METHOD AND SYSTEM FOR CURRENCY CONVERSION

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority of U.S. provisional application no. 60/079,947 filed March 30, 1998, U.S. provisional application no. 60/079,948 filed March 30, 1998, and U.S. patent application no. 09/217,257, filed December 21, 1998, titled, "Method and Apparatus for Localizing Currency Valuation Independent of the Original and Objective Currencies."

FIELD OF THE INVENTION

This invention relates generally to computer systems and more particularly to dynamically converting a first currency to a second currency on a computer system.

BACKGROUND OF THE INVENTION

The need to convert currencies presents an ongoing problem in international commerce and includes not only the need to translate between the currencies of a sender of a product and a receiver, but also those of handlers of the product and any taxing entities in between the sender and receiver. Further, translation between currencies involves translating representations of the currencies as well as translating currency values.

While currency conversion is at face value a simple mathematical event, many obstacles prevent effective and direct implementation. These obstacles include the date and time sensitivity of currency values, and the complexity of rate data, that is, the time value of money. Currency rate data comprises historical rates, prior market close rates, delayed market rates, immediate market rates, future rates (forecasts and with interest-bearing components), options (bets as to future price for sales or acquisition of a currency), stripped bonds, and any other financial instruments. Currency rates vary depending on factors such as

direction of currency translation (i.e. from USD to DEM or DEM to USD), bids, asks, transaction size-dependencies, and whether specific dates/times/currency pairs are missing or unavailable.

The constantly changing relative values of currencies further complicates the operation of currency translation. Currencies undergo sudden and rapid devaluation, and reissues. In addition, new currencies are introduced from time to time, as when countries join together as in the European Union, which plans on introducing a new currency, the Euro, in 1999.

Finally, a currency is not an exact entity. For example, a "dollar" could define a United States Dollar, a Sierra Leone Dollar, or many others. Each dollar has a different value in reference to each other, a value which fluctuates by usage, the size of the translation, and over time. The dollar may also have a different value based on where a trade (or posted bid/ask) takes place. Further, the currency of a specific country is not always a single entity, and could be represented by multiple currencies of common acceptance. The Franc and the Peso are both openly used in Andorra, for example.

A reliable currency translation system must be able to handle the following situations: missing rate information, translation from an original currency basis to an objective currency target through one or more intermediate currencies, and transaction costs and spreads where bid and ask or future contracts can substantially devalue the results.

In the case where a potential customer wants to compare costs of goods or services available from sources in a plurality of countries, such as a trans-oceanic telephone circuit at the countries terminating that line, the task quickly becomes time-consuming and onerous. There is a need for a system to perform this task efficiently and accurately.

In accounting functions including financial statements and projections, etc., it is desirable to have a uniform asset base in order to track currency data with respect to time. There is a need for a system which translates currency to base values which can be compared over time.

A new aspect of international commerce has emerged in the form of the Internet. A problem in Web-based commerce is that online catalogs display pricing information in the local currency of the business hosting the online catalog regardless of scope, customer reach, or target market of the offered products. Global commerce, however, is not specific to language or currency, and there is a need for a method for translating currencies from a base currency of a hosting business to a currency useful for potential customers using a Web site. An accurate and reliable means for translating between currencies would also be useful to potential customers reading printed publications, or otherwise involved in international trade.

Conversion of the value alone from one currency to another is insufficient for complete solution to the problems of currency conversion. Currencies are not displayed the same way in every country and customers expect that a currency format is localized with the prevailing accepted syntactical standard. It would be very useful, for example, for a Web user accessing a page originating in another country to see prices in the Web user's own currency, displayed in the locally accepted format. The display of currency formats in the expected format in a remote location is complex and not handled by existing systems and methods at the current time. Standard techniques for numerical formatting are insufficient because the currency value is not merely formatted, but also might contain prefixes, suffixes, unusual symbols, and sub- and superscripting.

The problem for multilingual and multiple currency web sites is that not every language or culture formats currencies (and numbers) in the same way. For example 1,000,000.00 in the U.S. becomes 1.000.000,00 in Germany. In addition, various currencies have locally accepted display formats. For example, some locales will display 1'000'000 and $^{00}/_{100}$ (superscript/subscript) instead of 1.000.000,00. Furthermore, currency symbols and formatting are based on prefixes, suffixes, and the handling of negative values in different ways. The differences in currency representation create

functional problems for banks unfamiliar with specific currencies and cultural idioms. A successful currency conversion requires both translation of currency value and conversion of the representative symbols as well as display in the appropriate format.

Finally, lack of a functional result is a serious problem for all data processing operations, which typically halt when encountering an error or lack of information. Rate data may not be immediately available at the time it is needed to fulfill a translation request. For business, and data processing, to continue, a way of handling missing data is needed in a reliable translation system.

It remains desirable to have a method and apparatus which provides easy currency translation in a manner structured to provide conversions within the natural workflow of business.

It is an object of the present invention to provide a method and apparatus for performing currency translation which accommodates dynamic currency data.

It is another object of the present invention to provide a method and apparatus for displaying product prices in local currencies on Internet or web-based product catalogs.

It is another object of the present invention to provide a method and apparatus for converting and displaying currency values in local currencies for conversion of text for printed price lists.

It is another object of the present invention to provide a method and apparatus to translate the value of assets in foreign denominations to a base currency or any other foreign currency, or currency equivalent such as gold, platinum, palladium, silver, or rhodium.

It is another object of the present invention to provide a method and apparatus to maintain a uniform asset base valuation for accounting functions such as financial statements.

It is another object of the present invention to provide a method and apparatus to provide arbitrage opportunities for currency speculation by using fast, accurate and reliable currency translation.

It is another object of the present invention to provide a method and apparatus to evaluate multiple sources for acquiring products and services based on localized costs, such as comparing the cost of a trans-oceanic telephone circuit at the countries terminating that line.

It is another object of the present invention to provide a method and apparatus to support local currency valuations in terms of the Euro (EUR currency unit mandated for introduction in 1999).

It is another object of the present invention to provide a method and apparatus to support accounting systems so that transactions can conform to the FASB 52 (1981) standards for providing cross-currency valuations at the time of the transaction or converted balance sheet rollups at current valuations.

It is another object of the present invention to provide a method and apparatus to perform logistical support for arranging international sales and delivery by providing reliable currency valuation and projections.

It is another object of the present invention to provide a method and apparatus to optimizing costs or profits for international investment transactions.

It is another object of the present invention to provide a method and apparatus to evaluate travelers' checks and other cash-convertibles.

It is another object of the present invention to provide a method and apparatus to display a currency value in the locally expected format.

It is another object of the present invention to provide a method and apparatus to resolve currency codes (common character-based and numeric), country names, exchange rate symbols, and currency names in converting from one currency to another.

It is another object of the present invention to provide a method and apparatus to provide display localization independent of any computer configuration including language settings, keyboard layouts, preferred date formats, and

numerical formatting, particularly overcoming host computer configuration limitations to a single display format.

It is another object of the present invention to provide a method and apparatus to provide automatic recognition of currency information within a text-based document, formatting of that currency information into a localized display, and replacing of the original currency display with the newly created localized format.

SUMMARY OF THE INVENTION

The problems of translating between currencies are solved by the present invention of a method and apparatus for localizing currency valuations.

The present invention is a currency translation system that provides for the dynamic translation of a first currency value into a target currency value for the purpose of aiding localization and globalization of financial transactions. The system may be used as a standalone translation system or it may be embedded in a larger application such as a financial analysis program or a Web commerce program. The system takes as input the starting currency, a target currency, and transaction rules. The system maintains a database of currency rates, currency histories, conversion rules and currency representation data. Optimization and backtracking techniques are used to deal with partial rate information and in order to find optimal valuations involving a triangulation of currency translations. The system can produce a single result or a matrix of results from which the user can choose an optimal valuation. The system also provides for the formatting of a numerical currency value into a presentation specific to the locale of the translation request.

Further, the system includes support for translation from a single original currency to plural objective currencies, either as a single original to a single objective, a single original to plural objectives, plural originals to one-for-one plural objectives, plural originals to plural objectives. In other words, one basis can generate a specific

target or a list of targets in different currencies, or multiple sources can generate a one-for-one translation or a complex collection of lists.

By providing a middleware application (inline in-process system and method) that is easily placed between other computer procedures, the currency translation system creates a new fundamental business function. This functionality extends the ease with which businesses of all types can promote products and services beyond a small, local market to a global market with a localized presence. In addition, this invention simplifies the task of evaluating assets of all types (cash-convertibles, stocks, bonds, mortgages, financial instruments, property, corporate entities, etc.) for at least two purposes. First, reduction of mixed basis values to a single currency basis simplifies asset management and accounting. Second, immediate and dynamic currency translation facilitates global finance and optimal markets in terms of locating the best investments and financing.

The currency translation system can be used to dynamically translate currencies from a base to that which is familiar to a web user in another country, to roll-up a multinational's accounting system into a single currency basis, or to evaluate an investment in different countries. The system provides for implementation of accounting systems and data storage of currency or balance sheet valuations using unlimited bases with rollup to a single or many objective currencies while accounting for the present or future value of money. The invention is a system and method that provides for the formatting of a numerical currency value into a presentation specific and necessary for the localization and globalization of business. The system formats currency values for visual display in a presentation consistent with localized expectations.

The currency translation system will facilitate local business to realize international commerce opportunities. The results for customers in the market will be acceptable and familiar rather than "foreign." This is an important aspect in creating the essence of localization and

internationalization for doing business in far-off locations. The invention will expose business and software developers to a focused set of tools that facilitate global commerce without the complexities of local banking systems, brokerage quoting systems, and the general lack of currency information and services at the present time. The most immediate ramification will be the inclusion of these capabilities within online, Internet, and other electronic commerce systems, such as EDI (electronic data interchange), ACH (automated clearing house), electronic web-based storefronts, and web-based advertising. This process and method will simplify complex multiple currency and financial transaction processing operations.

The present invention together with the above and other advantages may best be understood from the following detailed description of the embodiments of the invention illustrated in the drawings, wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic diagram of a currency converter system according to principles of the invention as implemented in a preferred embodiment thereof;

Figure 2 is a flow chart of the operation of the currency converter system shown in Figure 1;

Figure 3 is a flow chart of the operation of the currency converter employing optimization techniques in cases of partial data according to the principles of the present invention; and,

Figure 4 is a flow chart of translation of the representation of currencies according to principles of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 1 shows a currency converter system 10 according to principles of the present invention. The currency converter system 10 resides generally in a computer system having a currency converter processor (hereafter referred to

as the currency converter) 15, and a database 20 storing, for example, user inputs and rate information. The currency converter system 10 accepts user input 25 and provides output 25 to the user where the user may be a person at a terminal on a computer system or a computer process accessing the currency converter system 10. In a first embodiment of the currency converter system 10, a rate data feed 30 provides currently available currency rate data to the database 20.

The currency converter system 10 accepts a plurality of inputs that define a basis, or original, currency. The currency converter system 10 also accepts inputs that define the transaction. The currency converter system 10 translates the original currency value, according to these inputs and also stored conversion rules, into a value for an objective currency, or target currency. The currency converter system 10 then provides an output in a format as required by the user, whether the user is a person or a process.

In the present preferred embodiment, the user inputs are stored in the user specifications data structure 35. The substantive currency information is in a currency codes data structure 40. The information for the currency symbol and other visual presentation is in a currency symbol data structure 45. The currency country information is stored in a country code data structure 50. The transaction information, e.g. source and target dates, is in a transaction data structure 55. Information relating to the value of the transaction with respect to the transaction context is stored in a foreign exchange (FX) valuation data structure 60. A flag data structure 65 holds the data for the various flags in the currency converter system 10. These are exemplary data structures for the present preferred embodiment of the invention. The invention may be carried out using other possible data structure arrangements.

The valuation of the currency is translated according to a change in basis. That is, the objective currency value is the target value resulting from a calculation using a new basis. The basis includes the elements of: country, currency name, currency code, ISO character code, currency symbol, the

relative size of the currency value, the direction of the translation, and the date and time for the currency translation. These elements are stored in the various records in the database as discussed above and the conversions are performed by the currency converter 15.

Because currency value is relative to other currencies and because value fluctuates over time due to fluctuations between currencies and the time value of money, a complex data structure is required to keep track of currency values over time in order to effectively translate currencies. This is accomplished in the present embodiment of the invention, by the combined data structures of the currency codes data structure 40 combined with the FX valuation data structure 60. The two data structures combined store currency identification information, time values and an associated basis, which is described above. For historical values of currency, currency rates would be delivered by the rate data feed, or data having multiple entries with various associated times and bases, in relation to a plurality of other currencies could be stored. In alternative embodiments, the Euro could be used as a base currency. In further alternative embodiments, a basis may be translated to a currency equivalent such as gold, platinum, palladium, silver, or rhodium.

Figure 2 shows a flow chart of the method of operation of the currency converter 15. First, the currency converter 15 accepts inputs of data from the user, block 100. The user input data includes the original currency valuation, the target objective currency, and transaction rules including the dates and times defining the transaction or transactions, and descriptions of the original and objective currencies as shown in the user specifications data structure 35 in Figure 1. The user specifications are not limited to those listed here.

The inputs could be from a human user, inputs from a computer program, or a text-based document such as a page from a Web-based catalogue. If the input is from a text-based document, a filtering process, such as any one of a number known in prior art, identifies the currency inputs in the document.

A translation process to be performed by the currency converter 15 could be a present-time conversion from one currency to another, but the process could also be a historical or future value of money through a translation of currency histories or futures, respectively, and data for those transactions may be entered accordingly. The translation process could also be from a currency basis to optioned values of currency.

Next, conversion rules are specified, block 110. Conversion rules include the conversion rate and the source of conversion rate data. The conversion rules can be taken from a number of sources: immediate user input, a database with conversion rates and country, currency, and symbol information, or computer dictionary lookup table, and/or foreign exchange rate data feeds. By taking user input for conversion rules and rates, the system can handle both known and previously unfamiliar currencies, and can calculate with both known and previously unfamiliar rates.

Next, the conversion rules are customized in response to the user inputs and the transaction rules. This step includes matching the user inputs against user specified conversion rules, a table of currency conversion rates, or a database with currency conversion rates, block 120. The database may be maintained current through various optional methods such as electronic media and delayed or live feed electronic delivery. Further, customizing the conversion rules includes operations such as reconciling currency price differences, handling complex triangulation discrepancies, computing a balance sheet, or systematic work-in-progress contra-asset category for rounding errors.

The currency value is then translated, block 130. That is, the customized conversion rules are used to translate the original currency to the target currency.

Where the currency value translation is not a straightforward application of conversion rules to input data, the translation issues are resolved, block 140. The issues may include issues of currency spreads (i.e. the difference between bid and ask prices), historical, delayed, future

and/or interest laden spreads, spot quotes, swaps, future contracts, and remittances during the conversion process. In the preferred embodiment, a matrix solution is used to optimize the value of the currency using the user specification. Optimization methods of determining the most efficient path from a first point to a second point, such as determining which currency translations yield the most value, are well known and any one of a number of optimization methods may be used here. Ideally, the optimization method chosen would preserve most of the value of the base currency in the conversion process by finding the largest numerical amount resulting from currency trade preferably by checking amount breakpoints and multiple brokerages for best results.

The currency information is then processed for output based on the factors of country name, country codes, currency names, currency codes, or common currency symbols, block 150.

Figure 3 is a flow chart which expands the process of Figure 2 in order to provide a result even when there is missing or out-of-date data. This is important to applications such as Web-based commerce and various financial programs and any other system which requires a result.

The currency converter takes input as in the process described above in Figure 2, block 200.

The currency is then translated to a target currency using the process disclosed in Figure 2, block 210.

Then the original currency value(s) is replaced with an intermediate objective single or plurality of object currencies' value, block 220. In other words, one or more base currencies can be translated one-for-one into a new currency or each base currency can be translated into many or all available currencies to create a matrix output.

If a currency is missing a bid, ask or close valuation between an original currency and a target currency, optimization techniques, described above in the description of Figure 2, are applied in order to estimate a currency value, block 230. Then, backtracking techniques are applied to complete a currency translation or conversion in order to complete the process, block 240. Backtracking is a feature

that reassembles new queries and compound logical constructions from existing attributes and procedures, usually to optimize or reduce complex information into a simpler form. Backtracking is often used to construct a conversion result from one currency to another directly or through one or more other intermediate currencies (also known as "triangulation"), and then process intelligently from different intermediate points to discover if there is a more efficient route. This is critical for complex data processing operations that will often stop when encountering missing or incomplete currency rates. This happens when conversion rates between two specific currencies are not current, seem in error, or are unavailable (due to rate date errors or lack of trading information) and conversion through one or more intermediate currencies facilitates the process.

Finally, optimization techniques are applied to maximize objective currency valuation and/or minimize conversion and transaction costs incurred during complex currency translations or conversions, block 250.

Using the above processes, the user, software designer, or workflow integrator can, by specifying the original currency, the objective currency, dates for the original valuation and object valuation, and the original value, apply an inferred target foreign exchange rate to scale the original valuation to the objective valuation. The original valuation can reside in a database, as a record, as a text file, or a stream inside a larger text stream. The translation is immediate and is dynamically correct based on the accuracy of the conversion rate data and the inputs.

The middleware implementation of the above-described translation engine provides for immediate, dynamic, and in-line conversion of a currency. This means it can be used for display of online web-based transactions in the local currency or used for the dynamic valuation of worldwide assets in a single currency of cash, fixed, or long-term assets within an accounting system. In addition, the functionality can be attached to a database (through object-orientivity) so

that translation and display of a currency is automatic without additional labor input at time of display or usage.

Figure 4 is a flow chart showing the process of presenting a translated currency in a comprehensible format, i.e. in the format expected by one using the target currency. The process and method that accepts various inputs that define the numerical value of a currency and the name of that currency. This is used to match the necessary parameters against user specifications, a table of prevailing currency formats, or a database with currency presentation rules. A raw numerical number is formatted to be comprehensible and match the common business practices of the objective location. User-specifications, table lookups, or database references provide the information to handle currency presentation applying the local currency prefixes, suffixes, and the currency-specific symbols, and the process provides the sequences to create the objective currency in the appropriate localized format.

The process takes as input the name and value of the currency to be represented, block 300. Then, the input is stripped to a raw numerical value, block 310. The currency name is than matched to the sources of currency presentation information: user-specifications, table lookups, or database references, block 320. Then the number representing the value of the currency is formatted according to the currency presentation information, block 330. The appropriate prefixes or suffixes are then applied, block 340. The currency punctuation is standardized according to the presentation information, block 350. Finally, a negative sign or parentheses are applied to the result, or the result is displayed in red in color displays, if the result is a negative number, block 360. In this way, a user sees currency represented in an understandable format in the representation accepted local to the user.

It is to be understood that the above-described embodiments are simply illustrative of the principles of the invention. Various and other modifications and changes may be made by those skilled in the art which will embody the

principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. In a computer, a method for translating a first currency value to a second currency value, comprising the steps of:

providing a first currency value, a second currency, and translation rules;

storing conversion rules to be applied to the first currency value;

customizing the conversion rules in response to the first currency value and the translation rules before application to the first currency value; and,

converting the first currency value to a second currency value using the customized conversion rules.

2. The method of claim 1 wherein the conversion rules include currency rate information.

3. The method of claim 1 wherein the conversion rules comprise historical currency exchange rate information, whereby a past first currency value is converted to a past second currency value.

4. The method of claim 1 wherein the conversion rules comprise projected currency exchange rate information, whereby a projected first currency value may be converted to a projected second currency value.

5. The method of claim 1 wherein the conversion rules include user-specified rules.

6. The method of claim 1 wherein customizing the conversion rules further includes reconciling currency price differences.

7. The method of claim 1 wherein customizing the conversion rules further includes reconciling triangulation discrepancies and rounding differences.

8. The method of claim 1 wherein customizing the conversion rules further includes resolving partial information.

9. The method of claim 1 further comprising:

outputting a matrix of valid translations from the first currency value in response to the transaction rules.

10. The method of claim 1 further comprising:

backtracking currency histories to use historical rate data when up-to-date data is not available.

11. A system for translating a first currency value to a second currency value, comprising:

means for storing a first currency value;

means for storing translation rules;

means for storing conversion rules; and

a currency converter for applying the translation rules and the conversion rules to the first currency value to translate the first currency value to a second currency value.

12. The system of claim 11 wherein the means for storing the first currency value further comprises a means for storing the value and an associated date.

13. The system of claim 11 wherein the means for storing the first currency value comprises means for storing the value as compared to a plurality of other currency values.

14. In a computer, a method for translating a first currency representation to a second currency representation, comprising the steps of:

providing an input currency having a first representation;

providing currency representation information for a currency output;

formatting a numerical value of the input currency according to the representation information resulting in the currency output;

applying prefixes and suffixes to the currency output as required by the representation information;

applying punctuation to the currency output as required by the representation information; and,

applying an indicator of negative value to the currency output as required by the input currency input,

whereby the currency input having a first representation is translated to the currency output having a second representation.

15. The method of claim 14 wherein said step of providing currency representation information further comprises providing a currency name and representation information associated with the currency name.

16. The method of claim 15 wherein said step of providing an input currency further comprises providing an input currency having a name and a value.

17. The method of claim 16 further comprising:

converting the input currency value to a raw numerical value before formatting the input currency; and

matching the input currency name to a name in the provided currency representation information.

18. The method of claim 14 wherein said step of providing currency representation information further comprises providing user specifications for currency representation information.

19. The method of claim 14 further comprising storing a plurality of currency names and representation information associated with the plurality of currency names.