CASE STUDY

Managing the Introduction of a Voice-Oriented Data System in the Retirement Services Division

The case study presented here depicts a technology that does not actually exist. That hypothetical technology, however, sets the stage for important dynamics among public managers, private vendors, political leaders, subordinate jurisdictions, and public sector employees and unions. The details of the case situation are pertinent to many real jurisdictions, but the situation and characters are fictional.

The year is 2017 and the information industry is entering what many observers believe to be its most profound transformation since the late 1940s Fundamental developments within the past decade, coupled with several new advances in nonlinear laser optics, promise to redefine the very nature of informators (formerly known as computers). It is predicted that the traditional distinction between processing capacity (often measured in units such as MIPS), memory, and storage capacity (both traditionally measured in units such as megabytes and gigabytes) will soon be obsolete. The classic categories of "hardware" and "software" no longer apply. Since the processing and storage of information are no longer separate in any way, these traditional distinctions no longer have meaning.

Several dramatic theoretical and engineering advances have combined over the past decade to bring about this new generation of machines. The first prototypes are now several years old, and a handful of small firms in Silicon Valley, off Route 128 in Massachusetts, and in Tech Valley (along the Hudson River in New York) are rushing to market with new products. Foremost among these is Voice Office Systems, Inc. Thus far, traditional giants in the field such as IBM-Sheduan, Oracle, Sun Microsystems, Texas Instruments, and Microsoft have failed to introduce product lines using this revolutionary new technology.

BACKGROUND OF THE NEW VOODS TECHNOLOGY

The advent of Voice-oriented Optical Data Systems (VOODS) resulted from the convergence of five basic and applied engineering advances since 1997. The fundamental discovery that made this new technology possible came from a Danish mathematician, Erling Svensen. Svensen had demonstrated that, in theory, an infinite amount of information could be stored within the so-called "attractor" for a specialized set of equations.

Charles Farnworth, a physicist at Cal Tech working on the Defense Strategies Project, had demonstrated that Svensen's attractors could be nearly perfectly described using less than one

megabyte of information. In theory, an essentially infinite amount of information could be stored within a structure that itself could be described with a relatively small amount of data.

All of these developments would have been so much theoretical mathematics had it not been for the development of the first nonlinear laser devices at the Massachusetts Institute of Technology in 2005. For the first time, a physical device was capable of producing the theoretical attractors originally posited by Svensen. Using a small bit-oriented program to define the structure of the attractor, virtually limitless amounts of information could be stored in the structure of the attractors themselves. In much the same way that a single set of nerves controlling the muscles of an arm or leg can produce an almost infinite variety of movements, so too the limited, but cleverly structured, information defining the attractor allowed for the development of virtually infinite new combinations of information.

The third breakthrough emerged from the Japanese initiative in "fifth generation Artificial Intelligence-oriented" machines first launched in the early 1980s. While this research program had not paid off for many years, the theoretical propositions developed by this research were directly applicable to the new VOODS technology.

The fourth breakthrough was in the systematic work on voice encoding and decoding that had been ongoing in many research centers since the 1980s. Reliable protocols for coding voice commands had become available in traditional bit-oriented machines in the late 1990s. This technology was taken wholesale into the devices used to code the structure of the attractors.

Finally, dramatic advances in laser optics provided the final advance necessary to bring about the new generation of technology. The creation of fully optical logic devices had clearly obviated the need for semiconductors or any form of electronic circuits. This, of course, was necessary for the final development of nonlinear, attractor-oriented information processing machines.

PRACTICAL APPLICATIONS OF THE NEW VOODS TECHNOLOGY

(See the accompanying schematic.)

While the theoretical and applied innovations that brought VOODS into existence form an interesting chapter in the history of science, the practical applications of the new technology are no less astounding. Voice Office Systems, Inc. (VOS) brought about the first commercial applications of this new technology in the very early Twen-Teens (as they came to be called).

VOS' new system was capable of actually learning the voice, syntax, and style of an individual user. Each of these features of speech would be programmed into separate and ever-increasingly complex and unique attractors. Hence, the combination of these three attractors could literally learn to recognize and mimic the voice and speaking patterns of an individual.

Furthermore, using knowledge frames and inference-generating structures, additional modules of the system could literally learn routine office procedures. Using this powerful combination, such machines could carry out assignments using broadly worded instructions. For the first time, a machine could receive and "understand" abstractly worded verbal instructions such as "Draft a letter to Smith at Keystone Industries requesting an update on progress on the generator

contract." Attractor structures within the memory contained the necessary specific information on Mr. Smith, on Keystone Industries, and on the generator contract to create the necessary letter. In effect, the machine could play the role of an administrative assistant of infinite patience and untiring energy, if only limited intelligence.

VOS quickly came to realize that this new technology could be invaluable in storage of various forms of personal data – health records, insurance information, retirement records, payroll records, employment actions, etc. Various attractor modules could learn the pattern and style of a "data manager" who could be located almost anywhere and could interact with the system over gigabyte wireless networks. Other attractors could "learn" the knowledge frames associated with a broad range of well-defined (and some not so well-defined) situations and problems that might face an organization when tracking information about users, customers, clients, or patients – what came to be called "units" in the new data storage format. These attractors could take the place of certain "professionals." With sufficient programming and learning, the attractors themselves could "learn" to exercise a limited degree of discretion over decisions that used to be left to "front-line" workers and professionals.

Each "unit" (i.e., person) in a database could be assigned a single attractor, so that in some sense one could imagine that the machine had come to learn about or "know" each unit about whom data was being stored. The machine could act as an intelligent assistant, helping to monitor input, output, and processing of new information and cueing organizational staff when problems might exist (such as potential patterns of behavior likely to affect an insured's risk profile; patterns of service usage likely to raise costs; fraudulent claims; improper usage of the system; "hacking"; etc.). Staff could query the system or update it whenever they interacted with the "units." The bottom line? The expert human judgment of professionals could be extended through this system, allowing fewer professionals to complete the work currently done by existing human and computer systems. The knowledge of a few extremely talented professionals could be propagated throughout the system through appropriate attractor structures.

Moreover, the non-expert aspects of many organizational systems could be greatly streamlined by the unique "intelligence" of the VOS system. Senior personnel in an organization would have far greater resources to draw upon in making decisions about goods or services for their "units", be they customers, clients, or patients. Since the system would have better, more complete information about a "unit" than was possible with paper or electronic records, and since the VOS system could continually stay abreast of (1) new information, (2) new models for analyzing that information, and (3) new ways to leverage the information, each "unit" would receive better-informed, more consistent, more specially tailored services. In short, services could be revolutionized.

GENERAL PROBLEMS WITH THE VOODS TECHNOLOGY

While the new VOODS technology offers immense advantages, it is not without its practical problems. Foremost among them is the uniqueness of individual attractor structures. The simple facts are that VOODS systems programmed to be used by one data manager or professional

cannot be used in any effective way by another. That is, these "assistants" can be responsive to only one combination of voice, cognitive structures, and operating procedures at a time.

Second, these machines are not easily compatible with any of the old electronic machines. This is especially a problem, since most of the data systems developed in the 1980s, 1990s, and early "Oughts" were in the form of fully relational databases in electronic form. While these relational databases are now clearly obsolete, they are in use everywhere and represent immense capital and staff investments. More importantly, they contain essential information concerning, for example, "unit" demographics, which should be transported from these old systems into the new VOODS system. At the moment, only a "low-tech" solution is practical: optical scanning by the new system of individual data records in the old system, plus the creation of additional attractors that specify how the scanned data elements relate to each other.

Third, VOS has moved toward a new unit of information, the MERG (memory encoding and recall generator), for creating the attractor structures. MERGs bear no relationship to old memory units such as bits, bytes, or words.

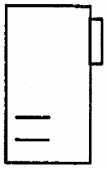
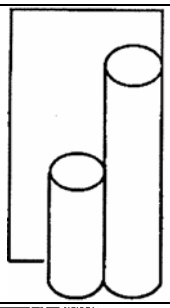
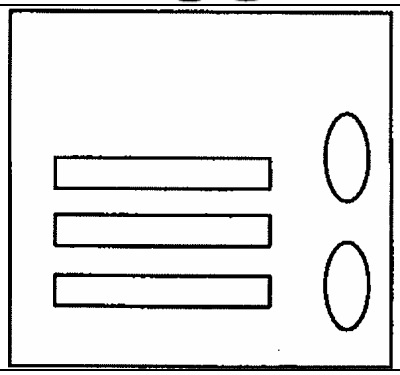
In addition to these technical incompatibilities, the new VOODS technology creates a host of personnel and management issues. For example, data processing professionals have been trained for some time to work in an environment of fully integrated micro and mainframe systems with fully distributed processing through local area networks (LANs) and Internet2 (the 50 gigabyte per second successor to the Internet). This orientation will lose most of its functionality in the new world of VOODS technology. Existing data processing professionals were brought up on old concepts of fully integrated, relational databases and traditional hardware and software systems. The retraining costs will be immense.

THE SITUATION WITHIN OFFICE OF STATE COMPTROLLER

Dr. Sally Ehrlman, the Executive Deputy Comptroller (EDC), has been watching the development of the new VOODS technology since it first hit the press in the early Twen-Teens. A hospital administrator by training, Ehrlman had closely followed the first hospital systems pioneered at the Harvard Medical School. Before becoming EDC, she applied for and received a demonstration grant to introduce the new technology within a hospital she was managing. This grant had been provided by the VOS Corporation itself, with VOS providing equipment and expert assistance in the project.

Her hospital experiment was an overwhelming success. Physicians were able to maintain individualized records on all clients and to use these data profiles for patient management. There was a demonstrated increase of 35 percent in the number of patients who could be served by the physicians on staff. Yet, even with this greatly increased patient load, they applauded the results and felt that patients were not being shortchanged in any way. In fact, just the opposite – they took great satisfaction in giving better care to more people with the same level of effort. It was an actual case of that elusive goal "doing more with less." Physicians and clinicians were flocking to use this new technology, practically leapfrogging over the facility managers and data processing personnel in their understanding and use of the new technology.

Figure VOODS.1: Major System Components

	**Hand-held Personal Attractor Device (HandPAD). Contains attractors related to an individual user. Measures 6" x 4" x 1". Each employer must have a HandPAD; OSC will need several hundred for its employees.** **Unit cost $7,500 (2017 dollars).**
	**Personal Attrractor Generator (PAGE). One unit located in each county. Generates and stores attractor structures for each staff member and "unit." Imports analytic and procedural attractors from central AID. Up to 300 structures can be embedded in each HandPAD. Handles inquiry traffic between HandPADs and AID.** **Unit cost $1.64 million (2017 dollars).**
	**Attractor Integrator Device (AID). Maintains continuous scanning of all PAGEs. Responds to inquiries from all HandPADs and PAGEs. Performs integration across all attractors and users. Generates locally available profiles and reports on demand and automatically as the results of integrative "learning." One central unit needed for OSC in Albany.** **Unit cost $503 million (2017 dollars).**

Comptroller Litesi appointed Dr. Ehrlman (an outsider to OSC) specifically because she was viewed as an innovator in the use of technology for management of complex record systems. The Comptrollers efforts are in line with Governor Cuotaki's ITNow initiative, which was the centerpiece of her last campaign and will be a major issue in her upcoming re-election struggle. Upon becoming EDC, Ehrlman decided that VOODS technology was ideally suited to the management of data in at least two of her areas: Retirement Services and Pay and Revenue Services, but has opted only to begin by implementing the system in Retirement Services.

Dr. Ehrlman envisioned a new system with the following features:

- Integrated information storage and retrieval across the retirement systems
- Improved public access to retirement records
- Powerful heuristics to (a) aid workers in their estimation of future resources available to them and (b) improve the actuarial basis for state allocations to the retirement system
- The ability to "learn" new information about actuarial models as they are published
- The ability to use existing public *and* private databases to provide a better profile of life expectancy on a worker-by-worker basis
- Automation of many appeal and modification functions (for instance, those related to changes in marital status)

- A higher degree of decentralization allowing the attractors to be tailored to the needs of workers, senior decisionmakers in OSC, and data managers among the local government "employers" who are responsible for data entry
- Greater devolution of data responsibilities to local government, schools, etc. (the "employers")
- Integration of many automated office functions for staff at all levels

The Comptroller has (somewhat warily) supported purchase of a VOODS system. The estimated cost of purchasing this new equipment is $783 million (in 2017 dollars), with a training budget of about $14 million included in this number. However, the estimated payback period is expected to be less than four years.

PERCEIVED PROBLEMS WITH THE VOODS SYSTEM

Not everyone is totally pleased with the new technology, certainly not the technology as being marketed by VOS.

The popular press is filled with rumors that IBM-Sheduan is about to release its own version of the VOODS technology. Informed speculation is that IBM-Sheduan will not adopt the same MERG standard as has VOS. These rumors suggest that IBM-Sheduan has developed and is testing a more powerful new technology for shaping attractor structures that will not be compatible with the VOS system and may work better. It is likely, however, that VOS will institute a patent fight if IBM-Sheduan attempts to enter this market. A major lawsuit could push the availability of competitive systems off for years.

Laying this problem aside, there remains the technical problem of incompatibility between VOODS information systems and the more traditional bit-logic electronic machines. Information processing professionals in OSC predict that the adoption of the VOODS technology will lead to the creation of two entirely separate information systems within OSC – the legacy electronic systems and the new, attractor-based one. There appears to be little hope in the near future of reconciling the VOODS data structures to the more traditional structures necessary to maintain the existing bit-logic relational databases. Some specialized transfer protocol is needed, and although much R&D work is going on, nothing has yet been tested or put on the market. Having just spent the past decade gaining integration of hardware and software capabilities within OSC, information processing professionals are understandably reluctant to allow a fracturing of information systems again.

Jack Langhan, President of PEF, has already expressed stiff opposition to the new technology. Quite frankly, their fears stem from the belief that the new VOODS technology will strip many workers of professional responsibility, making their jobs almost routine in nature.

Local governments around the state have expressed concern that the system will force them to retrain workers to be data managers for the new reporting system. They worry that hiring costs may rise since a new attractor must be "trained" with each new data manager hired. They are

also concerned that the new system may have hidden costs that they will have to bear. VOS has suggested that savings on OSC's side could be shared with employers in the system, but so far the Comptroller has made no promises.

Civil Service is concerned about the new technology for several reasons. First, it seems clear that their newly completed conversion of several job series to reflect an electronic age will become obsolete. For example, after what everyone agrees was much too long a struggle, Civil Service titles finally reflect the reality that some stenographic and secretarial positions no longer exist. They were only recently reclassified entirely into the word processing and information processing series. Since these new VOODS systems are truly voice-oriented (they even have proper grammar and can spell), Civil Service is beginning to realize that the very nature of clerical and data entry work is about to be completely transformed again. Furthermore, a two-decade-long debate still rages over the role of technical information skills in professional job classifications. Do they belong in specialty titles or are they so fundamental that, like literacy, they belong in the description of every skilled occupation?

Program managers in the facilities have yet another set of concerns. Using a sophisticated network of the latest generation of blade servers for support of database-driven, web-delivered services, they have finally achieved a relatively uniform information environment. Most facilities have completed the transition to a paperless office, and internal and external communications, as well as worker records and financial systems, are all being handled within it. The new VOODS technology now threatens to create self-standing information systems within every subunit in OSC - perhaps with every OSC employee having his or her personal information environment. The administration of sources is bound to be complete bedlam.

THE CURRENT SITUATION

After much acrimonious debate in the Assembly (lead by Assemblyman Gartin, who has close ties to the downstate "bit-based" companies like IBM-Sheduan, and eight members from rural districts) but with relatively strong support in the Senate (especially from the President Hrgin and three senators from regions where VOS has subcontractors), a bill was passed to fund the initial deployment of a voice-activated system. The initial budget is $692 million (2017 dollars). The Assembly required local employers to pick up the remaining expense ($91 million) as a form of cost-sharing. After an initial round of bidding, VOS was selected as the primary contractor, but IBM-Sheduan and Oracle have lined up supporters in the legislature to pressure OSC over the VOS contract. VOS has several partners in their bid, including PalmOne (to construct the HandPADs), Microsoft (to build a user interface, perform maintenance on the existing system, and as partner on data transfer development), and four subcontractors to help build the basic infrastructure at OSC in Albany and in those counties where OSC has no permanent presence (cooperative siting of the PAGEs within a county or local government facilities is one option).

Think about these questions:

1. Who are the primary stakeholders in this deployment? How are they likely to perceive this new technology?

2. What are the resources that these stakeholders bring to the project – and to efforts to block deployment of VOODS? Be creative; there may be resources at work here that are not explicitly mentioned in the write-up.

3. What are the primary migration issues in moving to this new technology?

4. What strategies might OSC pursue in order to make implementation more successful?