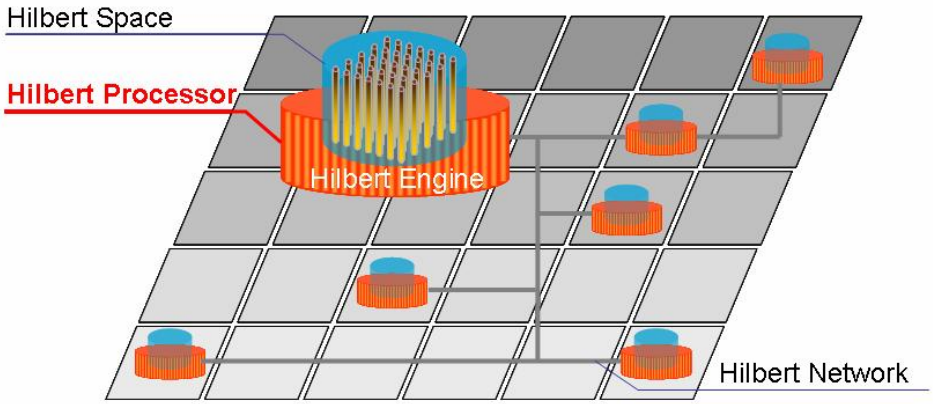
HILBERT® PROCESSOR/ENGINE OVERVIEW

The Hilbert Processor processes all operations necessary to access, manipulate, store and analyze data within the Hilbert Space. It also coordinates the connection of multiple Hilbert Engines and Spaces together to form a networked Hilbert Infrastructure. Because Hilbert Space and Hilbert Processor are that closely connected we will use the term Hilbert Machine to describe this unique combination in the future. There is no Hilbert Processor without a Hilbert Space and vice versa.

Three Major Steps

To make data from databases (structured data) or text from text files (unstructured data) available to the Hilbert Space and to access and analyze it, the Hilbert Engine performs three major steps:



The Hilbert Processor within the Hilbert Architecture

- **Migration**
  Parsing information from table format into single-word files
- **Quantification**
  Converting numbers and text data into unique integers and storing the data along with its context in a multi-dimensional representation (the Hilbert Space)
- **Access & Analysis**
  Finding and accessing data and their contextual relationships in Hilbert Space by applying advanced mathematical operations, and re-converting them to their original representational form.

Why Hilbert?

We are the only solution provider for ultra high-speed access, manipulation, storage and analysis of large volumes of structured and unstructured data.

Speed, Flexibility and Scalability have been the design criteria of the Hilbert solution.

The Hilbert solutions are offered as embedded Hilbert Engine technology, standard products or industry specific solutions.

Bjorn Gruenwald, CEO and Founder of Hilbert Technology Inc.

Hilbert Engine running on an off-the-shelf PC achieves performance levels comparable to those of large mini-computers or even mainframes.

Low cost of ownership

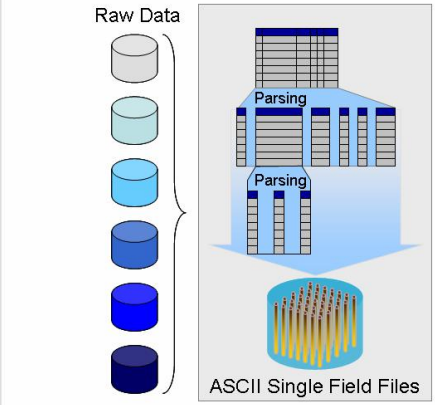
The Hilbert Engine transforms data from source databases into the data's original format without imposing any restrictions or re-formatting rules

No data load restrictions from analysis and reporting

Backup and restore capability for structured and unstructured data

Migration

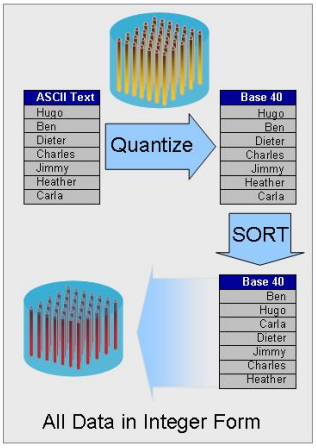
The Migration phase converts each column of a database table into single-word ASCII text (***A**merican **S**tandard **C**ode for **I**nformation **I**nterchange*) or numeric files as appropriate. This phase will also parse text fields which contain more than one word into multiple single-word files. In migrating an un-structured text file, each word is handled individually and stored, along with its position within the text, in single-word ASCII files analogous to a database table. Having such small files promotes rapid and efficient accessing and processing because a larger quantity of closely related data can co-exist in the computer memory at the same time. This set of ASCII files is the starting point for the Hilbert Engine, and is used as reference data.



Migration ASCII Table Information into Hilbert Space

Quantification

The quantification process converts or quantifies numbers and text data into unique integers to allow complex but highly efficient mathematical operations to process converted text information in exactly the same way as it processes numerical data. The quantification process transforms the ASCII text into integers by utilizing a Base-40 algorithm (representing 0 ... 9 and A .. Z plus four extra characters), which allows a unique and economical representation of all data whether originally in numeric or text format. This is the default base; Quantification can be configured to use ***any*** base, as may be needed to satisfy the requirements of the data and the character set used (Arabic or Asiatic languages may take more than 40 characters to represent all their text and numeric information). A simple yet powerful mathematical concept allows the Hilbert Architecture to support all language data.



Quantizing ASCII Information to Numbers in Hilbert Space

The Hilbert Engine does not require human intervention to decide which data to keep and which to throw away since all data is considered valuable, even if it has errors

No data load restrictions from analysis and reporting

No loss of detail in analytics

Embedded data enrichment

Access and analysis is quickly available to your existing processes when you use the Hilbert Engine as an embedded system--preferably in an **SOA** (Service Oriented Architecture) environment

Low cost of ownership

Ease of integration

CPU and RAM usage as well as disc access optimization produces unparalleled performance and speed

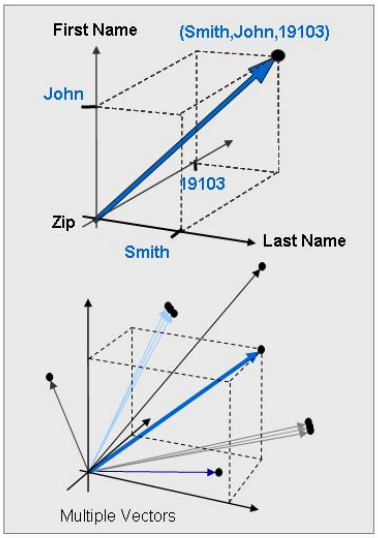
Low cost of ownership

Ability to analyze data in ways not even thinkable before Hilbert technology

Access & Analysis

The representation of all data as integers allows highly efficient mathematical algorithms to be employed in the access and analysis of information within the Hilbert Space. The power of mathematics, from simple arithmetic comparisons to advanced Fourier analysis can be applied to harvest the information that resides within data.

The results are dramatic. Searching and sorting are performed at the full numeric processing speed of the computer, with no added overhead. In addition, the entire body of several hundreds of years worth of mathematical theorems and processes can now be applied in analyzing all the data. Since Hilbert Space data are quantitative (numerical), the process of indexing, which is a time consuming process for existing databases, is not required. Moreover, the files containing such data are significantly smaller and much faster to use than equivalent indexes for ASCII files.



Access and Analyze Data in Hilbert Space

Multiple vectors with similar attributes naturally cluster in multi-dimensional space, unbounded by rule-based algorithms. In this environment, fraud and duplicate entries are detectable and marketing campaigns can be optimized to address people who have similar purchasing patterns or demographic profiles.

Analysis can encompass the entire data set or operate on a subset of the total data set. A subset contains only the attributes specified as relevant by the analyst. Patented, high-speed comparison algorithms provided in the Hilbert Engine make the results of analysis highly accurate and highly efficient.

Scripting Language

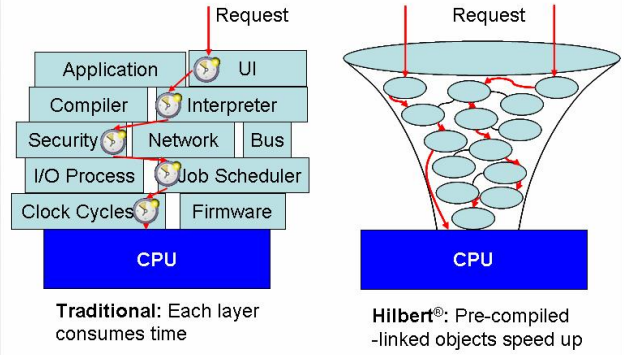
The Hilbert Engine understands (and is, itself, partly written in) an optimized scripting language called the Hilbert Script. Hilbert Script is an easy-to-use, efficient language that users of the Hilbert Engine can quickly grasp. The language compiles quickly and has a low overhead at execution time. Hilbert Script contains a rich selection of graphical routines in addition to powerful analysis tools—it is easy to build appropriate graphical displays of complex analytical results.

Optimization

In addition to the optimization of data storage and access in Hilbert Space, the Hilbert Engine optimizes the speed of CPU (**C**entral **P**rocessor **U**nit), RAM (**R**andom **A**ccess **M**emory) and disc access.

- ***CPU Optimization***

  This performance optimization is inherent to the Hilbert Architecture, achieved through the revolutionary and non conventional application of mathematical methods to the design of intelligent machines. An explanation of Hilbert CPU optimization entails three main concepts.



Hilbert® CPU Optimization

  First concept: the Hilbert Engine bypasses most of the operating system (yes it could even run without a operating system), and in so doing bypasses most of the "other" work a CPU does when managing multiple program execution or performing operating system related jobs.

  Second concept: the Hilbert Engine distributes the computing load automatically over the Hilbert Network, among enough workstations so that results can be generated in an optimally short time.

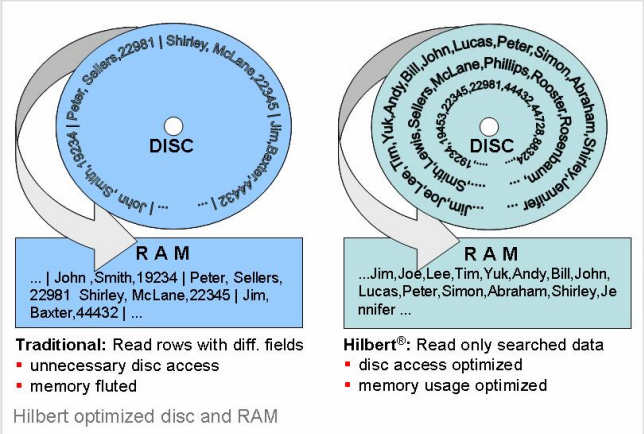
  Third concept: the conversion of ASCII-text into Base-40 integers allows Hilbert to process an entire word in only one CPU cycle while traditional processing of ASCII Base-16 coded words is done character by character, one character at a time, and so requires one cycle for every character in the word. Working in Base-40 gives a speed comparison of 1 minute in Hilbert to apx. 20-40 days in traditional environments; this allows ultra high-speed data analysis even in multi-terabyte data environments.

- ***RAM Optimization***

  This optimization is a by-product of bypassing most of the operating system, which of course eliminates any associated operating system RAM usage. Thus all of the RAM is free to compute, data from a multi-terabyte environment can be computed as Hilbert Space data in memory at ultra high-speed

Disc Access Optimization

Even in a multi-terabyte data environment all Hilbert Engine files are kept small and are memory-mapped. When a file is needed, all that is relevant to that file is brought into memory and kept there as long as required. Because all column data is stored in single-word files a search within (for example) "Family Name" data will force the disc read head to start reading at the beginning location of all data relevant to "Family Name." Subsequent reads incur no costly lifting and moving of the reading head; all data is streamed into memory with minimum disk head movement, greatly reducing delays due to repeated disk access operations.



Hilbert optimized disc and RAM

Conclusion

The Hilbert Engine is optimized for ultra high-speed data handling and does data analysis in seconds instead of hours or even days. Optimized data storage and access in Hilbert Space, the use of highly efficient mathematical algorithms in the Hilbert Engine, and the CPU, RAM Disc, and network optimization synergize to open a new dimension of unmatched processing speed and analytical performance to business intelligence. Not one of our competitors comes close.

Your Advantages

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  - Low cost of ownership
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- The Hilbert Engine does not require human intervention to decide which data to keep and which to throw away since all data is considered valuable, even if it has errors
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  - Embedded data enrichment
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  - Ease of integration
- CPU and RAM usage as well as disc access optimization produces unparalleled performance and speed
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  - Ability to analyze data in ways not even thinkable before Hilbert technology

About Hilbert

Pennsylvania based Hilbert Technology Inc. is an international provider of business intelligence (BI) solutions for large and medium size enterprises worldwide. The offering is based on the revolutionary, patented Hilbert Engine technology for the ultra high-speed access, manipulation, storage and analysis of large volumes of structured and unstructured data. The Hilbert solutions are offered as embedded Hilbert Engine technology, standard products or industry specific solutions. Organizations in public services, law, government, finance, communications, whole- and retail sales, transportation & tourism and chemical & pharmaceutical can employ Hilbert solutions to gain unparalleled speed in access and analysis over large data volumes.

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