CSNET: A PROPOSAL FOR NETWORK CLEARANCE AND SETTLEMENT

by

Mark Ginsburg*

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Abstract

I present a brief introduction to exchange-based clearance and settlement, and current practical and research problems posed by various infficiencies that exist in this process. Then, open network protocols are reviewed to set the stage for the design of a hypothetical clearance and settlement network (**CSnet**). Important and desirable attributes such as security, robustness, and extensibility will be discussed. A practical networked implementation of order flow and execution, the Financial Information Exchange (FIX) protocol will be discussed since it parallels in several key areas the CSnet proposal. Further directions for study in the area will be indicated.

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1 Overview of Clearance and Settlement

Let us consider the following participants in the processes of **Clearing**, matching the buy and sell orders and sending confirmations ('confirms') to the buyers and sellers and of **Settlement**, the dual task of transferring the issue from the seller to the buyer and conversely transferring the cash payment from the buyer to the seller:

- Member firms. Brokerage houses that are members of the exchange where the trade took place, e.g. the New York Stock Exchange (NYSE).
- Clearinghouse. The National Securities Clearing Corporation (NSCC) which is the largest domestic clearinghouse, was created in 1977 by the merger of the NYSE, American Stock Exchange (AMEX) and over the counter (OTC) clearinghouses [GKW94]. Inputs to the NSCC and outputs (compares and miscompares) from the NSCC to the member firms are in fixed-column formats, based on the 80-character punch card and 132-character report width of yesteryear. The NSCC processed 95 % of the US equity trades in 1990 [Ano90].
- Exchange. The Exchange, for example the NYSE, is populated by brokers working for member firms and independent brokers. Each party and counterparty to a trade must be accredited by the exchange and have a unique badge number. They NYSE has four member classes [Wei86]: specialists, commission house brokers, two-dollar brokers, and registered floor traders.
- US Government Regulatory Agencies.
  - The SEC.

    The US Securities and Exchange Commission, in conjunction with the automated arms of the exchange [1] monitors trading activity for possible illegal activities such as insider trading. The SEC in conjunction with other federal authorities investigates and prosecutes illegal trading; the starting point is raw trade data furnished by SIAC. It is rare but not unheard of to suspend an entire equity class pending investigation.
  - Other Government Agencies

    For example, an announcement from the Department of Justice than an illegal trading investigation has been initiated can lead to other firms not entering into repurchase agreements with the targeted firm. In severe cases, a generalized boycott of the targeted firm may be organized or state legislatures may vote to suspend the targeted firm from bond underwriting.
- Depository. The depository, for example the Depository Trust Company (DTC), is a corporation owned by banks and member firms that holds securities, arranges for payment and settlement, and must keep track of stock that is marginable or loanable by the firm (non-segregated, or "non-seg") and stock which is not marginable by the firm (segregated, or "seg"), either fully paid for or not in the customer's margin account. Non-seg stock may be used by the firm as a pledge against a debit account at a bank (margin, or "hypothecation" [Wei86]) or as a short-term loan to other firms. The firm receives 140 % of collateral on the marginable securities and thus the dual use of non-seg stock provides critical financial flexibility to the brokerage houses.

2 Practical and Theoretical Clearance and Settlement Problems

2.1 Clearance Problems

2.1.1 Practical Issues

When the two sides to a trade do not agree, uncompared reports cause manual cleanup in the affected member firms and a real financial burden (estimated to be $250 million annually for the nearly 15,000 items

[1] The Securities Industry Automation Corporation, SIAC, in the case of the NYSE and AMEX.

per day that are uncompared by the NSCC [GKW94]). Typically, the NSCC transmits the compare and uncompare reports to the member firms via a CPU to CPU link and the firms print out the reports for manual review by the Purchase & Sales Department staff. The somewhat cryptic codes used by the NSCC to categorize miscompares forces a manual review of every problem trade.

In a typical equity transaction ("regular-way"), the firm faces a five day settlement cycle and hence miscompares can result in serious market exposure. Exposure can come about from disagreement on net price (quantity times trade price) and it should be noted that the difficulties are compounded in foreign monetary trades because of potential shifts of the foreign currency versus the dollar. The firm also faces penalties from the exchange if miscompares are not fixed in the cycle.

On the other hand, many uncompares are traceable to simple clerical errors, such as an invalid badge number or a trade-time difference of a few minutes. There is no system in place currently to help automate the resolution of minor problems or help prioritize the risk of the daily set of miscompares to a given member firm.

2.1.2 Research Issues

Message flexibility, via an extensible Prolog-based scheme, is argued to help reconcile miscompares by application of defeasible reasoning and to facilitate the description of new security types [GKW94]. The authors assume a generic network backbone to carry the messages between firms and the clearinghouse and between the firms themselves. I will show in this paper how the dual approach of a open network protocol and a system of distributed databases can substitute for a formal message structure and permit easily developed solutions to message representation on the part of all participants in the clearance and settlement process.

2.2 Settlement Problems

2.2.1 Practical Issues

Even if a trade is successfully compared, the transfer of ownership must still take place. Many member firms retain a dedicated staff to deal with the daily problem of institutional fail to receive and fail to deliver trades, a special case of "fails" [2]. Buy-side institutions often require physical delivery of the security on a COD basis (deliver versus payment, or DVP) or they will physically deliver securities in exchange for cash on the sell side (receive versus payment, or RVP). Fails cause immense market exposure since they are typically high volume. The factor of foreign exchange shifts plays a role here as well to add to the sum exposure in the case of trades made in foreign denominations. It is rarer for individuals to insist on physical delivery but fails can occur there as well.

Another potential headache is the book-entry transfer that occurs at the depository. Most stock held by the member firms is held in 'street name,' that is, held by the firm on behalf of the customer.

The depository (for example, DTC) must transfer stock out of the correct category of the member firm's holdings en route to the buyer or conversely must place stock into the correct category en route from the seller. The member firms' financial health is dependent on the accurate bookkeeping of seg and non-seg stock since the ability DTC to member firm communication is rather rudimentary and, if a dedicated line exists, the transmissions will be in a fixed columnar format. In addition, the DTC has separate processing routines to handle night-time bookkeeping transfer] (the "PDQ" cycle) and the physical transfer of securities during business hours, or "mainline activity" [Wei86].

2.2.2 The Design Problem

A single participant cannot design effective clearance and settlement procedures without an efficient networked backbone in place.

[2] this is usually a subsection of the Cashiers or "Cage" department.

Can we build this hypothetical network, linking all the settlement participants, and confer efficiency by its basic open design? This paper will argue that such a network is realistically implementable and show concrete examples of efficiencies thus earned.

3 Building CSnet

A network approach, in conjunction with replicated (distributed) databases, suggests itself to allow timely flow of information between all interested parties in clearance and settlement. Let us start from first principles and see how an efficient network can be designed.

3.1 Network Design Principles

Fortunately, a rich body of practical experience accumulated over two decades with the large scale Internet has taught us some properties that would clearly be desirable in a smaller scale clearance and settlement network. The overarching principle that CSnet must follow is **openness**. An open architecture does not lock any network member into a pre-ordained choice of hardware or software, nor does it presuppose a minimum or maximum network membership limit. The open approach assumes non-proprietary standards and practically speaking, decreases the risks member firms face buying into the scheme.

- Extensibility. The system should grow easily with the addition of new member firms or with the addition of new processing capability at the clearinghouse hub. Conversely, 'shrinkability' is also important - the ability for the system to easily delete a member firm if needed.

- Reliability and Robustness. Here, *Structured exception handling* is critical. Standards must be in place to handle unexpected events: malformed token headers or data contents, network slowdowns or fragmented transmissions, etc. The network must also have redundant hardware components to create fault tolerance.

- Member Firm Hardware and Software Freedom - an outgrowth of openness.

  It is impractical to insist that member firms agree on a single hardware processing or network connectivity platform. The network should operate on a protocol that is compliant with all major processing and network vendors. TCP-IP (Transmission Control Protocol – Internet Protocol) is an non-proprietary, or open protocol and is a good example of a routing protocol that is understood by all major vendors. TCP breaks data transmissions into chunks of approximately 2,000 characters. It then ensures that the data are properly reassembled at the receiving end; and IP ensures that the sender need not specify a 'hard-coded' network path in order for the data to reach the recipient.

- Standardization. A robust, well-defined transport protocol which is not reliant on a for-profit entity for further development carries many advantages. Third-party vendorrs can develop network-aware software efficiently; CSnet members can fully participate in the standards-making process.

- Security. Naturally, member firms have no basis to trust each other with the details of their trades. Therefore, an extremely secure encryption algorithm must be selected to encrypt the packets before they enter the outer ring. Public-key encryption [Aba94] is a good choice. The destination member firm uses its private key to decrypt the packet; therefore intermediate nodes (member firms which physically stand before the destination), while easily being able to intercept and download the encrypted packets, are unable to decipher them.

- Performance. Speed is of the essence when dealing with trades in the millions of dollars. Naturally, firms would not want a slow network to contribute to the risk of outstanding questioned trades by extending the time needed to resolve them. Fortunately, 100 Megabit per second (100 MBS) or better network data speeds are now routinely available from a variety of vendors.

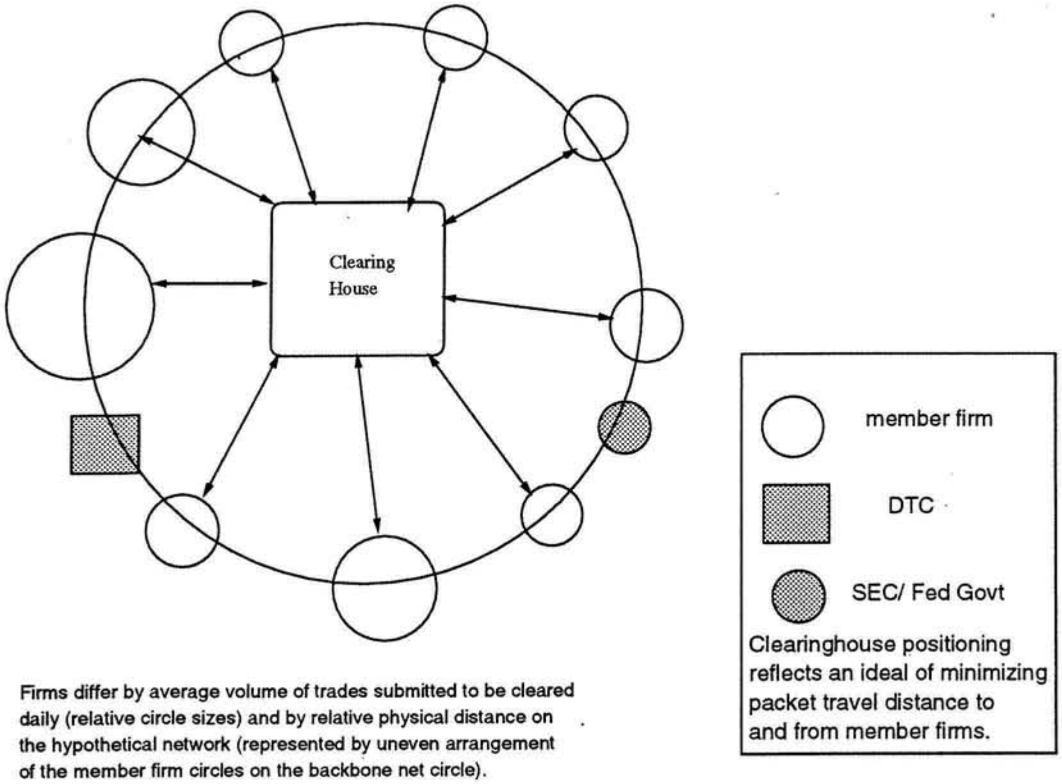


Figure 1: CSnet Architecture

Figure 1 shows an idealized beginning. The clearinghouse is positioned at the hub, recognizing that it will handle the bulk of the messages and thus it should be central. Member firms, the depository, and the "Government" (the SEC and possibly other agencies) are on the ring.

3.2 Canonical Network Abilities

Leaving aside the mechanics of message format, hardware requirements, and security for the moment, I list the minimum set of network abilities that every participant in CSnet must have:

- Initiation. Each participant can initiate a **token**, the fundamental unit of data on the network. Each token has a source address, a destination address, and other header information which will be discussed later.
- Routing. Each participant, if acting as a 'middleman' (receiving a token that has not yet reached its final destination) has the appropriate software to find the best network path for that token so that it reaches its final destination most efficiently. The best path is a function of local network congestion and of temporarily down nodes. Note in passing that the intermediate routers obviate the need for the sender to affix a predetermined route to the token's header. This is called *"connectionless"* network architecture and is the mainstay of the Internet routing protocol [Ste94]. In CSnet, a connectionless token path provides maximum flexibility to the network under the inevitable circumstances of one or more nodes being down.
- Recognition. Each participant has the proper software to recognize a token's header - e.g. some tokens require further routing, some require a lookup routine on the internal database of rules, and some require other forms of software action.

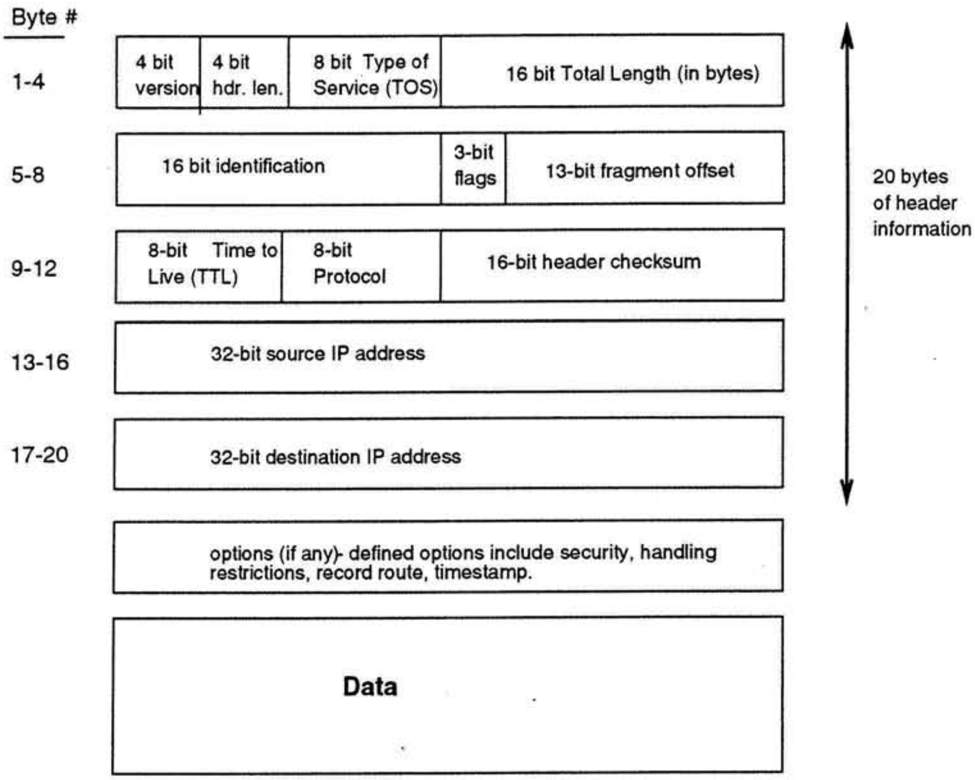


Figure 2: The Token Header

3.3 The Data Token

There is no reason to deviate from standard TCP-IP architecture in describing the data token header. Figure 2 shows the combination of the data token and its header of 20 bytes [Ste94].

The most important elements of the token header are the *Type of Service*,which will alert recipients to the type of token (advisory, action, etc.), the source (where the token originated), the destination (one token is necessary per unique destination) and the security option - whether or not the data following the header are encrypted.

For the data portion of the token, I suggest a simple array of attribute and value pairs. Replicated databases stored around the network ring can keep the master dictionary of security types and their corresponding required and optional attributes. The point is to get away from the aging metaphor of fixed column formats; since those descriptors a) inevitably get short of space and b) often run into trouble when competing standards groups in different continents duplicate efforts [Tec93].

With an attribute-value array, the participants can process the data using whatever software solution they like. Validation is straightforward and can be totally automated as discussed in Section 4.4.2.

3.4 Databases: another important network resource

3.4.1 Member firm distributed databases

Beside simply being present on the network, member firms may also find it to their advantage to build internal databases of miscompare clean-up rules. For example, a minor price miscompare, if it results in a net difference of less than a pre-arranged cutoff, can be split among the parties [GKW94]. Such rules are strictly voluntary. The databases can also contain useful information such as the security issues a firm has on hand to loan that day. The internal databases can be built, updated and queried easily using a relational data manager (RDBMS).

Underlying the network connections between the participants must be a simple method of accomplishing such important goals as handling new settling entities, or automatically resolving some of the most common miscompares.

The embracing of SWIFT messaging standards by the ISO body [Tec93] shows that firms participating in global trading do need a uniform method of communicating. Prolog has been presented as a hypothetical messaging solution [GKW94]; however, it cannot be assumed that member firms will easily coalesce on this issue. If an ad-hoc standard does not exist for a new type of message, SWIFT is a formidable obstacle for adoption.

However, fixed format messages are in my view only a short-term solution since an open network allows abstracting the message in the form of a token and its header in such a way that affords maximum flexibility to the participants. How might this work?

The problem can be approached from the following angle. We know the network may be implemented irrespective of message format choice; now we can ask: is there a message format that leverages our choice of open networking? I argue for the simplest possible token data architecture; that of attribute-value pairs. I will not constrain the network participants on the processing of the data; although the header is in fact rigidly defined by the TCP-IP protocol.

How might a distributed database work with attribute-value pairs? As mentioned previously, a dictionary of security types and required and optional fields allows for simple validation of the tokens. Moreover, a new entity (as announced by one or more participants, and possibly ratified by a board) can be defined in the form of an advisory token from the board or from the clearinghouse. The advisory token can update the replicated data dictionaries and thus we have instantaneous support for the new entity without the manual headaches new issues currently cause clearance and settlement systems.

New items might be thought of in terms of inheritance of properties of existing issues, but in my opinion this is unnecessary. It would be a violation of the spirit of the openness of CSnet to force participants to process events expressed in an object-oriented language. Instead, the new instruments can be fully described in a set of attributes and optional constraints.

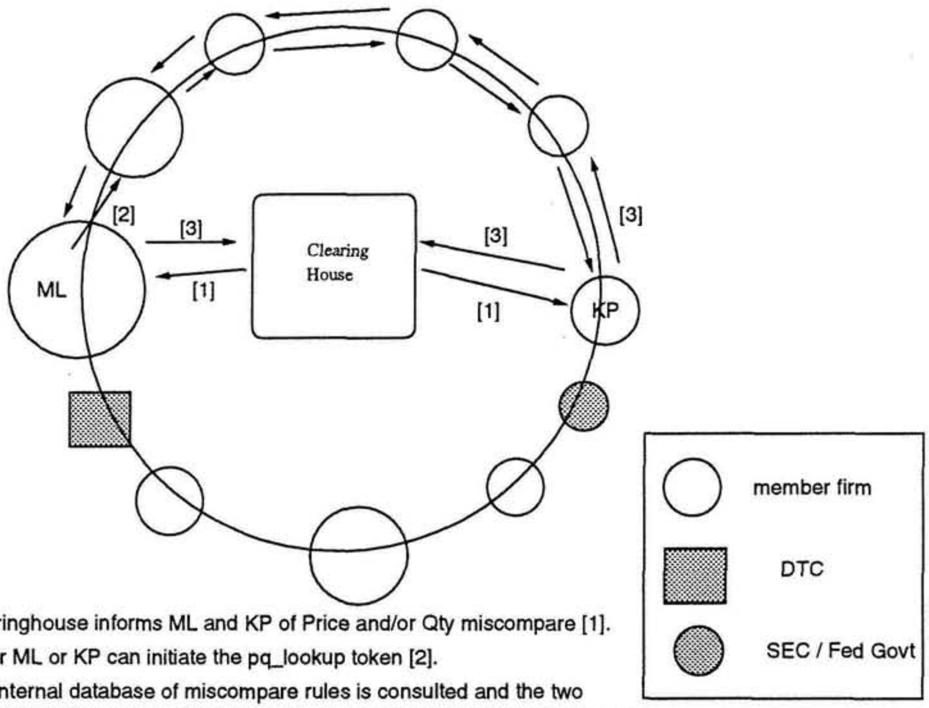
The key point is that the member firms have freedom to use whatever software platform they wish to add the new entity to their processing capability. The tokens are variable length in nature and hence as much data room as needed is available to describe the new entity's attribute values when it is traded.

Naturally, the possibilities at the member firms' sites are plentiful. They may, if they wish, describe the new entity in terms of existing 'primitives' or they may maintain a database of entity codes and associated attributes. The network is passing settlement tokens quite quickly around the ring and the onus is on the member firm to implement a "recognize and act" architecture that is responsive to the token identification.

3.4.2 Centralized Clearinghouse and Depository Databases

Central organizations such as the clearinghouse and depository can maintain and update important databases to assist in clearance and settlement. For example, the clearinghouse can provide the valid badge numbers (which change daily) as a queryable resource; the depository can make available non-seg stock inventory figures on a CUSIP by CUSIP basis. Queries take the form of tokens; encryption makes the queries secure and one simple implementation would be a relational architecture with SQL queries in the token's data section.

Another example is the master database dictionary of settling issues. This resource would contain all the required and optional attributes of each security class, e.g. a municipal bond or a preferred stock. When



Clearinghouse informs ML and KP of Price and/or Qty miscompare [1].
Either ML or KP can initiate the pq_lookup token [2].
The internal database of miscompare rules is consulted and the two firms either (i) send pq_clean tokens to each other and the clearinghouse, if automated cleanup possible, or (ii) send pq_unresolve tokens to each other and the clearinghouse [3].

Figure 3: Price or Quantity Miscompare

a firm sends a token pertaining to a given security, it should first pass through the dictionary to check the attirbute syntax. In the centralized model, validation tokens would all be passed inward to the clearinghouse and back out to the originating member firm.

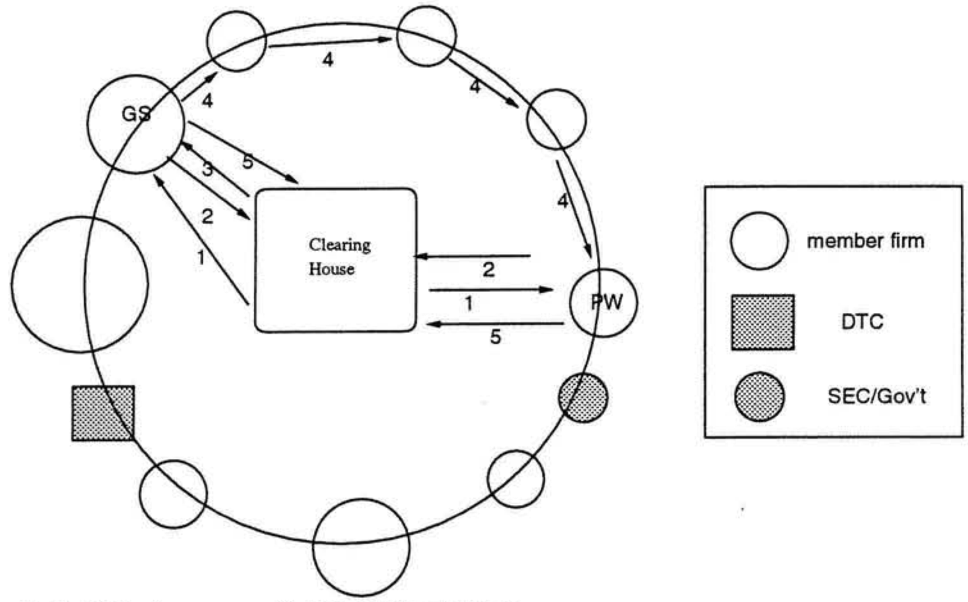
An alternative network arrangement for the dictionary would be to replicate it at various points on the outer network circle to simplify validation of the clearing and settlement tokens. In this way, processing is offloaded from the clearinghouse and distributed at various points between member firms.

3.5 Practical CSnet Examples

How might the CSnet work in practice? Figure 3 shows the common situation of a price or quantity miscompare, resulting in a net price owed dispute. The clearinghouse has informed Merrill Lynch (ML) and Kidder Peabody (KP) of the dispute and the two firms send pq_lookup tokens to each other. The firms consult their internal databases and automated cleanup may be possible (pq_clean tokens sent to each other and to the clearinghouse). If not, pq_unresolve tokens are sent.

Another common example handled well by CSnet is the badge miscompare, as shown in Figure 4. Goldman Sachs and Paine Webber are opposing sides on a trade which differs only one one badge number. The clearinghouse maintains a database of valid badge numbers which GS and PW can query. GS learns of its error, and sends a fix_badge token to PW, and consequently the trade is fixed without manual intervention.

Another function of CSnet which can potentially prove to be valuable to the Cashiers Department is its ability to accommodate the frequent need of a firm to borrow stock to complete a transaction, such as a fail to deliver [Wei86]. Figure 5 shows an example of Donaldson Lufkin Jenrette needing to borrow a security, and broadcasting a stock_loan_request token to as many firms as it sees fit. There is evident cost-saving advantage in the cooperative arrangement, as the services of a third-party 'finder' to find loanable securities



Goldman Sachs (GS) miscompares with PaineWebber (PW) on
badge number [1]. GS and PW send an authentication token to the clearinghouse[2].
The clearinghouse returns a failed_authentication token to GS together
with permuted combinations of digits that are valid, and verifies valid
substrings [3]. PW receives a passed_authentication token.
GS discovers the correct badge and sends fix_badge token [4] to PW.
GS and PW send their findings to the clearinghouse [5].

Figure 4: Badge Miscompare

may well be avoided.

The clearinghouse will find it very convenient to use CSnet to broadcast advisory messages to all member firms. Conversely, member firms will benefit from the timely dissemination of clearinghouse news. Figure 6 shows the common example of a trade entering the regular-way cycle 'as-of' a date in the past. Thus, as-of trades can be placed into the cycle which the belong more promptly and a current source of confusion and error for the Purchase & Sales departments of member firms would be minimized.

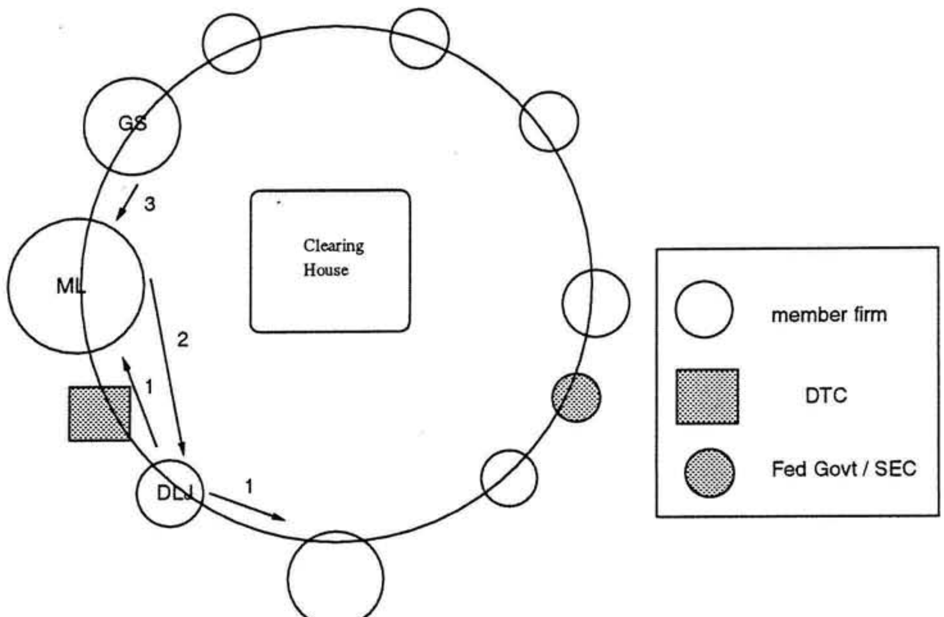
4 Implementation

Many of the hardware (connections, processors, routers, gateways) components for CSnet are already in place. For example, the larger member firms have Internet domains: Merrill Lynch, ml.com, Goldman Sachs, gs.com, Salomon Brothers, sb.com, etc. Therefore, these firms have gateway machines sitting on the Internet and routers that implement security on the bidirectional traffic coming into or out of the firm. They own a pool of IP numbers and can assign a few of them to the CSnet experiment. The routers are fully optimized for determining best network path in the face of one or more participants suffering temporary down time.

Also in place are dedicated lines running from the clearinghouse (NSCC) and the depository (DTC) to many member firms.

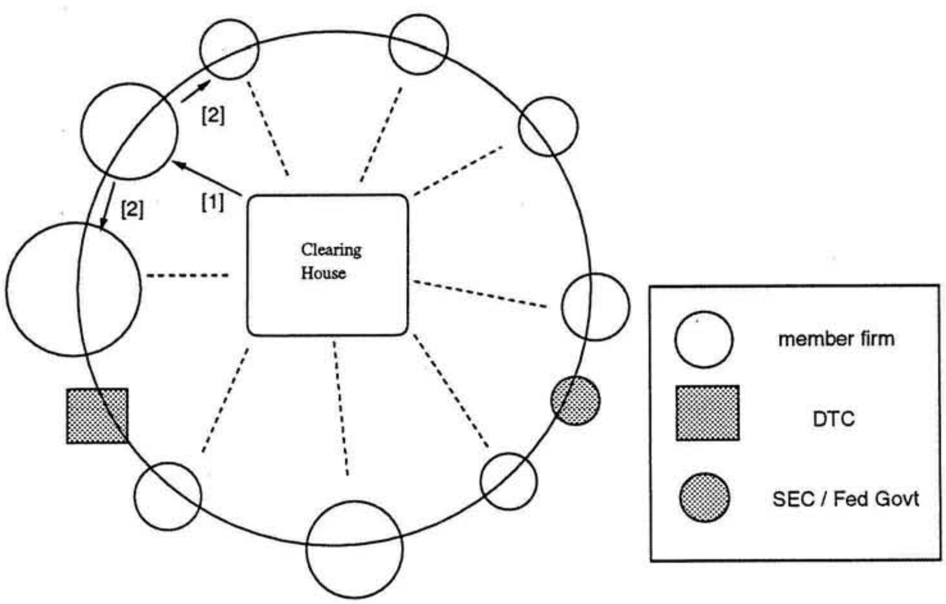
So what do we need to do? Simply put, an **open** and **secure** network must be built:

- Ensure that all participants in CSnet are networked using the TCP-IP protocol. In the first phase, select participants for a CSnet prototype. Have each pioneer build a routing table based on the pool of CSnet prototype IP numbers.



A member firm DLJ needs to borrow a security to complete a fail to deliver. Often it enlists the services of a "finder" (Weiss, 1986) to locate loanable securities for a fee. The alternative is CSNet. The firm in need transmits a stock_loan_request token [1] to all or some member firms depending on the token route header. The corresponding cashier departments can check and send back issue_available [2] or issue_not_available [3] tokens plus overhead fee stipulations.

Figure 5: The stock loan request



Clearinghouse had processing problems the business day prior and now transmits the as_of token along one of the spokes (arbitrary choice). [1] The transmission is then propagated around the ring [2] to all the member firms and other CSNet participants.

The as-of trades are on a five-day "regular way" cycle as-of yesterday although they are being processed today.

Figure 6: Clearinghouse As-of Advisory

- Distribute the RSA encryption software, which is in the public domain (i.e. no cost to the participants) and train in its use. I predict that the member firms will react well to a strong initiative displayed early in the area of secure (private) transmission.
- Establish a CSnet Network Operation Center (CSNOC), analogous to the large NOC's administering Internet traffic but on a much smaller scale. Staffers can monitor CSnet traffic, tune routers as needed, and issue network advisories. A logical place for the CSNOC would be in the clearinghouse machine room. This is not necessary in the prototype stage; it becomes critical in a production environment where network bottlenecks must be identified quickly.
- Establish fallback plan in the event of CSnet outage. The existing scheme of transmitting fixed-column reports is rather unwieldy and perhaps is not the best choice. Another possibility is a backup installation running on a different medium. For example, CSnet might normally be running on a fiber-optic ring and the backup net might be in the traditional underground T-3 coaxial cables. Again, this is not important in the initial stage.
- The initial deliverable will be to demonstrate a CSnet prototype. The time-frame in my estimation is approximately six months give or take a month.

Naturally, prototype rollout will be more persuasive than any theoretical arguments.

If a few of the larger member firms, the clearinghouse, the depository, a subset of interested regulatory agencies and a subset of interested commercial banks prototype CSnet, it will be possible to demonstrate gains in efficiency in clearance and settlement without sacrificing the privacy of proprietary data.

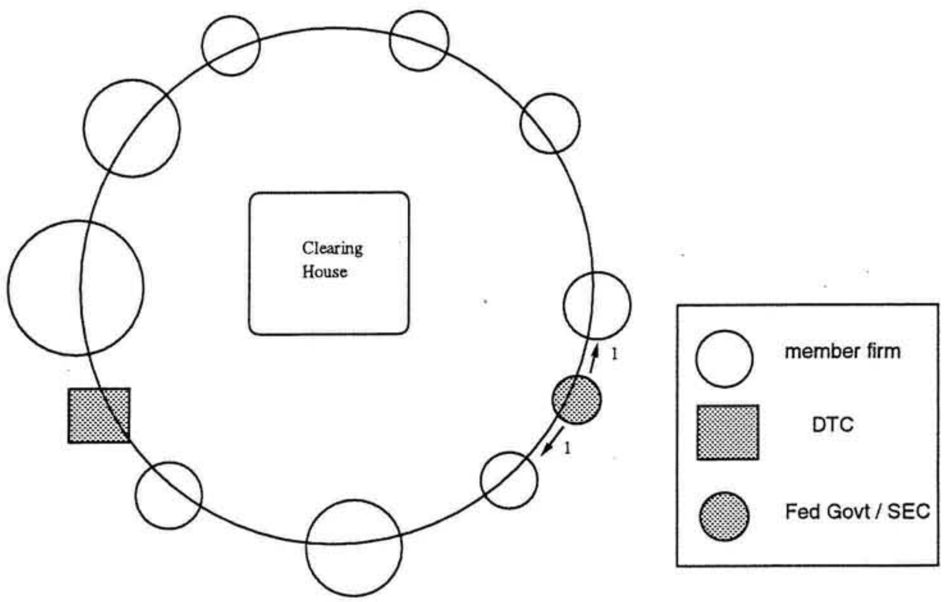
I view the programming effort in prototypic environment to build on a shared library of common code (in the spirit of the Internet) as firms strive to build tools to access the replicated databases of clearance decision rules, current badge numbers, stock loan availability, and the like. The effort on the whole is greatly simplified by the commonality of the TCP-IP data header and the choice of CSnet to make use of attribute-value pairs in the body of the messages facilitating industry standard SQL queries.

Aside from the general market forces driving information systems toward open architectures, there is are several additional incentives of CSnet: extensibility (as mentioned earlier); minimal capital expenditure, air-tight security, and liberation from fixed-format securities messaging.

4.1 The Financial Information Exchange (FIX) Protocol

In 1992, Salomon Brothers and Fidelity Investments started a working group to evaluate the effectiveness of order flow and broker execution on a TCP-IP based network. From its inception to the present day, the backbone network is an open item [Ano93] – member firms and institutions have not committed to full network interconnection. Nevertheless, it is interesting to note that the experiment is gaining acceptance with major institutions such as Fidelity, State Street, and Alliance and with the brokers they do business with[Mat95]. The FIX messaging format is tag-based and does not have a fixed length. The FIX system increases market liquidity by allowing order flow on a public network. The FIX standards and future directions are determined by a dedicated Securities Industry Association (SIA) committee with brokerage and institutional members. For example, the FIX security standard is currently DES (Data Encryption Standard)[Mat95], in which the sender and receiver must both know the same secret key to encrypt and decrypt messages. The protocol is free of charge to any interested party [Wis95a] and third-party vendors, such as Thomson Financial Services, have declared a commitment to use FIX in proprietary products such as Thomson's Autex, which transmits market information to brokers and fund managers[Wis95a].

As with CSNet, the FIX philosophy is to permit application program interfaces (APIs) to be built independently by network participants; for example, Fidelity has an order management system to archive order flow submitted via FIX[Mat95]. Settlement and clearance functions are not part of the current implementation of FIX; however, an extensible tag definition language includes theoretical support for those areas[Mat95]. The FIX steering committee is split on this issue; some believe it is still an open question



The SEC (positioned arbitrarily on the ring) transmits bidirectionally a Form_4 token [1]. Thus every member firm is virtually simultaneously aware of officer purchases and sales. Since this indicator is an important one for trading, the network arrangement improves market efficiency. The frequency of Form_4 transmissions (1 per event? 1 per 5 events? 10 events?) can be fine-tuned during network operation.

Figure 7: Form 4 Advisory

whether the development work involved in reconciling trade systems and settlement systems in the FIX framework is justifiable [Wis95b].

Thus, FIX and CSnet share the philosophy of open networking coupled with independent software development on the part of network participants to process the tokens. The tokens themselves are extensible; FIX uses tag-value pairs in a similar manner to the CSNet proposal. Third-party software development is facilitated in both cases by a freely available base protocol.

5 Future Directions

The ideas behind CSnet can easily be extended to events that occur before the actual trade is made. Consider one problem of today's securities markets – burdensome, hard to read, or hard to acquire information adding needlessly to market inefficiencies. For example, the SEC adds compliance overhead to the trading process. It requires corporate officers who own more than 10 % of a class of equities to file a notice when they decide to add to or reduce their holdings. Thus, in certain trades, there is required accompanying regulatory paperwork. The larger brokerage firms post personnel at the SEC reading rooms in New York or Washington, D.C. to learn of the officer filings in the timeliest manner possible. This is a source of market inefficiency as small investors are likely to learn of the officer(s) plans hours or days after the large firms [3].

If the SEC were to post Form 4 advisories on the network, as shown in figure 7, the participating member firms would learn of the officer plans virtually instantaneously. The firms could reroute the news to the broker workstations and so the customer is much more quickly apprised of this important event.

Another example falling in this category is the rather dense wording of mutual fund prospectuses. The

[3] The change in ownership is Form 4 which is submitted to the SEC manually; the SEC plans to incorporate the form into the EDGAR electronic archive in 1996.

SEC, or equivalently common libraries built by the network participants, can parse these forms[4](485APOS and 485BPOS) after they are submitted electronically via the SEC EDGAR [5] software. The output of the parsing routine would be an easy to read profile, supplying investors and brokers with key bullet point items of the fund. The prospectus synopsis can then be supplied as a prospectus_profile token to all participants. Again, market efficiency is aided as the readership of the fund prospectuses (now in a more readable format) increases sharply.

It should be added that a network linking member firms, with a secure routing protocol, would also be quite helpful to many front-office (sales and trading) functions. One simple example is realtime reporting of the Treasury Bill auctions in the form of tokens sent by the Fed to all participants.

6 Conclusion

"The future direction of financial markets will be charted by automation and systems" [Web93] - and hopefully the nature of the automation will be based on sound principles. CSnet shows us that fundamental network and database principles can be applied to the difficult problems of clearance and settlement. A practical implementation of a prototypic CSnet, in my opinion, would have both a low capital cost (much of the hardware and software is already at most sites) and a low time investment (the modularity and synergies of an open system speed development). The network and its associated databases will break the chain of standards bodies working with inherently limited fixed width messages by exploiting principles that have already been proven on a global scale. The basic infrastructure assumed to support CSNet has already been leveraged advantageously in the FIX order flow and execution network. There are two possibilities to evaluate empirically the efficiencies gained from an extensible and open network protocol for clearance and settlement:

- If FIX expands to subsume settlement and clearance functions then the theoretical efficiencies discussed in this paper will take on a concrete form and empirical studies will become possible. The likelihood of this expansion increases (and, I would argue, is inevitable) when one considers the benefits that would accrue to network participants that possess unified network-aware software solutions for order flow, order execution, trade confirmation, clearance and settlement.
- A prototypic CSNet can be implemented irrespective of FIX's expansion timetable. At a low capital cost, empirical data can be gathered from a subgroup of volunteer participants.

In either event, a practical implementation of CSNet will present a rich field for data gathering. Pre- and post-network data on miscompare rates, miscompare clean-up times, and frequency of rules-based clean-up facilitation between network participants can all be measured. Data content privacy can be guaranteed by encryption protocols without weakening the measurement tools. Post-implementation, further studies are possible to study the synergies of integrating networked order flow and execution (the FIX protocol) with networked clearance and settlement.

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[4]This is possible because sufficient structure is required of the mutual funds in order to pass EDGAR filing validation checks.
[5]Electronic Data Gathering, Archive, and Retrieval

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