

IT Transformation

KEEL Technology “Executes” Business Strategy

Comsim Whitepaper

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Abstract: CEOs are recognizing that they need to get more from their IT organizations and are asking that CIOs take a more active role in defining and executing the business strategy.¹ This means more than just providing tools to support business decisions. It means taking an active role in creating a more efficient business model. In the industrial age “machines” were created to amplify the capabilities of humans in manufacturing (more production and higher quality). The computer age brought about new ways to manipulate information and control those machines. The computers have created more and more “information” for humans to interpret. Database engines, search engines, data mining tools, and business intelligence tools have all provided support for collecting and organizing information for those poor humans to interpret. If it was economically and physically possible, all humans on earth could probably be applied to interpreting the data. And when they were finished, they wouldn’t be able to “explain” how the information was interpreted to begin with.² One might suggest that for CIOs to take a more active role in executing a business strategy, it would be most helpful to provide a way to mechanize the business execution strategy. That is the objective of this paper.

Introduction: When Sam Palmisano was speaking on the “emerging take-charge role of CIOs around the world”, he was probably not suggesting that he was relinquishing responsibility to Mark Hennessy, the new CIO of IBM. One interpretation of this suggestion is that CIOs should insure that “tools” are provided to facilitate the operation of the business: ERP, Business Intelligence / Business Analytics, Collaboration Tools, Governance and Business Metrics, Social Networking, EDI, etc. These tools and services, along with their support, can be considered the conventional role of the Information Technology (IT) organization:

- to automate the collection of information;
- to facilitate the exchange of information;
- to manage the security and accuracy of the business data;
- to provide access to the volumes of information in a summarized format that can be understood by the decision makers;

¹ Sam Palmisano (IBM CEO) has focused on the “emerging take-charge role of CIOs”...“driving long term growth, leading innovation”...that has been interpreted by Mark Hennessy (IBM CIO) to include “actually setting the strategy and executing it.” – WTN Media Fusion CIO – “IBM’s Hennessy embraces new CIO leadership model” - July 14, 2008, by Joe Vanden Plas

² At least today we do not know how the human brain really works to interpret information. It continues to be a discussion topic for philosophers and neuropsychologists. Also, the human written / verbal language (like English) is not effective in explicitly describing information.

All of the above bullet items are provided so that the business managers can make the best decisions for their organizations.

But maybe Palmisano was suggesting more than this conventional role. Perhaps he was suggesting that the IT departments should take a more active role in the execution of the business strategy. This paper suggests what this would mean and how it might be accomplished. Maybe the IT organizations should facilitate the operation of the businesses; automate some of the decision making processes; enable the organization to capture the value of their management skills in a manner that would allow them to create a continuous improvement process. Maybe this is what IBM's management team is expecting from their CIO. Maybe this is the role that all IT departments should be providing for their organizations. The value of "reuse" has been around for a long time, but seldom has it been used to facilitate the management process.

The Problem

The Business Management Problem: Before you try and improve the business execution process it may be appropriate to provide a basic definition for management:

“Management in business and human organization activity is simply the act of getting people together to accomplish desired goals. Management comprises planning, organizing, resourcing, leading or directing, and controlling an organization (a group of one or more people or entities) or effort for the purpose of accomplishing a goal. Resourcing encompasses the deployment and manipulation of human resources, financial resources, technological resources, and natural resources.”³

If we stand back and look at this definition, we might be able to summarize it by saying that *management is* the act of *interpreting* information and *acting* upon that understanding in order to accomplish a goal or goals.

Now let us differentiate business goals from personal human goals. Business goals commonly have to do with profit motivations, and sometimes more altruistic motivations. Sometimes business goals are documented as the organization's "vision" or "mission statement". Business decisions are commonly allocating resources to help achieve the long term goals.

Personal goals are commonly more private. They often include self-preservation, accumulation of wealth, personal glory, or the desire for personal power or authority over others.

While not specifically noted, personal goals are sometimes contrary to business goals. Decisions made by humans are almost always biased towards personal benefit. When

³ <http://en.wikipedia.org/wiki/Management>

personal goals and business goals are the same, the business wins. Organizations attempt to tie business goals to personal goals. That works to a limited degree by focusing at least some attention on the objectives of the business. But it still leaves lots of leeway for the human decision maker to bias the decisions for their personal benefit.

It is a human trait for a person to resist an audit of their decision-making process. In the medical profession, doctors want their patients to “assume” that they always know everything necessary to treat disease, and that they are not biased towards any treatment or diagnosis. Politicians allocate funds to meet the needs of the population and want their voters to assume there are no hidden reasons for their decisions. Military officers pursue military objectives by exercising command and control decisions. They do not want their particular biases to be exposed. Similarly, business decision-makers want everyone to assume that their decisions and actions are best for everyone without recognizing that there may be some personal reasons for making, or not making, particular decisions.

In reality, most decision-makers do not know everything. They make their decisions based on what they know, what they have heard, and how they feel at the instant they make the particular decision(s). Often they are facing multiple issues (personal and business) that determine how they allocate their time in order to study the issues. There are always business stress points as decision-makers are pulled in many directions at the same time. All of these issues impact the quality of the decisions made, and the resultant actions that are taken.

Management Migration: Business decision-makers take their skills with them in pursuit of their personal goals. Mid-level managers develop their skills as they are exposed to new problems. They probably make, or at least suggest how some decisions should be made, in their development years. When they walk out the door, or move to a new job, they take their experience with them.

Human Decision-Makers are Human: Humans also suffer from limitations of being human. Human error has been identified to have several components:

- Lack of Attention / Situation Awareness
 - 20 minutes of focused attention can be handled by humans
 - Humans are commonly dealing with many different simultaneous issues
- Failure to Perceive
 - Humans commonly fail to pick the issues from complex patterns
- Limited Short Term Memory
 - The 7 plus or minus 2 rule for the number of concepts a human can consider at one time
- Poor Judgment
 - Improper integration of multiple inter-related pieces of information

These reasons all assume that the decision-makers *want* to make the right decisions. If you add human “behavior” to the mix you can add procrastination (there is no decision that you cannot run away from), personal versus company objectives, personal risk

tolerance...all of which can be counterproductive to management of the business then you begin to understand why the execution of business strategy can use some help.

Weaknesses in human behavior can be translated directly into weaknesses in the business execution process:

- Lack of Attention / Situation Awareness
 - Management fails to react to changes in the market, the economy, the political climate, technology advances, competitive strategies and tactics
- Failure to Perceive
 - Management is made up of individuals with their own levels of understanding of individual topics and may not recognize new opportunities or risks when they pop up
- Limited Short Term Memory
 - Management attempts to keep track of all the “trees in their forest” and just cannot keep up with all the decisions and actions that must be managed for most efficient operation
- Poor Judgment
 - Management fails to appropriately assign resources and allocate risk because they have no formal way to make decisions (gut feel management)

Accountability: Decision-makers are seldom held accountable for the decisions that they make. There are several possible reasons for this. The foremost reason that decision-makers are not held accountable for their decisions is that any explanations that they provide are described using a verbal or written language (like English). Every sentence is subject to interpretation by the presenter and by the listener. Rarely are “all” the justifications for a decision or an action described in a mathematically explicit manner. The English language is not mathematically explicit. For example, if a decision or action had a secondary impact, even if it impacted the primary decision, it would probably not be exposed (kickbacks, personal investments, friends, promises, trips and sporting events provided by lobbyists, etc).

Management Training: Many companies have formal training classes they offer to their management personnel. Sometimes operation-focused companies have management training programs where they bring new hires through rotating job functions in order to expose the new managers to various parts of the business in hopes that this will broaden their experience base as they take on more and more management decisions. Some companies send their managers to formal decision-making classes (like Kepner-Tregoe, etc), where “soft” processes are taught. The key point is that every time a company acquires a new “manager” the costs are repeated. If they hire a new manager at the senior level, they can only “attempt” to guess how successful the new manager will be in a new business environment. In these cases, the costs (and risks) can be very high.

Summary of the Problem:

Presently corporate officers cannot provide a mathematically explicit justification for their decisions, even if they wanted to. The English language does not allow a mathematically explicit presentation of information. Every noun and verb requires some level of personal interpretation. When the nouns and verbs are modified by adjectives and adverbs, it is easy to see how information can be twisted to support any decision or action.

Also, no one ever attempts to highlight every item that is considered in making a decision. And it would certainly not be possible to explain every item that is not considered in the process.

Where we are:

1. It is impossible to improve what you cannot measure.
2. It is impossible to measure what cannot be measured.

This means that if you want to improve management you must have a way to measure management decisions.

If you want to measure management decisions you must have an explicit way to document how decisions are made.

If you want to have an explicit way to document decisions and actions you must have a way to expose **all** of the alternatives considered and **all** of the pieces of information that impact those alternatives.

So the present state of the art is to create glossy presentations supported by spreadsheets full of numbers, to baffle the audience and suggest that the business decisions have been validated. The “gut feel” and “personal biases” are hidden from review.

The Requirements

Augmented Management: This paper suggests a technical approach to provide augmented management (the ability to facilitate continuous improvement in the business execution). The objective is to capture the processes a business thinks it understands in a manner where the decisions and actions can be revisited, audited, reused and enhanced. The assumption is that if decision-making processes can be architected so they can be reused and extended, then business management can be captured as a corporate competency that can be retained and enhanced over time. An organization should be in a mode of making better and faster business decisions. And they should create a decision-making repository that increases their organizational value.

Disclaimer (Start Small and Expand): When we talk about augmented management, we are talking about a path to the future. One would not want to suggest that day-one, all decisions will be automated. The objective is to start with the low-hanging-fruit and build a process that will be extended over time that gradually covers more and more areas. This process will then be used to *assist* the human management team by highlighting concepts that have been previously captured so the organization can hopefully accelerate response to recurring issues, and to minimize costs and risks in the process. Using this process would also insure that information that has previously been deemed important is considered in those recurring issues, thus eliminating some of the opportunities for human error that might have been encountered in the past.

Requirements: To extend the responsibilities of the IT organization, one must provide a service that has the following characteristics:

1. Models must be mathematically explicit
2. Easy to capture decision-making models
3. Easy to modify and extend
4. Easy to understand, explain, and audit
5. Reproducible / Can be automated

Explicit Notation: This is a requirement, because if one cannot describe information in a mathematically explicit manner it can never be measured for its importance or value. This is especially true when most management decisions result from the accumulation of multiple factors.

Easy to Capture: Differential calculus is commonly used by mathematicians and scientists to define functional relationships between complex data sets. Calculus, however, is not the common language of most management teams. Some might consider it appropriate for managers experienced in certain domains to be able to explain their ideas to mathematicians. Those mathematicians would, in turn, create the complex formulas and give them to the software engineering team to encode and test. Several cycles would likely take place before anything of value would be available. This scenario can easily be rejected as it would be extremely costly and prone to translation errors.

Easy to Modify and Extend: Organizational management (like military commanders) will continue to encounter a changing environment. Competitors will continue to search for new opportunities to place their products and services in the lead. If one is to provide a solution to management, it must be easy to extend to support new capabilities, new risks, new cost items, new regulations, and new options to consider.

Easy to Understand: Competitors will not just sit still. A management decision that was correct one day may be wrong (or less than optimal) the next day. When things go

wrong, it is mandatory that the reasons for failure can be immediately determined. Only when the reasons for failure can be easily understood, can the models be corrected.

Reproducible: Machines were created to amplify the capability of humans (speed) AND to improve quality at the same time. By automating the interpretation of information and providing explainable / auditable decisions and actions, a company's IT organization can facilitate the execution of the business strategy.

Types of management decisions: Some example decisions and actions commonly allocated to management include:

- Prioritize / Re-allocate / Re-direct
- Do / Don't Do (choose between separate options)
- Expand / Downsize (Add / Remove)
- Reward / Punish

These types of decisions and actions require that management has the capability to *understand* and *measure* pieces of information in order to respond.

Business Vision and Core Competencies:

Fundamental to making any business decision is the organizations business vision and core competencies possessed by the business. These items are necessary for the managers to understand as they make their day to day decisions. The vision statement identifies the objective of the business. The core competencies are the company's perception of the tools they have to achieve the business objectives.

The Solution (KEEL Technology)

Knowledge Enhanced Electronic Logic (KEEL®) Technology⁴ provides a new way to process information. More specifically, it provides a way to capture, test, package, audit, and explain human-like reasoning, that in turn, allows systems incorporating KEEL Technology to execute organizational strategies. It accomplishes the capture and test tasks through the use of the KEEL "dynamic graphical language"⁵ (DGL) to graphically encode business policies. The KEEL DGL also supports the audit and explains tasks by making it easy to understand how information is interpreted. KEEL Technology supports the packaging of the policies as KEEL "engines" are created to interpret and execute the policies created with the KEEL DGL. It accomplishes all of this without conventional

⁴ <http://www.compsim.com/AboutKEEL.htm>

⁵ YouTube video introducing the KEEL DGL: <http://www.youtube.com/watch?v=WBs-w1lgZgk>

mathematical formulas, so that anyone, with reasonable intelligence, can “model and see” how information is integrated and how “decisions and actions” are accomplished.

Company “policies” commonly define a code-of-conduct for employees as they perform their duties. These policies tell the employees how to react to situations (how to interpret situations and how to respond). Sometimes their primary purpose is to document that management has performed their governance duties to insure that legal and ethical decisions are made. Some companies give their employees simple tests to show that they have some minimal level of understanding of the policies.

At the highest level of an organization, a strategy will have some kind of business objective. This might be called the “strategic vision”. For example, it is to make a profit by satisfying a market demand using some kind of product or service. The organization has several things under its control: It can attempt to increase demand with advertizing or by adding new products to its portfolio or by expanding its geographic coverage. It can also increase the number of trained sales personnel to attempt to increase its market share within the total market. It can acquire or create new products that might entice the existing customer base to upgrade their systems. How an organization chooses to move forward is a “subjective” decision-making process that can be modeled and executed with the help of KEEL Technology. In this manner, KEEL can define management policies that can be measured and audited like any other process.

Real-world-results highlight deficiencies in the tactics that have been employed in the pursuit of the strategy. The types of adjustments are relative to the size of the business and the resources under its control. It may not be appropriate to just correct the most important things first. It may be more appropriate to adjust multiple parts of the problem at the same time.

A Simple Example:

Given: An organization has a particular product that addresses a specific market. In the “perfect” situation, the organization has a manufacturing organization that is perfectly sized to manufacture the appropriate number of parts to satisfy the market. The company also has the “perfect” number of trained sales staff to reach the desired market.

Potential issues:

1. Inventory increases.
2. Manufacturing cannot keep up with the demand.
3. Sales personnel leave the job for new opportunities, limiting product sales.
4. Changes in the products confuse the sales team limiting their ability to sell.

These “items” are inter-related and the management response to this “simple” situation cannot be effectively handled by addressing parts of the problem in isolation. A balancing act must be performed to address the items collectively.

With KEEL Technology, one models the inter-relationships between factors using the KEEL “dynamic graphical language”. This allows organizations to create interactive business models that can be deployed as autonomous-consultants to help management execute the business strategy more effectively.

When you are finished you have a policy that equates to a complex mathematical formula. As you develop the policy you interact with it and see how the system will respond. You get immediate feedback. You describe how the policy is to be interpreted; not how to solve a specific problem.

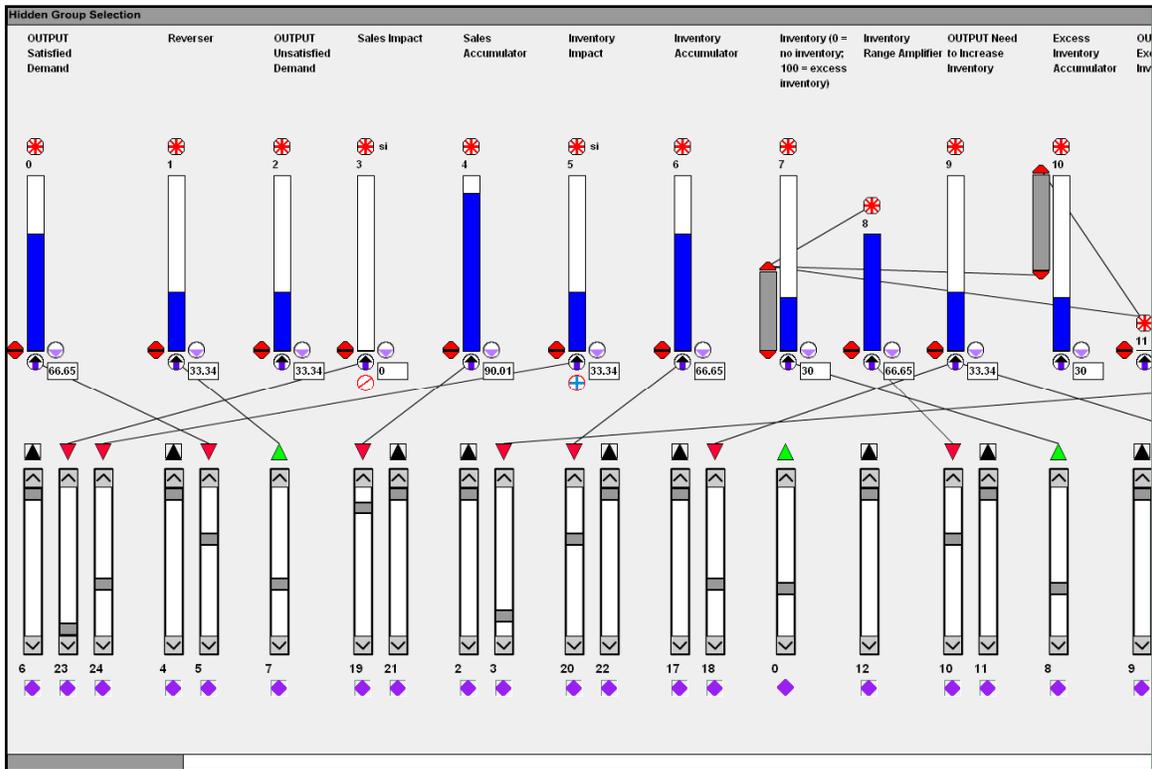
When developing models in KEEL, one is always considering the importance of pieces of information AND how any piece of information might impact others. There may be direct and indirect relationships that need to be considered.

The suggestion is that organizations can build their own “models” and extend them as they strengthen this part of their business.

With KEEL, one can create models that highlight the most important actions that a business might take and show the relative importance to other actions. One can trace wires to understand dependencies. This example shows how inventory and a trained sales staff need to be collectively managed. It is not appropriate to accumulate a “planned” inventory if there are no sales personnel to sell them. It is also not appropriate to accumulate a trained sales group if there is nothing to sell.

The following image shows a screen capture of this simple policy defined using the KEEL dynamic graphical language. If you execute this language on a personal computer you can interact with it by adding factors that contribute to the decision-making process. You can identify complex relationships between data items. You can simulate inputs and see immediately how your model will respond.

In this simple example, you can simulate changes in inventory and available trained sales staff and see the impact on market coverage. You can see automated directions for manufacturing and the acquisition and training of sales personnel. You can trace the justification for the decisions and actions as well as cause and effect.



NOTE: This is an example, and not a tutorial on the KEEL dynamic graphical language. A more in-depth discussion of the code can be found at the link below.

Creating complex models has historically required complex mathematics that has been encoded in complex monolithic software applications which are difficult and costly to develop and manage.

Using KEEL Technology, the policy execution process is separated into a display component (determining how one might want to interact with the policy) and the operational model that can best be developed, viewed and understood with the KEEL DGL. To examine this example and interact with the KEEL DGL, go to Compsim's website at:

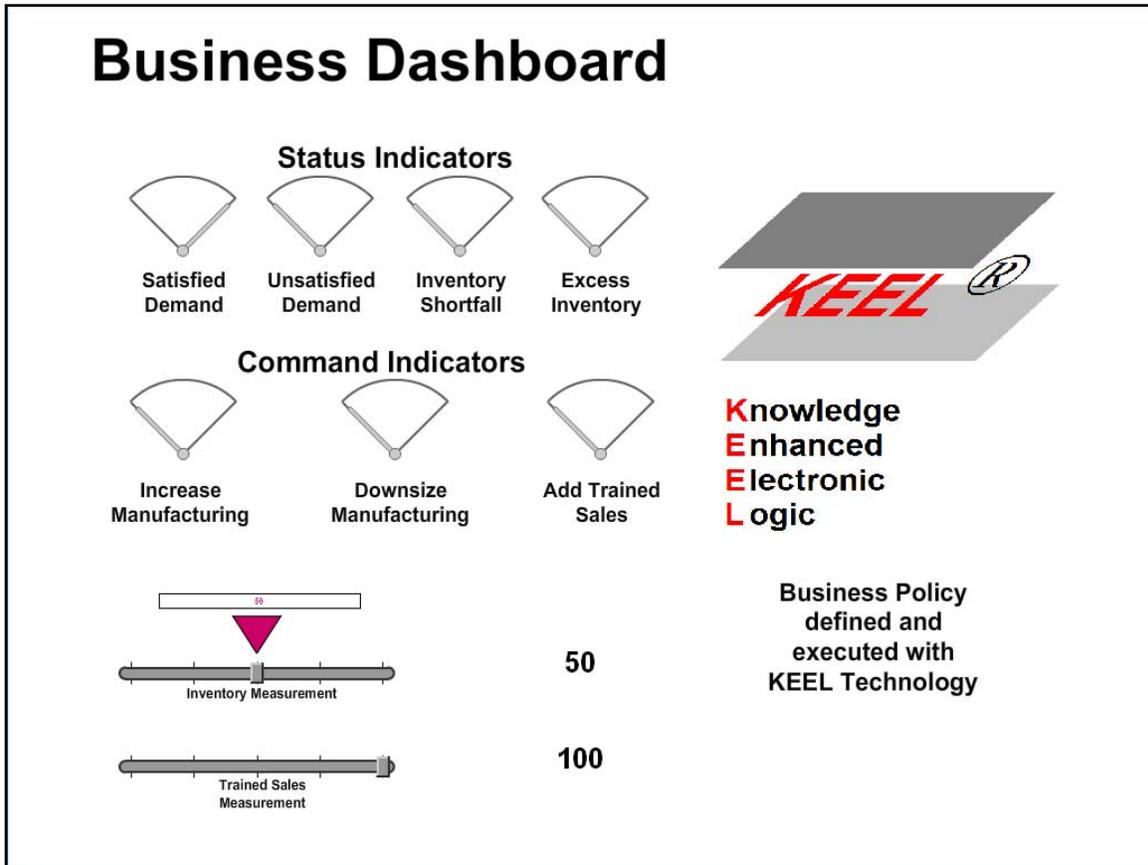
<http://www.compsim.com/demos/d62/ShowKEELBusiness1.html>

This links to a Flash rendering of the KEEL DGL for this example where the interactive nature of the language can be tested. A discussion of this specific model is provided.

Models created with the KEEL DGL can be packaged as source code for KEEL "engines" that can be integrated into the organizations management tool set. KEEL "Engines", process the information and can easily be integrated into almost any application. Presently C, C++, C++ .NET, Java, JavaScript, Visual Basic, Visual Basic .NET, C#, Flash ActionScript, Octave/MATLAB, Python (and a few others) are supported. Unlike other IT "tools", however, it is possible to create an active advisory

service to act on real-time business data and execute the strategy (or provide an auditable “second opinion” as appropriate).

KEEL Technology (language and processing components) makes it easy to integrate policies encoded in KEEL into almost any application architecture. The following image shows how the previous example might be displayed in a business dashboard. External data collection techniques would be used to drive the sliders. The URL above, points to a more detailed explanation with both the language-rendering and the dashboard driven by KEEL “engines”.



Summary

It is now suggested that IT Organizations need to take a more active role in the execution of business strategies. Businesses need to make better, faster decisions to compete. There will be more demands from regulatory institutions and from stock holders to insure that the decisions and actions taken are appropriate. Failure to act will not be tolerated. This requires that the decision-making process is performed better and faster. It also requires that the decision-making policies and practices are audited. Knowledge Enhanced Electronic Logic (KEEL[®]) Technology provides a way to capture, test, package, audit, and explain human-like reasoning that drives the execution of business strategies. KEEL Engines can encapsulate skill set that organizational management must possess in order to fulfill their decision-making responsibilities.

KEEL Technology supports the requirements to be

- explicit and measureable,
- easy to learn and use,
- easy to modify and extend,
- easy to explain,
- easy to package for automation.

KEEL Technology provides the foundation to support the mechanization of the types of management decisions commonly made by management teams of large and small organizations today. KEEL Technology is available now, only from Compsim.

Compsim LLC is a technology provider focusing on next generation cognitive technology for application in business, government, automotive, medical, military, financial, and electronic gaming markets. Compsim licenses its KEEL[®] technology for use in embedded devices, software applications and for the Internet. The website is: <http://www.compsim.com>.

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