign-exchange systems	The proposed model is built on continuous real-time (24/7-principle), which means that every system is automatically synchronised by being able to process continuously. The synchronisation problems between batch-based systems are completely avoided.
5. Automate and standardise institutional trade matching	All trade is automate matched and in settling exchanges the matching is executed as part of the instant process
6. Expand the use of central counterparties	The need for central counterparties will disappear in a real-time settlement environment, because it is only money liquidity that needs to be monitored and provided. Securities shortages will be avoided because the custodians omnibus-accounts just reflects the total securities balances of the investors
7. Permit securities lending and borrowing to expedite settlement.	Securities lending/borrowing will be available and will even be a prerequisite for trading in settling and guaranteed exchanges

Recommendation	Assessment
8. Automate and standardise asset servicing processes, including corporate actions, tax relief arrangements and restrictions on foreign ownership.	For corporate actions and tax arrangements efficient technical solutions are proposed. However, regulatory type of improvements needs international authority cooperation.
9. Ensure the financial integrity of providers of clearing and settlement services	The two-level accounting hierarchy provides a straightforward solution for financial integrity when proper license requirements are in place. The overall situation is reconciled continuously. The number of intermediary institutions will also decrease resulting in clearer responsibilities.
10. Reinforce the risk management practices of users of clearing and settlement service providers	Settlement and delivery risks will decrease to very close to nil in a real-time environment. The structure of the system in itself will improve risk management.
11. Ensure final, simultaneous transfer and availability of assets	This is a basic feature in the real-time network solution. The assets will be available continuously and there are no possibilities to create assets by unlawful 'overissuing'.
12. Ensure effective continuity and disaster recovery planning.	Distributed network-based systems are more robust than centralised systems with single-point of failure problems
13. Address the possibility of failure of a systemically important institution.	Failures will be easier to manage because in the real-time environment a component can be removed immediately and the balances will reflect the situation at that moment. The open settlement/credit risks are probably lower in a continuous system compared to batched systems and especially low in the real-time network model. Because of the competitive structure in the model the risk for a 'too-big-to-fail' situation to occur will be low. The overall systemic risk amount will be lower.
14. Strengthen assessment of the enforceability of contracts.	Requires authority cooperation and legal harmonisation.
15. Advance legal certainty over rights to securities, cash or collateral	Requires authority cooperation and legal harmonisation.

Recommendation	Assessment
16. Recognise and support improved valuation and closeout netting arrangements	True real-time settlement will not require netting arrangements, but gridlock resolution algorithms may use netting features. However, netting implies queuing, which means delayed settlement
17. Ensure appointment of appropriately experienced and senior board members	General requirement for all kinds of infrastructures
18. Promote fair access to securities clearing and settlement networks	The network-based solution emphasise and require especially open access between all participants of the infrastructure
19. Ensure equitable and effective attention to stakeholders interests.	General requirement for all kinds of infrastructures
20. Encourage consistent regulation and oversight of securities clearing and settlement service providers	General requirement for all kinds of infrastructures. The proposed simplified institutional structure makes regulation and oversight/supervision more straightforward.

Appendix 5

Abbreviations

API	Application Protocol Interface
ATS	Alternative Trading System
BIS	Bank for International Settlements
CIN	Custody Identification Number, proposal
CB	Central bank
CBT	Customer Business Terminal, the network platform for interfacing the SWIFT network
CCP	Central counterparty
CESR	Committee of European Securities Regulators
CGFS	G-10 Committee on Global Financial System
CLS	Continuous Linked Settlement, real-time system created for PVP settlement of currency deals
CSD	Central Securities Depository
DVD	Delivery versus deliver, processing mode where two types of securities are exchanged against each other
DVP	Delivery versus payment, processing mode where securities are delivered against the agreed value of money
DVPC	Delivery versus payment matching code, proposal
EACH	European Association of Central Counterparty Clearing Houses
ECB	The European Central Bank
ECBS	The European Committee for Banking Standsards
ECN	Electronic Communication Network
ECSDA	European Central Securities Depositories Association
EDIC	Exchange deal identification code, proposal
EEA	European Economic Area
EIN	Exchange Identification Number, proposal
ESF	European Securities Forum
EU	European Union
FESCO	Forum of European Securities Commissions
FIBV	World Federation of Exchanges
FIWG	Financial Internet Working Group
FOP	Free of Payment, processing mode where securities are delivered solely (without any attached payment of funds)
FOPC	Free of payment reference code, proposal
G30	The Group of Thirty
GIF	Graphic Interchange Format

GMT	Greenwich Mean Time often referred to as the Coordinated Universal Time
GSTPA	The Global Straight Through Processing project that was stopped in November 2002
IBAN	International Bank Account Number standard
ICAN	Proposed International Custody Account Number
ICSD	International central depository eg in Europe Clearstream and Euroclear.
IOSCO	The International Organization of Securities Commissions
ISD	Investment Services Directive
ISMA	The International Securities Market Association
ISO	International Standards Organisation
ISSA	The Information Systems Security Association
JPEG	Joint Photographic Expert Group
NASD	National Association of Securities Dealers
Nasdaq	National Association for Securities Dealers Automated Quotation System
NYSE	New York Stock Exchange
OTC	Over the counter trade/transaction
OECD	Organisation for Economic Co-operation and Development
PKI	Public key infrastructure
RIN	Registrar (CSD) Identification Number, proposal
RTGS	Real-time Gross Settlement system
SATC	Securities systems Audit Trail Code, proposal
SCSS	Securities clearing and settlement system
SEC	US Securities and Exchange Commission
STP	Straight-Through Processing
SWIFT	Society for the Worldwide Interbank Financial Telecommunication
SWIFTnet	SWIFT's new TCP/IP based network structure/product
TARGET	Trans-European Automated Real-time Gross settlement Express Transfer, the interoperable network of RTGS systems established by the EU central banks
TCP/IP	Transmission Control Protocol/Internet Protocol is the basic communication language protocol for the Internet.
TIFF	Tag Image File Format
XML	Extensible Markup Language used to build common formats for data to be transferred

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