International Journal of Engineering and Applied Sciences (IJEAS)
ISSN: 2394-3661, Volume-2, Issue-5, May 2015

Knowledge Machine Design: Pathways of Knowledge in Machines

Syed V Ahamed, Sonya M Ahamed

Abstract— **Knowledge elements are as universal as life itself. The varieties of such knowledge elements are as profuse as the diversity of life forms. In fact, there is no life without embedded knowledge to continue and supply the essentials of living. Conversely, there is no knowledge without life forms to support it continuum of change and adaptation. Symbiotic as they are the interdependency has prevails since the beginnings of life. The evolution of species is founded on the increasing complexity of kels that perpetuate knowledge to constitute new knowledge.**

The knowledge enhanced to gratify the needs for the incremental change in the species is time dependent statistical occurrence. The change may be microscopic or cataclysmic. Change and adaptation are both essential. All forms of life abide by the law that knowledge and life are in deepest harmony just to keep living. After Darwin, we have realized that time to evolve flows through the process of neural adaptation to learn to be the fittest to survive. Knowledge to live by and life to enhance the genetic code are the two chromosomes in the womb of humankind.

In the more evolved species, the complexity of kels and their structure both reach astounding levels perhaps reaching their peaks in human beings. In the other species, the complexity is tailored to suit their own form of life and its needs with three (physiological, safety and reproductive) lower level needs. By process of trial and error, they learn to be optimal in the expenditure of time and energy to learn the adaptation. In humans with higher levels of needs [1] and a higher level of comprehension, the dynamic movement of kels becomes scientific and almost mathematical process. In this paper, we propose a mechanism for the pathways of knowledge in the society and for the graphs for solving complex problems.

Index Terms— **Knowledge Analysis, Integration and Disintegration of Knowledge, Knowledge Elements, Knowledge Evolution, KEL Machine**

I. INTRODUCTION

The origin of *kel* (to represent knowledge cell) is derived from the word pixel to stand for picture element (i.e., picture-cell, written as pixel). In addition, there is a resounding similarity between *kel* and the naturally occurring elements in chemistry at the atomic, molecular and at a reactionary level. For instance, the chemical elements also consist of neutrons, positrons and electrons that play an adaptive role as the elements form molecules, and complex chains of organic, inorganic compounds, and acids. Similarly, a *kel* consists of noun, a verb and a convolution to join them. Nature has provided an innate intelligence for the physical world of materials to exist.

Knowledge element (*kel*) is defined as the minutest particle of comprehensible knowledge that is also computable. Like quantized particles in physics, *kels* have a life of their own and like atoms in chemistry; *kels* can be tracked and reformulated to make up other compound and super *kels*. The principle occurs is nature many times and even in astronomy when numerous Nova structures regroup themselves as a Supernova. In Chemistry, most of the basic elements (like hydrogen, nitrogen, oxygen, etc.) present in biological-cells make up tissues and organs of the body.

Kels support knowledge structures and their organization as much as chemical elements support life forms in species. The greatest commonality lays in the functions that chemical elements and *kels* serve. Whereas elements serve to make the well-structured organization of compounds and molecules secure and stable, *kels* serve to make larger *kels* to be consistent, coherent and cogent. In some cases, the both processes are dynamic and transient.

Much like elements that can be grouped, regrouped, and assigned atomic weights, *kels* can also be classified, reclassified, and assigned *kel*-weights to convey how much the any particular *kel* can be beneficial or detrimental to the society. After all, chemical elements can be used in medicines and in poisons. Much as chemical analysis leads to the separation of constituting elements in compounds, knowledge analysis can leads to the basic *kel*s that constitutes a large body of knowledge centric objects or *KCOs*. At the first stage of the analysis of knowledge, it can be reduced to its tiniest elemental cells, i.e., into *kels*. At the second stage of analysis the atoms in elements, *kels* can be decomposed into quantized groups of noun objects, quantized types of convolutions and quantized sets of verb functions; wherein the convolutions bind noun objects and verb function into a nuclear structure of an action by a noun. For example, a simple *kel* such as John speaks has a different bondage between John speaking than a *kel* John yells or the *kel* John hollers between John (a noun) and speaks, yells or hollers (series of verbs with the same meaning but different tonalities). This simple *kel* can also be an integral part of a larger *kel* such as John speaks at a conference about chemical analysis, etc. The role of the convolution * between the *no* (John) * *vf* (yells) is different from its role in *no* (John) * *vf* (hollers) or in John speaks.

Most species deal with modules or *kuanta* of rudimentary knowledge in order to gratify their routine social and deficit needs and acquire them to make life easier. Most elite learn to deal with and manipulate more advanced *kuanta* of

Syed V. Ahamed holds his Ph.D. and D. Sc. (E.E.) degrees from the University of Manchester and his MBA (Econ.) from the New York University

Sonya M. Ahamed holds Masters Degrees in Social Sciences and in Philosophy and worked as a Senior Research Associate at Columbia University

sophisticated knowledge in order to gratify their special needs and learn them to satisfy their needs, environment, and their circumstances. *Kels* do indeed have a hierarchical structure. Like nature itself, knowledge exists in all textures, sizes and forms. Human senses that operate in real and physical space offer a very tiny glance of a much more intricate and sophisticated universe of knowledge that can be sensed by perception and resolved by programming/mathematical tools. To deal with reality and use in the knowledge era, the structure of knowledge needs careful adjustment, alignment and association, especially if it is to be deployed in computational environment.

II. THE KNOWLEDGE ELEMENT (*KEL)*

Kels play a complex role in communication of knowledge between humans and knowledge systems. *Kels* can share noun objects and convolutions as much as atoms can share the nuclear elements, electrons and valency bonds. The particularly adaptive role of atoms to form varieties of compounds is similar to that of *kels*, when they arrange and rearrange their structures of *no's*, **'s* and *vf's*, to form different configurations of knowledge in a chain of *kels* to form minor *kco*'s (knowledge centric objects) and major *KCO*'s. The analogy is evident to treat the chemical world as a type of knowledge society where the *no's*, **'s* and *vf's* are the basic building blocks and these *kels* are formed and unformed depending on the dynamic social setting and cultural setting. At a very microscopic level, change in the chemistry of every atom is as real as the change of every *kel.*

The role of a *kel* is as fundamental as the role of seminal biological cell in all species. The two chromosome pairs formed as XX (female) and/or an XX or XY (male) chromosomes to constitute the female and male genetic cell evolves after the genetic code in the male (no_1)-kel_1 penetrates and ruptures *(vf(s)* in a distinctly unique fashion(*)) the female (no_2)-$\underline{kel_2}$. A new kel_3 and a new no_3 (the fetus) is thus formed, and it carries the genetic code of both no_1 and no_2 as the no_3-$\underline{kel_3}$. One, twins, and multiple babies are all formed from the process[1] (no_1* vf_1). In a very oblique sense, the inception of knowledge and the origin of life are intertwined. The genetic code should be considered as knowledge that carries the imprint of the species and the two codes (male and female) that get interlock should be considered and the generation of new no_3-$\underline{kel_3}$ noun object-*kel*. Life, actions and behavior are coincidental with noun objects (*no's*), verb function (*vf's*) and the syntactic rules (**'s*) respectively that bind them.

When two *kels* interact to yield a new *kel*, or when two noun objects interact to yield a new noun object, the process can be represented by the symbolic process

kel_1 vf_{12}* → kel_2 for the forward action vf_{12} and by kel_2 vf_{21}* → kel_1 for the reverse process.

[1] The more precise representation of the entire set of processes is represented as $(qno_1 \leftarrow\rightarrow q^*_1 \leftarrow\rightarrow qvf \leftarrow\rightarrow q^*_2 \leftarrow\rightarrow qno_2)$ where the prefix *q* denotes a *kuantum* of the genetic code in each *kel*. Genetic science elaborates the processes that follow from the formation of the seminal cell of the fetus to the duplication of the cells but in the context of where and how the cells are deployed. The changes in the womb and the physiology of the parental object $\rightarrow qno_2$..

As a flow chart that can be programmed on a computer, the unit of interaction is shown in Fig. 1. In Fig. 1, the forward process from kel_1 to kel_2 is shown as *(i)* as full lines and followed by a backward process *(ii)* as dashed lines.

Conceptually, the unit of transaction that occurs between any two noun-objects (or *kels*) is shown in Figure 2. New *kels* are constantly being formed in the minds of humans and knowledge processing units (*kpus*) of knowledge machines [2]. The transient time could last as briefly as a flash in the mind or a cycle time of a *kpu*. The newly evolved *no'* can have lifetime of an unworthy paper or as long as the written word of the Scripture. The truest beauty lies in its truth and the eternal truth lies in its beauty. Together they make up the super-*kel* of timeless Time and flawless Beauty. An endless cycle of continuum results wherein *kels* are born, live and die like microorganisms, humans and even cosmic entities.

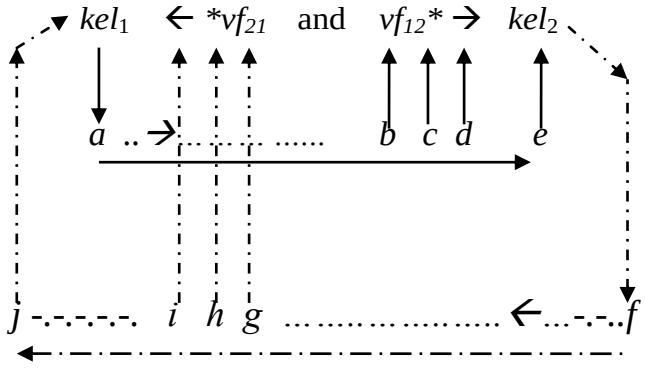


Figure 1. A programmable sequence of steps for a unit of a transaction between kel_1 and kel_2.

Small and large *kels* are recycled in most publications, dissertations and papers. Over time, it becomes hard to discover the origin of the innovation of the seminal *kel* (to the left of pico-*kels* in Figure 3) and the nature of the seminal *no's, vf's* and their convolution *(*)*. A breakthrough *kel* is as rare as the discovery of new knowledge leading to a new chemical element or a newly formulated drug, even though the routine synthesis of drugs in industry is as common as the rehashing of the technical contents in a new publication. The entire occurrence of cyclic nature of *kels* is depicted in Figure 3.

III. PROGRAMMABILITY AND DEPLOYMENT OF *KELS*

In dealing with *kels* in lives of most people, the noun objects, verb functions and their convolutions play a vital role in gratifying human needs. The gratification the lower needs of humans [1] are greatly influenced by noun objects, verb functions and their convolutions that address safety, physiological and social needs. The mental association between needs, and the corresponding objects, and verbs (to gratify such needs) is instilled in the minds of infants and it persists throughout through lifetime. Computers can track and find optimal inventory items and their functions for individuals, corporations, societies and nations as easily as human beings find. However, timeliness, precision and optimality are added features from *kel* and social machines.

If a lookup table for objects, verbs their convolutions and human needs is read into the memory system of a typical

computer, then the algorithms of gratify the entire spectrum of need can be programmed for individual personality types, cultures and (most) circumstances. Social programming has many more variables to consider than scientific programming, but even so, the methodologies of software and firmware engineering [3, 4] and design become applicable to social programming. The social processing units though different and more complex can be designed to handle a larger and more robust set of social operation codes or *sopcs*. The basic instruction set for social processor unit (SPU) based on the input processing of noun objects, their associated verb function, and the appropriate convolutions needs the features of object processor units [5] and the Instruction Register (IR) should be able to decode and secure the microcode for social functions. The *kels* will simply correspond to (very) long words or strings of binary data to be accommodated in the Data Register (DR). The social computers work with data structures in the memory rather than words stored in the memories of conventional computers.

The role of convolution symbolized as * is pivotal in *KEL* machines. Historically, convolutions have facilitated most social and business environments. In the simplest mode, the process of adding has permitted the measure of wealth, currency, grain, etc. Dollar values are simply added to measure the net worth of individuals, estates, corporations, etc. As a next example, when monies are invested with financial institutions, the dollars do not simply add over time and the net worth of the invested fund grows (or even depleted) in a convolved fashion depending on the nature of investment, socioeconomic conditions, location, management policies, etc. As a further example, an organ in a human body functions as a integral and adaptive unit to support the body and mind. The role of an organ is convolved with the role of other organs to support the human functions. In social situations, a statement or a unit of knowledge interjected can cause emotions, energies and functions to become convolved in conjunction with other *KELs* and it becomes more complex than simple addition.

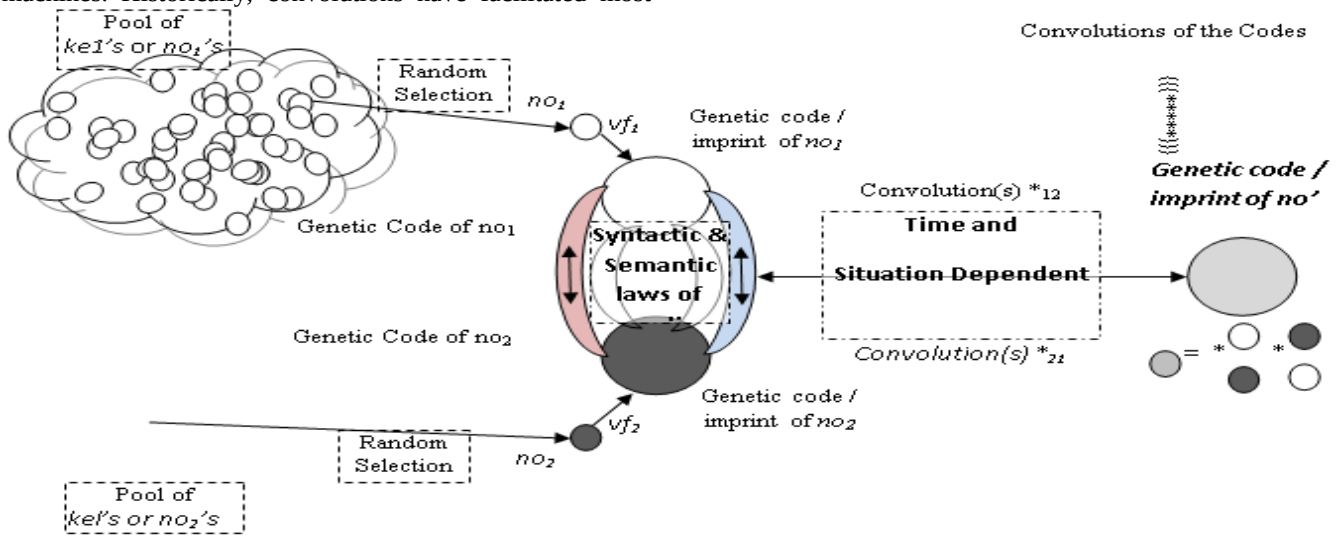


Figure 2. The diagrammatic representation of the interaction between no_1 and no_2 or between kel_1 and kel_2 that is depicted as a convolution whereby a new *no*' (shown as no_{12} / no_{21}) is evolved. The genetic imprint of both no_{12} **and** no_{21} are carried into *no*'. The newly formed *no*' becomes a member of a pool of *no*'s and the process keeps repeating. The flavors of knowledge are as widely dispersed as the sentiments human beings that carry and nurture knowledge elements.

At this stage of evolution of social computing, there are no software modules or hardware units the can process complex social functions like the complex number and array processors that process complex numbers and numerical data arrays. It appears that multidimensional data structure handling capability becomes highly desirable feature of social processor units (*spu*'s)[2]. In the modern machine, special software modules and/or hardware units are included to make the machine functions accurate, optimal and fast. Such a design strategy will facilitate the functionalities of the *KEL* machines greatly since such functions are complex and elaborate.

IV. The Architecture of a KEL Machine

Kel machines process knowledge elements and reside at the top of a new generation of computers to handle knowledge precisely, efficiently and optimally. *Kel* operation code (*kopc*) specifies the operation to be performed on a *kel* operand (*kopr*, that has a predefined format) with a set of attributes (if any) and a set attributes of attributes (if any). The *kopc's* and *kopr's* need appropriate pairing by a suitable knowledge machine compiler. The numbers of *kopc's* and *kopr's* can be quite large depending on the generality of the *kel* machine. The *kel* machines are expected to as precise and dependable as the mainframe business machines that handle a large variety of business, financial and economic problems and offer intelligent decision support systems for the large corporations.

A. The Design Framework of KEL Machines

During the current timeframe, *KEL* machines appear as conceivable as the von Neumann machine (1946-48) had been for the internal combustion (IC) engine designers of the Eighteenth century. Yet, the microcomputer-integrated circuit (IC) chips embedded in most the modern IC engines make them precise, efficient and optimal.

[2] The functions of *spu's* and *kel* processors are alike. The databases are primed appropriately for their different uses.

The blueprint of a *kel* machine becomes more extensive than that of a basic von Neumann machine and all the recent enhancements (massively parallel-processed, micro-coded, pipe lined, MISD (multiple instruction single data), and MIMD (multiple instruction multiple data), etc.) are applicable to *kel* machines. *Kel* machines are simply the new generation of social-computers personalized as hand held devices.

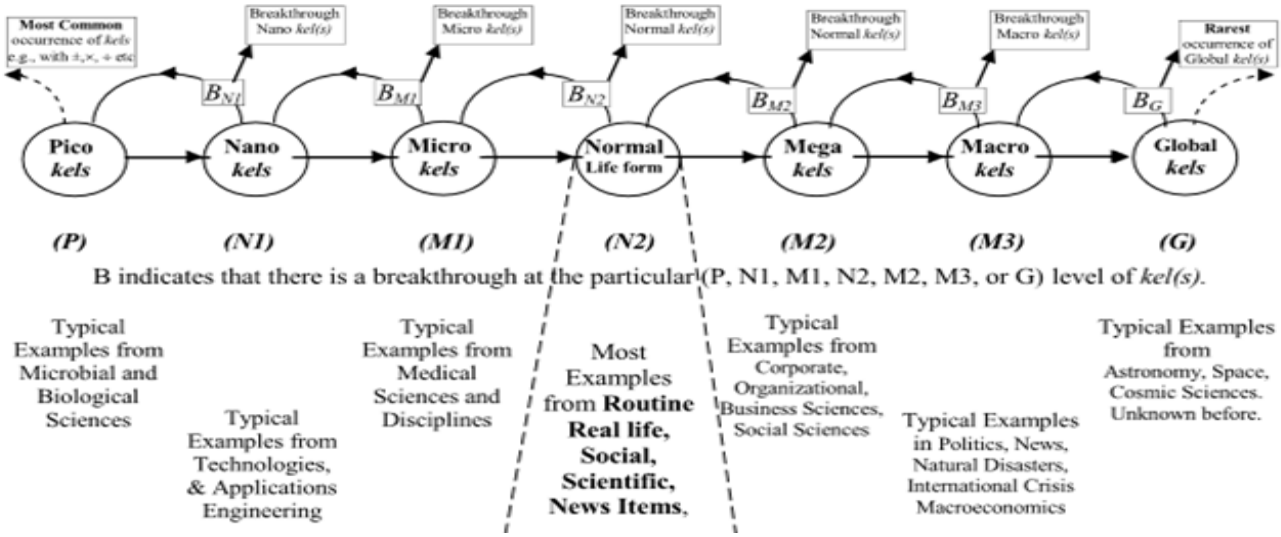


Figure 3. The depiction of the cyclic nature of *kels* in society, sciences, cultures and most environments. The change in the level of understanding and interpretation leads to either a *new kel* or backwards to the *pre-existing* and *documented kels*.

The processor unit of a *kel* machine is depicted in Figure 4. The operation of the machine is consistent with that of a typical computer. *First*, the next executable instruction is brought in the social (or *kel*) processor unit. *Second*, the operation code is decoded[3]. *Third*, the social (or *kel*) operands[4] are brought into to the processor as data structures with shared or dedicated storage within the processor architecture and the execution is done by the sequential or parallel steps in in the microcode that is invoked by the *opc*. *Finally*, the newly processed *kel* (or its data structure) is moved back into the memory of the *kel* machine. To this extent the sequence of operations (F, fetch; D, decode; E execute, and S, store the result) of traditional cpu's is retained in the *kel* cpu's.

B. The Deployment of Database Technologies

Databases are used extensively in the architecture shown in Figure 4 in order to facilitate the complex nature of operation codes and operands in *kel* machines. Such bases may not be necessary for the simpler *kel* machines that are functionally comparable to the simpler single instruction single data (SISD) von Neumann machine. Internet access is not shown in this figure but is easily provided by a dedicated Internet switch to address and access WWW bases. Numerous variations with dedicated or shared bus configurations are also possible for the computer architecture designers. This Figure offers a conceptual methodology and a framework for the newer versions of the Next Generation Knowledge Machines.

[3] The *sopc* (social operation code) can be more complex than the *opc* (operation code of typical computers) of typical computers and diversity of the codes can be quite large. However, complexity and diversity of operation codes are both easily handled by larger and more elaborate IC designs.

[4] Numerous secondary fetch steps may be necessary for bringing linked objects, the attributes and the attributes of the attributes into the processor caches.

The use of database technologies is extensive in most intelligent networks (such as IN/1 during the late eighties, and subsequently IN/2 and the Advanced intelligent Networks or AINs during early nineties, presented in Ref. 5) and in intelligent Internets. This role is necessary in the *KEL* machines, but to a larger and more refined extent. The noun objects (*no's*, their attributes, their relationship to other *no's* are all arranged as a tree structure), the verb functions (*vf's*, the semantic and syntactic rules, and relations to other *vf's*) and the permitted convolutions (**'s*) are also stored in databases and used in an intelligent fashion to cater for an application or social program. The processes though complex and cumbersome can be resolved in modern computers. A typical configuration of such a *KEL* processor is shown in Figure 4.

V. SOCIAL IMPACT OF KNOWLEDGE BASED MACHINES

The numerous social impacts (such as more user options, possible abuse of Internet, overly aggressive marketing, spread of computer bugs and viruses, etc.), of these advanced technologies have been predicated [6] as early as 1987. The technological advances during the turn of this century have further facilitated the spread of smaller corporate and home based intelligent networks.

The knowledge technologists have considerable benefits that can be derived from the future *KEL* machines on the one hand and conversely the marketers have more options to harass and to become deceptive about the products.

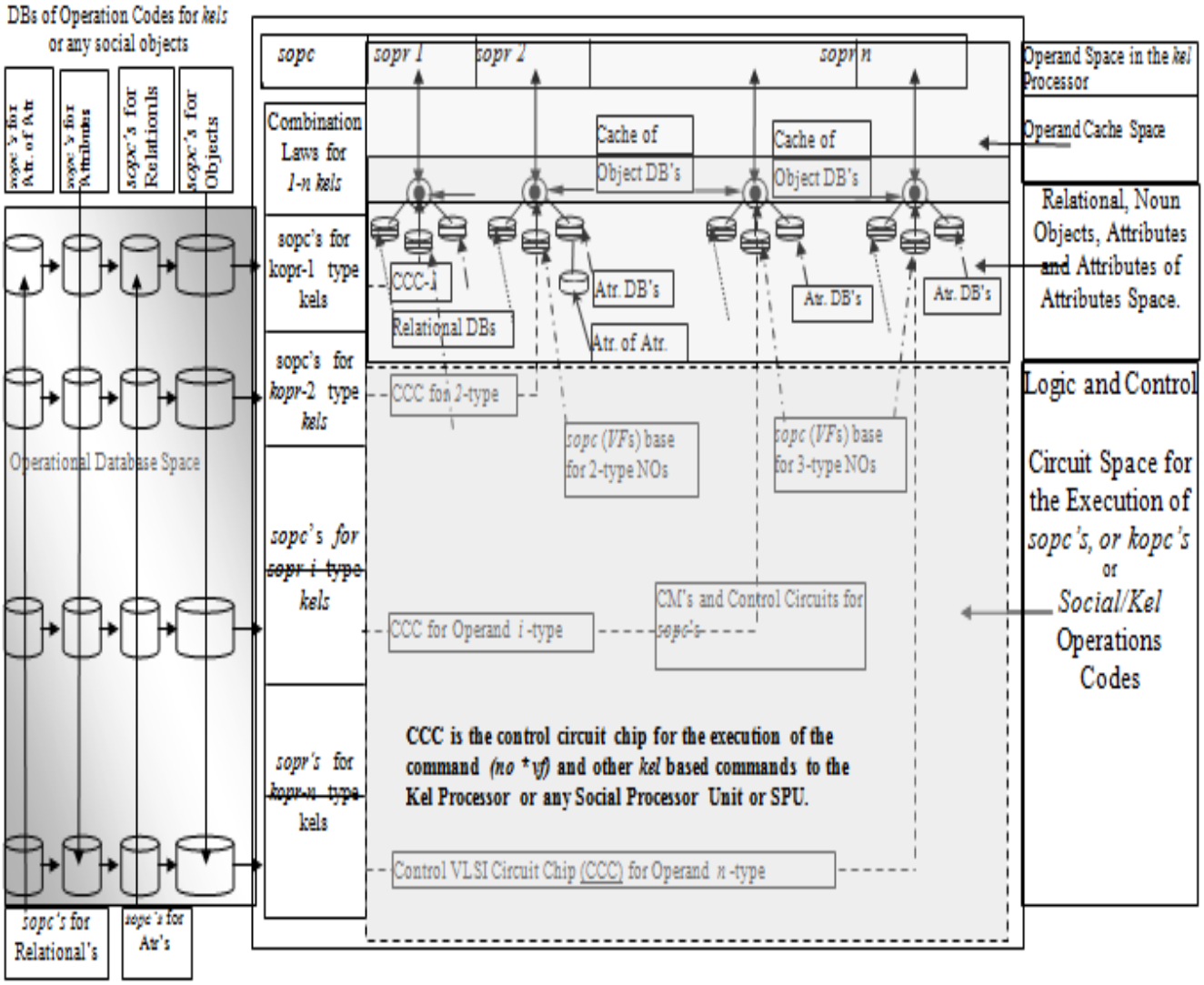


Figure 4. The structure of a *kel* processor for social or *kel* machines. The machine follows a typical FDE (Fetch, decode, (bring operands, linked operands, attributes, attributes of attributes into the processor) and execute sequence for a *social/kel* Operation Code (*KOPC*). Additional microcode code may also be necessary for the complex *OPC's* necessary for *kel* processing.

A. The Uses of KEL Machines

KEL Machines that are bug and virus free can save the users considerable time in performing routine activities of personal, social and corporate lives. The converse statement is equally effective. Personally and individually preferred action can be streamlined for user approval. However, *KEL* machines have the ability to fragment and reassemble functions and noun objects, and further select appropriate convolutions to couple them into decisions, knowledge, explanations, and convincing. It becomes essential that all the functions and their complexity be accurately executed. Such accuracy and dependability of major and minor functions has been already practiced in modern telecommunication networks, Intelligent Networks IN/1, IN/2, AINs, and Internets. The interdependencies between computer networks and intelligent communication networks constitute the platform to building very potent and beneficial social/KEL machines over the next few decades.

B. The Abuses of KEL Machines

As a historical precursor to the abuse of *KEL* machines, we look back on the abuse of Internet to spread mass hysteria and violence that has strengthened wars, social and global unrest. In the current social setting, the ugly news catches more attention than beneficial news and it is to advantage of the media owner to feed the emotional explosives than to explain and solicit the virtues of restrained and orderly transition to a more advanced society. In a sense the beneficial use of *kel* machines need as much precaution as the use of Intelligent Internet network services. The greater complexity (thus the cost) of these machines is likely to curtail the abuse by hate-mongers, mafia, thugs, drug dealers, sex predators, etc.

VI. CONCLUSIONS

A new methodology for processing knowledge is presented in this paper whereby any functionality in the knowledge domain is broken down into one or more (verb) functions by one or more (noun) objects in a predefined and stylized (convolution) fashion.

The methodology is the same as in any conventional machine wherein the laws of arithmetic and logic are broken down into finer and finer processes that are executable in the hard ware environment. The fundamental concepts for the

organization, hardware, the software and the firmware of the new *kel* machines are developed and presented here. The *kel* (knowledge element) machine needs specific architecture, memory organizations, bus structure, and switches to perform the interwoven and elaborate task to handle small and large *kel*s.

The chip design and the time sequence flow of processes need greater consideration than those in typical computers. The recursion of verb function on multiplicity of noun object is akin the multiply and add functions in array processors and in the graphical processors. The design of *kel* processors can become (almost) as complex as the design of various new generations of processors combined into one processor or to design the *kel* processor as an add on a new breed of social computers.

REFERENCES

[1] A. Maslow, *Farther Reaches of Human Nature*, Viking Press, New York, 1971. Also see, A. H. Maslow, A theory of human motivation, *Psychol. Rev.* **50**, pp 370–396, 1943. Also see, A. H. Maslow, *Motivation and Personality*, Harper & Row, New York, 1970., Professional, 3rd Ed., 2012.

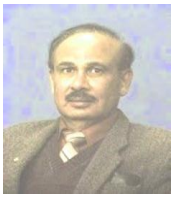
[2] S. V. Ahamed, *Next Generation Knowledge Machines*, ISBN 978-12-416629-5, Elsevier Insights, 2014

[3] L. Bass, P. Clements, Software Architecture in Practice, SUI Series in Software Design, Addison Wesley.

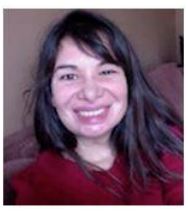
[4] W. K. Giloi, Editor, Firmware Engineering: Seminar veranstaltet von der gemeinsamen Fachgrupe Mikroprogrammierung" des GI Fachausschusses 3/4 und des NTG-Fachausschusses ... (German and English Edition), Springer (October 14, 1980)

[5] S. V. Ahamed, *Intelligent Internet Knowledge Networks, Processing of Concepts and Wisdom*, ISBN 978-0-471-788560-0, John Wiley and Sons, 2006.

[6] S. V. Ahamed, "Social Impact of Intelligent Telecommunication Networks" *Proceedings of Pacific Telecommunications Conference.* Honolulu. (January 18-22):407-414, 1987.



Syed V. Ahamed holds his Ph.D. and D. Sc. (E.E.) degrees from the University of Manchester and his MBA (Econ.) from the New York University. He taught at the University of Colorado for 2 years before joining Bell Laboratories. After 15 years of research at Bell Laboratories,, he returned to teaching as a Professor of Computer Science at the City University of New York. The author has been a Telecommunications consultant to Bell Communications Research, AT&T Bell Laboratories and Lucent Technologies for the 25 years. He received numerous prizes for his papers from IEEE. He was elected a Fellow of the IEEE for his seminal contribution to the simulation and design studies of the High-speed Digital Subscriber Lines. He has authored and coauthored several books in two broad areas of intelligent AI-based broadband multimedia networks and computational framework for knowledge. His doctoral students have continued to contribute to knowledge processing systems and wisdom machines proposed by him during 1999 to 2007.



Sonya M. Ahamed holds Masters Degrees in Social Sciences and in Philosophy and worked as a Senior Research Associate at Columbia University Digital Soil Mapping, Cyber infrastructure, Geo informatics, for the 15 years. Currently, she is a Ph.D. student with Dr. Jennie Stephens, at the University of Vermont and affiliated with The Rubenstein School of Environmental and Natural Resources.