

DATABASE SUPPORT FOR MICROCHIP IDENTIFICATION IN COMPANION
ANIMAL IDENTIFICATION

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A Master's paper submitted to the faculty
of the School of Information and Library Science
of the University of North Carolina at Chapel Hill
in partial fulfillment of the requirements
for the degree of Master of Science in
Information Science.

Chapel Hill, North Carolina

July, 2002

Approved by:

Advisor

Kenneth Andrew Brockway. Database Support for Microchip Identification in Companion Animal Identification. A Master's paper for the M.S. in I.S. degree. July, 2002. 58 pages. Advisor: Stephanie W. Haas

This study examines the use of microchips, scanners, and identification databases in companion animal identification and tracking. The study intended to discover whether the competitive database provider environment or the structure of the database systems themselves are appropriate for the information need, or if they are likely to change.

The PETtrac™ recovery network, operated by AVID Inc., and the Companion Animal Recovery (CAR) system, operated by the American Kennel Club (AKC) were examined and compared to the systems of the National Crime Information Center (NCIC), the Integrated Automated Fingerprint Identification System (IAFIS), the National Center for Missing and Exploited Children (NCMEC), and the proposed National Identification System. The services provided by PETtrac™ and CAR appear to be accommodating pet owners' needs for a reliable form of permanent identification and tracking. Competitive forces and business principles will likely determine any changes to the number or type of database providers, or to the structure of the database systems.

Headings:

Animal welfare -- databases

Database design

Identification numbers, personal -- United States

Integrated circuits

Pet supplies

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1. INTRODUCTION

The population of companion animals in the United States is increasing each year. As a result, the number of animals separated from their owners by either loss or theft is also rising. Unfortunately, evidence suggests that these animals are rarely reunited with their rightful owners. By becoming part of a growing homeless population, these animals place a significant burden on our communities by requiring organizations to manage them as feral colonies, strays, or shelter residents. In order to more efficiently manage and possibly decrease the number of displaced pets, individuals and organizations are looking to proactive “identification” as part of the solution.

Pet identification can take several forms, and each one has its advantages and disadvantages in identifying and recovering missing animals. One method that is becoming widely used as a permanent form of identification is *microchipping*. As used in companion animal identification, microchips provide a practical and effective identification alternative to more traditional methods.

Despite the promise of microchips, there has been little discussion concerning the ownership, design, and operation of microchip identification systems. Currently, two primary organizations are involved in operating companion animal identification and tracking databases relating to microchips. Are these organizations providing products and services that ultimately provide consumers and society with an ideal

companion animal identification system? How do companion animal identification and tracking systems compare with identification databases used in other applications?

To answer these questions, this paper will provide an overview of pet identification, microchip technology, the organizations that operate microchip identification databases, and the environment in which these organizations compete. A comparison will be made between companion animal identification systems and identification systems used to identify and track people. By looking at the information needs and database solutions behind human identification systems and measuring them against needs and solutions behind animal identification systems, we may better understand and predict the future of companion animal identification and tracking systems.

2. OVERVIEW OF PETS WITHIN THE UNITED STATES

The evidence and popular opinion suggest that pet ownership is an important component of family life and an important issue for our communities. A study sponsored by the Pet Food Institute (2001) indicates that the number of pets within the United States is on the rise. Data collected in 2000 shows that 55% of American households own at least one pet (para.1). According to Duane Ekedahl, executive director of the Pet Food Institute, the level of pet ownership comes as no surprise, “For 20 years we have seen the number of pet dogs and cats increase in the U.S. This simply shows the important part pets play in all our lives” (para.2). The Pet Food Institute (2001) study found there are over 75 million pet cats and 59 million pet dogs

in the United States, with 34% of households possessing at least one cat and 37% of households comprising at least one dog. These numbers are consistent with those reported by the Humane Society of the United States in regards to a survey completed in 2002 by the American Pet Products Manufacturers Association. The Humane Society of the United States (n.d., “U.S. Pet Ownership Statistics”) reported the American Pet Products Manufacturers Association found there are 68 million owned dogs and 73 million owned cats in the United States.

Based on the popularity of pets in the U.S., one could assume that Americans are educated and conscientious caregivers. However, we should be careful not to make assumptions concerning the health and well being of the American pet population simply due to the prevalence of pet ownership. The level and type of care bestowed on a pet can vary and there are no doctrines or official policies, beyond basic animal cruelty laws, that are universally followed by pet owners. What is considered acceptable or humane treatment is often a matter of opinion. A simple survey of people from varying cultural or socioeconomic backgrounds will uncover an array of beliefs and practices. However, it should be noted that geographic location (suburban vs. rural) or economic status - although possibly correlated with a certain grade of animal care - are not the only influencing factors. Although societal lines sometimes draw the differences, the underlying cause is predominantly related to education and basic awareness. Research conducted by the National Council on Pet Population Study and Policy (n.d., “About the NCPPSP” section, “Education Material”) reveals that “Many human-companion animal relationships fail because people have

inaccurate and inappropriate expectations of their pet's medical and behavioral needs, and their role and responsibility in providing for these needs.”

The care and management of 134 million individual pets, roughly half the human population of the United States, poses numerous challenges for individual pet owners and the communities in which pets live. Whether funded by tax dollars, grant money, or from the pockets of ordinary citizens, communities routinely spend thousands of dollars on animal control, sheltering, and advocacy. For example, in 1999, Gaston County North Carolina (n.d., “Animal Control” section, “1999 Budget”) budgeted \$1.1 million towards animal control. In 2001, the City of Bloomington Indiana (“Animal Programs” section, “2001 Expenditures”) expended \$662,149, divided between animal shelter operations, animal control field operations, volunteer coordination, and education. With limited budgets, communities are often faced with the challenge of placing a value on animal control. Such was the case in Toronto, Ontario, Canada according to the former Mayor, John Sewell. Sewell (2001) reported when the local Humane Society, who contracted with Toronto to provide animal services, said it would require about \$1 million annually (the prior contract was for \$776,000), the city's Board of Health decided to terminate the contract rather than renew at a higher price. According to the Board, the problem was money. The Board's chairman commented, “ We didn't have any extra money, and the question was whether we would take it from tuberculosis or dental programs” (Sewell, 2001, para. 4)

Organizations, both public and private, constantly struggle with animal control issues including the recovery of lost pets and the management of stray populations. Although it is difficult to compile a precise count of stray, lost, or unwanted companion animals, the Humane Society (n.d., HSUS Pet Overpopulation Estimates) estimates that each year between eight and twelve million dogs and cats find themselves at animal shelters. According to the National Council on Pet Population Study and Policy (n.d., “Shelter Statistics Survey”), of the total number entering shelters, roughly 10% will be returned to the original owner, approximately 25% will be adopted, and around 64% will be euthanized. With animal shelters often seen as a temporary home for lost or stray animals, it is surprising how many animals owners relinquish. The National Council on Pet Population Study and Policy (n.d., “Shelter Statistics Survey”) estimates that nearly 30% of shelter residents are surrendered. Reasons for relinquishment often include moving, landlord issues, inadequate facilities, allergies, or cost of maintenance.

Rising levels of pet ownership, coupled with the varying beliefs and attitudes toward responsible care, has led to a growing number of lost and stray animals. With few of these animals being returned to their original owners, an increasing burden is placed on our communities and the care facilities responsible for managing homeless populations. In an attempt to decrease the number of lost or unwanted animals, some communities and organizations are emphasizing pet-owner education that includes techniques such as spaying/neutering and pet identification.

3. PET IDENTIFICATION

A pet becoming separated from its home or owner is a common occurrence. It is so common that organizations like the LOST-A-PET Foundation (www.pethunters.com), based in Clovis, California, offer pet owners methods of finding lost pets that include the use of cat detection dogs, scent tracking dogs, infrared cameras, search cameras, night vision equipment, amplified listening devices, FBI-type profiling and evidence analysis. Most individuals will not choose to utilize such extreme methods to find a lost pet, but some owners will attempt to provide a first-line of defense by fitting their pets with some form of identification. Depending on the method of identification and circumstances of loss, identification can be an effective tool for recovering lost or stolen animals. Without identification the chance for recovery is greatly reduced. Surveys conducted by the National Council on Pet Population Study and Policy, suggest that only 16% of all dogs and 2% of cats entering animal control facilities are reunited with their owners (Olsen, Fisher, & Line, 1997, “Results from the Field Tests of the Universal Microchip Scanners”, “Introduction” section).

There are many types of pet identification products available and they generally fall under one of two categories: permanent and non-permanent. Permanent forms of identification include microchips and tattoos. Traditional, non-permanent methods are typically ID tags, ID barrels and ID collars. Table 1 compares these identification methods using several criteria.

Table 1 - Identification Methods: characteristic comparison

	ID Barrels	ID Tags	ID Collars	Tattoos	Microchips
Initial Cost	<i>\$5 - \$10</i>	<i>\$5 - \$20</i>	<i>\$10 - \$30</i>	<i>\$30 - \$75</i>	<i>\$30 - \$75</i>
Update/change cost	<i>No</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>
Effort required to change info.	<i>Very low</i>	<i>Medium</i>	<i>Medium</i>	<i>Low</i>	<i>Low</i>
Information limited by space	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>
Permanent	<i>No</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>
Acceptable for health certificates	<i>No</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>
Acceptable for international travel	<i>No</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>
Potential for loss or theft	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>
Subject to falsification	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>
Possibility for duplication	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>
Visually apparent	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Potentially</i>	<i>No</i>
Identity immediately available	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Potentially</i>	<i>No</i>
Requires engraving/embroidering	<i>No</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>
Requires professional application	<i>No</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>
Application requires anesthesia	<i>No</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>No</i>
Potentially harmful to the pet	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>
Can be used with a database	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Requires use of a database	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>Yes</i>
Longevity	<i>Adequate</i>	<i>Adequate</i>	<i>Adequate</i>	<i>Very good</i>	<i>Very good</i>
Can become tarnished/disfigured	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>
Potential item of fashion	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>

Notes: Table assumes that ID Barrels, ID Tags, and ID Collars are being used to record identification information without use of a database. **Shaded** cells indicate that the cell's value would change if supported by a database. Tattoos and Microchips are assumed to be supported by a database. Collars can become entangled which can result in injury or death.

3.1 ID tags

The standard ID tag is the most common method of companion animal (primarily dogs and cats) identification. Tags are relatively inexpensive and can be purchased quite easily from many types of stores. Typically the pet's name, owner's name, address and phone number are engraved into a metal or plastic tag that is attached to the animal's collar. Tags are not limited to recording only basic contact information, however. They can be equipped with more unusual features, like those offered by LostMyPet.com (www.lostmypet.com) or The Finder System

(www.familysafety.com). These organizations take the typical ID tag a step further by engraving each tag with a unique number or identifier. The unique identifier and the pet's corresponding information is stored in a database registry. In comparison to simple, engraved ID tags, database registries allow pet owners to record more information and update the information



Identification tag. From: www.pet-tags-online.com

relatively easily. In the case of LostMyPet.com, the tags, which are provided free of charge, include the LostMyPet web site address. After a person enters the animal's unique identification number, the owner's contact information is displayed. The Finder System also registers animals in a database, but utilizes voicemail technology to connect lost pets with their owners. A toll-free telephone number listed on the tag connects persons who have found a lost animal with the owner's private voicemail extension.

Although ID tags are an effective form of identification, they are not 100% dependable. It is the owner's responsibility to maintain up-to-date tags with accurate information. Tags are subject to various forms of degradation, like rust or fading, which leave tags unreadable. A more common occurrence is for tags to separate from the collar, or for the entire collar to slip off the animal. Finally, as ID tags are easily removed, they are of little help in instances of theft.

3.2 ID barrels

Compared with ID tags, ID collars, tattoos and microchips, ID barrels are the least expensive form of identification. ID barrels hang from the collar like an ID tag, but



ID Barrel © Andrew Brockway

the identification information is not visually apparent.

Instead, the information is recorded on a small piece of paper that fits inside the barrel or canister. For pet owners who move frequently or otherwise change identification

information, paper has advantages over engraving.

3.3 ID Collars

ID collars are very similar to ID tags. The main difference is that the identification information is integrated into the collar as opposed to hanging from the collar. Depending on the collar size and space holding the identification, there may be less space available for ID information. However, the integration of the collar and information does alleviate the problem of tags separating from collars. ID collars are typically made of either nylon or leather and usually require custom embroidering or engraving. Like ID tags, ID collars can contain unique identifiers that can be registered with a tracking database.

3.4 Tattoos

Tattooing, as a form of permanent identification, has been in practice for many years and is still used frequently. As with other forms of identification, a unique identifier can be registered with a database service. Tattoos are typically administered to the animal's inner thigh or, less commonly, the inside of the ear. Although useful



Tattoo. Carl Wilson. (1999, May-June).
Is There a Future for Tattoos? *Animal
Sheltering*.

as a method of permanent identification, tattooing has its drawbacks. In particular, tattoos are often difficult to apply, find, read, and trace (Lawson & Firmani, 1999, “Is There a Future for Tattoos?”, para. 3). All too often the tattoo is a meaningless

mark, or consists of useless information such as an outdated phone number. The Humane Society has also identified problems with the practice. Lawson & Firmani (1999) reported that shelters often apply thousand of tattoos each year, leaving the tattoo machine in need of constant repair. Also, the legibility of the mark often depends on the practitioner’s skill level (Lawson & Firmani, 1999, para. 7). With microchips as an alternative permanent method, the use of tattoos for identification purposes may become less popular. However, many shelters and veterinarians still use the technology to mark animals that have been sterilized.

3.5 Microchips

As a means of permanent identification, microchips have emerged as the method recommended by most animal care professionals in the United States. The technology is widely used in Europe, where companion animal identification is



Microchip. From: AVID. www.avidid.com

mandatory and where animal passports are necessary for crossing borders (Destron Fearing, n.d., “Companion Animals” section, para. 2). A microchip, also known as a transponder, is a rice-sized device that carries and emits a unique identification

number. The chip is implanted just under the skin, usually on the back of the animal's neck and between the shoulder blades. When identification is needed, a battery powered hand-held chip scanner is passed over the animal near the chip's location. The scanner provides a digital display of the unique number associated with the chip. The unique identification number corresponds with owner and pet identification information stored in a database. The technology has proven to be safe and will last the lifetime of the pet.

Although microchip technology holds great promise as the premier means of permanent identification, a few shortcomings have been discussed. Walt Ingwersen, DMV, of the American Animal Hospital Association, points out that many older chips emit a higher frequency than modern scanners can detect (Humane Society of the United States, 2000, "And the Survey Says", para. 4). Ingwersen admits, however, that care facilities and pet owners in the United States are unlikely to be affected by this issue (para. 4). The older chips in question were primarily used in Canada and Great Britain, and they have not been used or marketed for over five years (para. 4). Although the various U.S. chip and scanner manufacturers are currently producing technologically compatible products, the issue of technology obsolescence is a concern. Another possible problem, albeit uncommon, is chip migration. Migration occurs when a chip dislodges itself from the insertion area and moves to a different location within the body. The result is a non-read by the scanner, which leads to the conclusion that the animal in question does not possess a microchip. Although field tests have been conducted on the reliability of scanners detecting implanted

microchips from multiple manufacturers, there has not been an investigation to address microchip migration (Olsen, Fisher, & Line, 1997, “Discussion” section).

Since their introduction in the 1980s, shelters and animal care facilities have also struggled with the issue of choosing between competing microchip technologies and whether the technologies are *backward* (obsolescence) and *sideward* (functionality between models and brands) compatible. Until the mid to late 1990s, microchips for companion animal use in the United States were distributed by three organizations: AVID; Home Again - Schering Plough; and InfoPET/Trovan. Olsen, Fisher & Line (1997, “Introduction” section) reported that before 1996, a “universal” scanner that could reliably identify microchips from all three manufacturers was not available. This initial technological divergence frustrated many users. In order to confidently and correctly survey every microchipped animal, care facilities were forced to purchase scanners from all manufacturers. In addition to being cost prohibitive, this did little to instill confidence in the overall technology.

Today, the technology and chips manufactured by the major U.S. manufacturers feature universal scanners capable of reading each company’s respective chips. In 1997, the American Humane Association conducted field-tests to determine whether universal scanners could reliably identify implanted microchips from multiple manufacturers. The tests, conducted under supervision of the Michigan Humane Society (n = 265 animals) and the Animal Humane Society of Minneapolis (n = 200 animals), found that universal production scanners performed well in

identifying microchips from all three of the U.S. manufacturers (Olsen, Fisher & Line, 1997, “Results” section).

Table 1 is a comparison of companion animal identification methods including ID barrels, ID tags, ID collars, tattoos and microchips. The table evaluates each method based on how it is most commonly used. For example, ID barrels, ID tags and ID collars are considered without database support. Tattoos and microchips are assumed to be database supported. In general, the traditional non-permanent, non-database supported methods, tend to offer lower initial cost, easy application, a visual signal, and immediate identification. Permanent, database supported methods, such as tattoos and microchips, offer longevity, ease of update, enhanced security (loss, falsification), and travel & health certification.

4. MICROCHIP IDENTIFICATION AND RECOVERY TRACKING SYSTEMS

4.1 Microchip Technology, Manufacturers, and Products

Worldwide there are three main manufacturers or distributors of microchips used in animal identification: AVID; Schering-Plough (manufactured by Destron Fearing); and Trovan. Trovan, a German subsidiary of AEG/Telefunken, is the major supplier of microchip transponders in Europe. However, due to patent litigation filed by Destron Fearing and upheld by the U.S. Court of Appeals, Trovan is prohibited from selling Trovan microchips within the United States.

According to MicroChipImplants (1999), the basic prototype for the microchip used in biochips transponders was first introduced in 1979. The chips are tiny (rice sized), ranging in size from 12 to 28 millimeters in



length and 2.1 to 3.5 millimeters in diameter, passive electronic devices utilizing Radio Frequency Identification (1999, para. 4). Each chip is equipped with an antenna and is hermetically sealed in an animal-safe glass capsule. It stores a pre-programmed, unique identification number but no other information. Identification numbers cannot be altered. After being inserted under the skin, the chip is surrounded by a build-up of natural fibrocytes and collagen fibers that anchors it in a pre-determined location within the animal (Destron Fearing, n.d., “Electronic Identification” section, “BioBond”). The implantation procedure is simple for caregivers to learn, painless for the animal, and does not require anesthesia. Chips do not have an internal power source, such as a battery, and they are themselves inactive. Although the two major American microchip manufacturers, AVID and Destron Fearing, tend to advertise their products as being unique with patented concepts, the chips utilize the same basic technology. In laymen’s terms, they are more alike than they are different.

The basic microchip scanner is a lightweight, battery powered hand-held device, usually weighing less than two pounds. It emits a low energy radio signal that, when passed over a microchip, energizes the chip to transmit its unique number. The identification number, received by the scanner in milliseconds, is displayed on a



Scanner. From: www.avidid.com

Liquid Crystal Display (LCD) in an easy to read format. Depending on the application, the identification number can be relayed via computer interface to other equipment where the identification number can be linked with other data about the microchipped animal (Destron Fearing, n.d., “Electronic Identification” section, “Scanners”). The animal feels no sensation during the scan.

4.1.1 American Veterinary Identification Devices (AVID)

According to AVID (n.d., “How AVID Started”), the technology, as used by AVID, was developed by International Identification Incorporated and purchased by Dr. Hannis L. Stoddard III, D.V.M in 1985. Today, AVID manufactures its own chip and utilizes a unique and patented technique. According to Microchip I.D. (n.d., “Frequently Asked Questions” section) there are two chips manufactured by AVID; one that can be read only by an AVID scanner and a universal chip, called the Euro Chip, which can be read by all competing scanner brands. AVID chips carry a nine-digit (e.g., 220*609*321) numeric identification number.

AVID currently manufactures and markets three scanner models (MicroChip I.D., n.d., “Products” section, “Scanners”): Mini Tracker II, Mini Tracker II Plus, and the Power Tracker II. The Mini Tracker II is designed to read AVID brand chips only, while the Mini Tracker II Plus reads several chip brands including the chips

manufactured by Destron Fearing. Both the Tracker II and Tracker II Plus scanners are battery operated. Their rectangular shape (7" x 2 3/8" x 1"), resembling a downsized VCR videotape, has no handle and is not particularly ergonomic. The larger and more powerful, universal Power Tracker II, is much more user-friendly, coming equipped with an ergonomic handle and rechargeable battery system (MicroChip I.D., n.d., "Products" section, "Scanners").

Today there are many AVID microchip systems and scanners in use by shelters, animal control facilities, and veterinary offices across the United States. AVID products are supported by a proprietary pet-tracking database called *PETtrac*™.

4.1.2 Schering-Plough and Destron Fearing

In the United States, Schering-Plough markets the *HomeAgain*™ Companion Animal Retrieval System manufactured by

Destron Fearing. Destron Fearing is the pioneer and developer of syringe injectable, miniaturized microchip technology for injection under the skin of animals. The companion animal microchips manufactured by Destron feature their patented *BioBond*® anti-migration cap, a porous



HomeAgain product. Schering-Plough

polypropylene sheath attached to the microchip implant intended to impede migration of the device (Destron Fearing, n.d., "Electronic Identification" section, "BioBond").

Destron manufactures two portable scanners intended for the companion animal market, the *Pocket Reader*™ and the *Pocket Reader EX*®. Common to both scanners are the following important features:

- *SMART™ Technology* - A re-programmable integrated circuit allows them to read current and future microchip technologies.
- *Automatic Channel Searching* - Automatically searches for the presence of other manufacturer's microchips, locking in on the specific channel and reading the microchip.

Although both units operate on alkaline batteries, the EX model includes a DC power port allowing the unit to plug into a standard wall outlet with an AC/DC power adapter. In addition to the two Pocket Readers, Destron offers another portable model that includes a computer serial port for controlling the unit, monitoring the installation, and logging the unique identification number (n.d., “Electronic Identification” section, “Scanners”). Destron's and Schering-Plough's HomeAgain™ System is the microchip product endorsed by and partnered with Companion Animal Recovery (CAR) database managed by the American Kennel Club.

4.2 How Microchips are used in Pet Identification

After a chip is injected into an animal, the chip's unique identification number permanently represents the animal and will correspond to any contact information provided by the animal's owner. The number and contact information is forwarded electronically, or by hardcopy, to a central database or registry system used to record

identification information on companion animals. The companies that manufacture or distribute the microchip transponders or scanners do not necessarily administer the central databases (see Table 2). AVID, a manufacturer of chips and scanners, administers a tracking database (PETtrac™), however, Destron Fearing, the other prominent U.S. manufacturer, provides no accompanying database service. The American Kennel Club (AKC), an organization not affiliated with Destron Fearing, oversees and operates the Companion Animal Recovery (CAR) database through a partnership with Schering-Plough, the marketing agent for the HomeAgain™ microchip system manufactured by Destron. Although microchips manufactured by AVID or Destron are primarily registered in the PETtrac™ and CAR databases respectively, both of these database services will register chips from any manufacturer. Typically, the price paid by a pet owner includes the cost of the microchip, implantation procedure, and registration in one of the central databases. Although the price may vary depending on where the procedure is performed (shelter, veterinary office), it usually falls within the range of \$30 to \$75.

Table 2 - Microchip Organizations and their Activities

	AVID	DestronFearing	Schering-Plough	AKC
Manufactures chips	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>
Manufactures scanners	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>
Distributes chips, scanners	<i>Yes, AVID brand</i>	<i>No</i>	<i>Yes, HomeAgain brand</i>	<i>No</i>
Operates database	<i>Yes, PETtrac™</i>	<i>No</i>	<i>No</i>	<i>Yes, CAR</i>

Note. HomeAgain brand is manufactured by Destron Fearing

Animal shelters and veterinarians primarily perform the implantation of microchips. Often, the procedure is included in the adoption fee charged by animal

shelters. For example, the Animal Protection Society of Orange County North Carolina charges an adoption fee of \$99 dollars for dogs and \$75 for cats. This fee includes preliminary vaccinations and health care, sterilization, and microchipping. Shelters and veterinarians ordinarily feature only one brand of microchip, which is now almost exclusively AVID or HomeAgain™. As part of the total microchipping package, many shelters and veterinarians complete the registration procedure with either the PETtrac™ or CAR databases. Whether it is the pet owner or veterinarian's responsibility to complete the database registration depends on the policy of the care facility. It is, however, the owner's sole responsibility to contact the database service when updates of the contact information are needed.

Veterinarians, animal control facilities, animal shelters, or any organization that have a need to identify companion animals, own scanners. There are no restrictions placed on who can purchase scanners, and it is not uncommon for microchip manufacturers to supply various organizations with scanners free of charge. This gesture has been an attempt to facilitate the use of microchips in general and as an incentive to purchase microchips manufactured by a particular company.

Often, organizations will purchase several scanners, as they are usually portable, and are often taken into the field (i.e., by animal control officers). Although an organization may own scanners, their use is not guaranteed. The effectiveness of microchips as an identification tool is dependent upon the user. Shelter or veterinary office employees may use the equipment incorrectly, or in some instances, they may entirely neglect to scan an animal. Shelters and animal control facilities are not

required by law to scan for microchips, therefore it is the responsibility of each organization to establish internal policies and controls that ensure scanning of every animal entering the facility. According to Suzanne Aragona (personal communication, March 2, 2002), a representative from Chatham Animal Rescue and Education (CARE), a non-profit rescue organization in Chatham County, NC, some animal shelters do not have good scanning habits. CARE recently discovered a case where a local shelter, a facility that owns several scanners, failed to scan one of their shelter animals. The shelter released the animal in question into the foster program operated by CARE, who later placed the animal in a new home. Upon taking the animal to the local veterinary office for a pre-adoption exam that included a microchip scan, CARE discovered that the animal had previously been fitted with a microchip. The microchip was tracked by one of the central databases and the original owner was found to be living in the neighboring town. The rightful owner, who had reported the animal as missing, rewarded CARE with a \$300 donation. CARE, in turn, donated \$150 to the shelter even though they had admitted to not scanning the animal.

4.3 Distribution and Marketing of Microchips and Scanners

Microchip and scanner systems have numerous applications and are used by many types of organizations representing several market segments. Such systems are commonly employed in agriculture, wildlife conservation and management, medical research, and companion animal identification. Around the world thousands of species, from mice to elephants, have been fitted with microchips. For example, the

U.S. Fish and Wildlife Service use microchips in the study of grizzly bears, black-footed ferrets, and giant land tortoises (MicroChip I.D., n.d., “Frequently Asked Questions” section). Microchips are very versatile - the technology that has proven to be valuable in the identification of animals can also be employed in other areas. According to Microchip I.D. (n.d., “Frequently Asked Questions” section), chips can be used to permanently identify many types of objects. Chips can be imbedded in many types of materials and scanners can easily read through fur, bone, wood, glass, paper, ceramic, and plastic. In order to service these different markets and applications, manufacturers utilize varying distribution channels and marketing campaigns.

In terms of servicing the companion animal market, the products (microchips and scanners) manufactured by AVID are distributed and sold in two ways: directly by AVID and through authorized distributors. These distributors are not part of AVID Incorporated; they are individually owned and operated. For example, MicroChip I.D., a company based in Louisiana, distributes AVID products to the veterinarian, animal breeder, and wildlife research communities. A veterinarian could therefore buy microchip products from AVID directly or through an AVID dealer such as MicroChip I.D. Distribution is exclusive - MicroChip I.D. only offers products made by AVID and the microchips they sell are registered with PETtrac™, the database and tracking service operated by AVID. Microchips sold by AVID, but not used for the identification of companion animals (e.g., the U.S. Forest Service tracking grizzly bears), are not registered in PETtrac™.

Products are bundled and packaged in various ways to suit the needs of diverse organizations. Basically, bundles and packages are designed to either meet varying price points, accommodate users with very specific needs (bulk or individual pieces), or to simply make it more appealing to and easier for the reseller (e.g., a veterinarian selling the service to a pet owner). For AVID products offered through MicroChip I.D., organizations can buy sterile syringes equipped with one microchip already loaded in the needle, or non-sterile bulk microchips and reusable syringes. A non-reusable sterile syringe containing one microchip costs \$9.75 per syringe. Reusable bulk syringes, to be used with bulk chips, cost \$7.50 each. Bulk microchips, usually offered in easy-to-dispense cartridges of 25, are sold at a price of approximately \$6.75 per chip (Microchip I.D., n.d., “Products” section, “Microchips”).



Chip injector.
From:
MicroChip I.D.

Neither AVID nor Destron Fearing have extensive marketing campaigns aimed directly at pet owners. Instead, their marketing efforts are directed toward the care facilities (e.g., veterinarians, shelters) that are responsible for microchip implantation and scanning. However, compared to Destron, AVID targets the end-user more directly. In addition to manufacturing products, AVID operates a database and tracking service. Since an increasing demand for companion animal identification and tracking (i.e., microchips and database) would translate into higher sales of microchip products, AVID attempts to educate pet owners on the importance of permanent identification and the advantages of microchips. Destron, on the other hand, is only a

manufacturer and relies on other organizations, specifically Schering-Plough and the AKC, to market its products. Schering-Plough, through their Animal Health division, distributes and markets the products made by Destron. The AKC manages the Companion Animal Recovery (CAR) system, which is the database and tracking system that promotes the Destron products. For Destron to realize continuing demand for its products, it must rely on either Schering-Plough or the AKC to spearhead marketing efforts aimed at either care facilities or pet owners.

Pet owners do not directly purchase microchips and syringes, nor do they perform the medical procedure needed to implant a chip. It is more of a *service* - the veterinarian's medical procedure and the animal's registration in a tracking database - which an individual purchases when he/she has a pet fitted with a microchip. Furthermore, individuals do not directly buy and handle the physical product, and it is not a product that consumers necessarily *want*. In business marketing terms, it is a product they *need*. And ultimately someone has to make them aware of this *need*. Therefore, both AVID and Destron rely heavily on the organization providing the service (either the medical procedure or the recovery tracking system) to promote it to end consumers. One product that AVID dealers sell to organizations such as veterinary offices is called FriendChips™. The FriendChips™ package includes sterile syringes pre-loaded with microchips, informative brochures with PETtrac™ registration forms, and "I Am Lost" collar tags. This bundled product package is specifically designed to assist veterinarians in selling the overall service to their customers. Everything from materials to educate the consumer, to the physical

product itself, to the form used in the database registration, is provided in one simple bundle.

New organizations or organizations not yet offering microchip services are encouraged, through *Starter Kits*, to begin offering microchip services. AVID's Starter Kit #1 includes 50 FriendChips™, collar tags and brochures, a Mini Tracker II scanner, small display sign, and complete instructions. The Starter Kit #1 is available for \$695.00 through MicroChip I.D. Not only do product manufacturers market, bundle, and price products in an enticing manner, at times they give away products, free of charge, in order to encourage the use of microchips and to promote the use of their particular brand. AVID (n.d. "USA - Shelter Program" section), through their *USA Shelter Program*, provides free scanners to qualifying animal shelters. In order to participate in the Shelter Program, a veterinarian in the shelter's community must purchase an AVID system and use it actively to identify animals in his or her practice. The veterinarian then designates a particular shelter to receive the free scanner. Before receipt of the scanner, the shelter must, through written documentation, agree to scan all animals upon admission and prior to euthanasia or adoption. Likewise, the American Kennel Club (n.d., "Microchipping" section, para 2) has contributed over \$1.7 million towards the deployment of free scanners to animal shelters, SPCAs, humane societies, and animal control agencies.

The number of microchips and scanners sold by manufacturers for use in the companion animal market is determined by the number of pet owners who choose to use microchips as a form of permanent identification. In order to influence the

number of pet owners using microchips, marketing campaigns are used to educate owners about the importance of permanent identification, tracking databases, and the advantages of the microchip method. Depending on whether AVID or Destron-Fearing manufactures the products, the ensuing marketing campaign can involve different organizations. But common to the campaigns for products from both AVID and Destron is the importance of care facilities. Veterinarians and shelters have direct access to pet owners and play a vital role in the dissemination of information about microchips and tracking databases.

4.4 Database Tracking Systems

Within the United States, there are two main pet identification and recovery systems in use today, the Companion Animal Recovery (CAR) system managed by the American Kennel Club (AKC) and the PETtrac™ system operated by AVID Inc. Each of these systems is comprised of a central database that stores information intended to identify the owner of a companion animal.

4.4.1 Companion Animal Recovery (CAR)

The American Kennel Club, a not-for-profit 501(c) (3) organization, established Companion Animal Recovery (CAR) in 1995 (2001, “Committed to Reuniting...”). All animals, regardless of species, age, or size are eligible for enrollment in CAR. Microchipped as well as tattooed animals may participate. Enrollment typically takes place when the animal is microchipped or tattooed, but can

occur at any time. The form necessary to request enrollment is completed by the animal's owner (usually with assistance from the organization implanting the microchip) and is returned by post to the American Kennel Club in Raleigh, North Carolina. Although mailing the required information completes most enrollments, pet owners can also enroll and submit payment through the Internet.

According to the AKC (2001, "Committed to Reuniting..."), a onetime fee of \$12.50 covers lifetime enrollment in the CAR system and includes free changes/updates to a pet's record in the database. Having an animal fitted with a HomeAgain™ (brand of chip endorsed by the AKC) chip does not guarantee enrollment in the CAR database. Animal care facilities often differentiate between microchip implantation and database registration. For example, a veterinarian may perform the implantation procedure (at a cost between \$20 - \$50), but leave the responsibility of database enrollment and fee payment (\$12.50) to the pet's owner. If the veterinarian accepts responsibility for the enrollment process, the \$12.50 enrollment cost may be included in the overall charge - the final charge for a microchip implantation procedure and whether or not that charge includes enrollment fees varies between care facilities. The American Kennel Club and its Companion Animal Recovery service do not directly market and sell microchips and scanners. However, the AKC aggressively advertises and advocates the microchip components manufactured by Destron Fearing and distributed by Schering-Plough. The AKC's mission, through the CAR database, is to provide companion animal owners with an identification and recovery assistance service. For this reason, medical implantation

procedures and database identification services are two separate considerations with varying service levels and fees.

With animal identification and recovery assistance as the main objective, the information recorded and stored in the CAR database covers five basic areas: microchip or tattoo, pet, owner, alternate contact, and veterinarian.

Table 3 - Information Recorded in the CAR Database

Microchip/tattoo	Pet	Owner	Alternate Con.	Veterinarian
<i>Microchip ID#</i>	<i>Call name</i>	<i>Name</i>	<i>Name</i>	<i>Clinic name</i>
<i>Microchip brand</i>	<i>Species</i>	<i>Address</i>	<i>Home phone</i>	<i>Address</i>
<i>Date of implant</i>	<i>Breed</i>	<i>City</i>	<i>Evening phone</i>	<i>City</i>
<i>Tattoo ID#</i>	<i>Purebred?</i>	<i>State</i>	<i>Fax</i>	<i>State</i>
<i>Tattoo location</i>	<i>Sex</i>	<i>Zip code</i>	<i>Email address</i>	<i>Zip code</i>
	<i>Date of birth</i>	<i>Country</i>		<i>Day phone</i>
	<i>Spayed/Neutered?</i>	<i>Day Phone</i>		<i>Fax</i>
	<i>Color/markings</i>	<i>Evening Phone</i>		<i>Email address</i>
		<i>Fax</i>		<i>Perform procedure?</i>
		<i>Email address</i>		

(American Kennel Club, n.d., “Enrollment Form”)

After enrollment information is received and processed by the AKC, the owner receives a confirmation letter verifying the information and providing an opportunity to make any needed changes. Subsequent changes/updates, without necessarily using or referencing the confirmation letter, can be made by mail, fax, or email. In the case where pet ownership is being transferred from one individual to another, the AKC requires that the confirmation letter be used for verification (personal communication, December 12, 2000). The new owner will complete the designated area on the letter and return it to the AKC with a payment of \$6.00.

When a lost animal needs to be identified, it is taken to an animal care facility and scanned to determine the microchip identification number. The configuration of the number usually provides care technicians with enough information to determine the brand of microchip, HomeAgain™ or AVID. Uncovering the brand will be the first clue in the tracking process, as brands are strong indicators of inclusion in one of the two databases - Destron Fearing chips are usually registered in the CAR system, while AVID chips are typically found in PETtrac™. After detecting the identification number, the next step is to contact either CAR or PETtrac™. In the case of CAR, currently the only way to identify an animal is to call the 24-hour, toll-free CAR hotline for assistance from a CAR representative. The CAR database is queried with the microchip number. If the animal is indeed registered with the system, a CAR representative will immediately call the owner identified in the database.

4.4.2 PETtrac™ by AVID

PETtrac™ is a proprietary animal identification and tracking database managed by California-based AVID Inc., a manufacturer and distributor of microchips and scanners. Like the Companion Animal Recovery (CAR) system administered by the AKC, PETtrac™ charges a onetime registration fee (\$15.00), offers free changes/updates, and will accept registration from tattooed animals or those animals fitted with chips not manufactured by AVID. Pet owners may also purchase a \$40.00 lifetime membership, which enables them to register up to eight animals (AVID, 2000, “FriendChip-Clearly...”). As with HomeAgain™ chips from Schering-Plough, AVID

allows caregivers (vets, shelters, etc.) to determine the price they will charge for microchip implantation procedures.

As a one-stop shop (hardware manufacturer, distributor, and database operator), AVID is able to provide services not offered by CAR, who is not directly involved in the manufacturing and distribution of chips and scanners. For example, AVID records in their database the distribution history of each chip. In other words, when a veterinary office in North Carolina purchases an AVID chip, the chip's unique number is registered to that particular veterinary office as the *facility of origin* (personal communication, May 23, 2002). When an animal is fitted with a chip, regardless of whether the animal's owner completes the *owner's registration* and pays the \$15.00 fee, the animal is immediately traceable back to the facility of origin, in this case a veterinary office.

Furthermore, AVID has established disaster recovery programs with Veterinary Medical Associations (VMA) throughout the nation. Through these unique agreements, the PETtrac™ database is simultaneously running among multiple computer systems, ensuring that information will be secure and always accessible. For example in Pennsylvania's VMA office, AVID supplied the computer hardware, software, and data transmission line that would shadow the main PETtrac™ database in AVID's California headquarters (AVID, n.d., "USA - PETtrac™" section). Each time a chip is sold to a care facility, or registered to an individual pet owner anywhere in the country, the information is entered in the main database in California, which is then automatically duplicated and transferred to the Pennsylvania VMA. There is no

cost to the Pennsylvania VMA for serving as a back-up site; AVID pays for all hardware and system maintenance (AVID, n.d., “USA - PETtrac™” section). As an incentive to house a back-up system, the VMA receives a fee for every AVID chip sold in their state. In addition, the VMA is given free chips to protect service animals, guide dogs, police horses and police dogs.

After a lost animal has been found and the unique microchip number has been submitted for tracking, the owner identification and notification process differs slightly between CAR and PETtrac™. As mentioned previously, a CAR representative directly contacts the animal’s owner and informs her/him of their pet’s location. PETtrac™, on the other hand, does not automatically contact the animal’s owner (personal communication, May 23, 2002). Only in the instance where someone other than an official care facility (veterinary office, shelter, police, etc.) has found an animal would PETtrac™ contact the owner directly. Typically, when a shelter submits a number to PETtrac™, PETtrac™ provides the owner’s contact information directly to the shelter that in turn would call the animal’s owner. Under the scenario where the database record does not list specific owner information, PETtrac™ will contact the *facility of origin*, which is likely to have recorded information regarding that particular chip’s end-user (personal communication, May 23, 2002).

For each animal, the information recorded in the PETtrac™ database includes the following:

Table 4 - Information Recorded in the PETtrac™ Database

Owner	Alternate	Pet	Veterinarian	Implanter
<i>Name</i>	<i>Name</i>	<i>Call name</i>	<i>Name</i>	<i>Name</i>
<i>Address</i>	<i>Address</i>	<i>Species</i>	<i>Clinic name</i>	<i>Address</i>
<i>City</i>	<i>City</i>	<i>Breed</i>	<i>Address</i>	<i>City</i>
<i>State</i>	<i>State</i>	<i>Sex</i>	<i>City</i>	<i>State</i>
<i>Zip code</i>	<i>Zip</i>	<i>Date of birth</i>	<i>State</i>	<i>Zip code</i>
<i>Home Phone</i>	<i>Home Phone</i>	<i>Spayed/Neutered?</i>	<i>Zip code</i>	<i>Phone</i>
<i>Work Phone</i>	<i>Work Phone</i>	<i>Color</i>	<i>Day phone</i>	
<i>Fax Phone</i>	<i>Fax</i>	<i>Weight</i>	<i>Fax</i>	
		<i>Medication</i>		
		<i>Other</i>		
		<i>Microchip ID #</i>		

(AVID, 2000, "FriendChip Clearly...", Brochure)

4. CHARACTERISTICS OF DATABASE SYSTEMS USED TO IDENTIFY AND TRACK PEOPLE

Is there a database, past or present, which can serve as a model for developing other identification and tracking systems? By considering different tracking systems, such as those designed to identify and track people, it may be possible to determine where such systems are universally similar and where they are unique. This information may help us to understand whether identification and tracking databases naturally share a core structure, or whether their framework is determined on a case-by-case basis.

Since the terrorism acts of September 11, 2001, the United States government has proposed the development of National Identification System to track and verify the identity of every U.S. citizen and resident alien. Although much of the debate around this issue has focused on privacy and civil liberty issues, experts warn that the real challenge behind a national ID system is the database. Margie Wylie (2001)

believes the concern has risen from the notion that vast databases are notoriously mistake-prone, difficult to secure, open to abuse, and expensive to compile and operate. The database required for a national ID system would be huge, requiring a record for each of the over 280 million citizens and aliens (Wylie, para. 9). For comparison, the largest national ID database in the world is Thailand's, which covers a population of over 60 million (Wylie, para. 10).

If database size is a concern for operating a National Identification System, will size also be an issue for large databases designed to identify and track companion animals? The American Pet Products Manufacturers Association statistics from the 2001-2002 National Pet Owners Survey indicate that there are 68 million owned dogs and 73 million owned cats in the United States (Humane Society of the United States, n.d., "U.S. Pet Ownership Statistics"). Although not all pet owners choose to have their pets listed with a database service, the trend is toward higher levels of registered animals. The AKC (2001, "Committed to Reuniting....", brochure) claims to register 25,000 new animals each month in CAR. Furthermore, State or Federal authorities could make companion animal identification mandatory, as is the case in Europe. Wylie (2001) has suggested that there are challenging issues surrounding operation of large databases, such as one that would cover millions of people or pets. However, the concern may be overstated. For example, there would likely be few technical constraints. Many database products (hardware and software) are available to assist with storing and processing large amounts of data. The real challenges will likely surround the infrastructure needed for systems development, data collection, and

ongoing support. In regards to companion animal databases, the current data storage and retrieval requirements are relatively small. Therefore, the current database infrastructures are probably adequate. However, if usage levels were to rise significantly, such as in the case of mandatory identification, then companion-animal databases could face challenges akin to those associated with the proposed National Identity System.

The National Identity System would function as an “inert” database, meaning that a person’s record (identity information) would be idle until it was necessary to retrieve the record. In contrast, the listing of an individual in a missing persons database, which is an “active” database, triggers events upon entry of the record. Like the National ID System, companion animal databases are inert in nature. Until it is necessary to identify an animal, the animal’s record remains idle.

A National Identity System is intended to benefit all U.S. citizens. Clement, Stalder, Johnson, & Guerra (2001), report that such a system will make it easier to identify people on routine checks, allowing law enforcement officials to more easily identify those people likely to be associated with terrorist activities. For example, if a routine identity check yields an individual that can not be matched to a record in the database, then his/her identity and activities could warrant further investigation. Who should be responsible for the National ID system? Corporate America has shown interest in the project. Sun Microsystems and Larry Ellison, CEO of Oracle, have offered, for free, their products as the backdrop for the National Identification System (Clement et al., 2001, “Question 10”). However, with national security an issue,

responsibility for funding, developing, and operating the National Identity System will likely lie squarely on the United States government. Is it important for such a system to be operated by a certain (i.e., public vs. private) entity? Van Alstyne, Brynjolfsson, & Madnick (1994, p.18) suggest that *ownership* matters. In this context, ownership refers to a single entity exercising control over content, format, standards, and access. According to Van Alstyne, Brynjolfsson, & Madnick (p. 18) ownership is important because, “As various ownership structures generate different behavior, only one structure out of many is likely to maximize database value.” The choice of who will oversee such a system is an important decision.

How the system is structured (e.g., centralized or decentralized) is another important issue. When information gathering needs are present in areas like criminal justice, which tend to fall under government authority, the accompanying systems are often restricted (i.e., usage rights), centralized (central processing), authoritative, and managed by one entity. Van Alstyne, Brynjolfsson & Madnick (1994, p. 2) suggest that from a technology standpoint, database centralization is defensible in terms of data integrity and from an economic standpoint in terms of the costs of redundant systems. The National Criminal Background Check System (NICS) is an example of a centralized system. The Brady Handgun Violence Prevention Act (Brady Act) requires Federal Firearms Licensees to complete background checks on individuals attempting to purchase a firearm. As mandated by the Brady Act the NICS was established. The FBI-operated NICS is a national computerized system designed to access the FBI’s National Repository of Criminal History Records, which includes

records from all 50 states as well the National Crime Information Center (National Instant Criminal Background Check System, n.d., “NICS Program Summary”). Data stored in the NICS is centralized federal data, and access to that information is restricted to agencies authorized by the FBI (National Instant Criminal Background Check System, n.d., “NICS Fact Sheet”, Privacy and Security section).

Operation of a centralized system like the National Criminal Background Check System is important because it provides accurate and timely information enabling authorities and firearm licensees to make informed decision. Given the importance of gun control, development of a single, standardized system seemed logical. But the need for a centralized, authoritative information system is not always apparent nor is it always the first solution. According to the Criminal Justice Information Services Division (n.d.), in 1903 the New York State prison system began to use fingerprints for the identification of criminals. Over the next decade, countless other state and local law enforcement agencies established their own fingerprint systems. Although these individual systems represented a large collection of data, a growing demand by officials for a centralized national repository for fingerprint records led to an Act of Congress in 1921, establishing the Identification Division of the FBI (Criminal Justice Information Services Division, n.d., “History” section). The Identification Division is now known as the Criminal Justice Information Services Division (CJIS), which maintains the National Repository of Criminal History Records (used by the Brady Act) and includes the criminal fingerprint file.

The federal government oversees numerous centralized information systems, such as those associated with national security and law enforcement. There are other areas that garner national attention where information needs are being met by private organizations working alone or in joint ventures with government agencies. For example, in the area of identifying and locating missing children, numerous non-profit organizations not affiliated with Federal or State governments operate database tracking systems designed to help reunite missing children with their families. These include the North American Missing Children Association, Heidi Search Center for Missing Children, National Missing Children Organization, and the National Missing Children Center.

Probably the most respected and effective of these private, non-profit organizations dedicated to the recovery of missing children, is the National Center for Missing & Exploited Children (NCMEC). The NCMEC was founded in 1984 by John Walsh, father of a missing child and host of television's *America's Most Wanted*. Today, the NCMEC considers itself one of the best examples of government and private-sector joint efforts designed to address one of the nation's most troubling social problems (NCMEC, n.d., "State-of-the-Art Technology"). To date the NCMEC has received software technology and engineering from *Computer Associates*, hardware infrastructure from *Sun Microsystems* and *Compaq*, data-integration technology from *Merant*, and photo distribution from numerous corporations such as *Wal-Mart* (NCMEC, "State-of-the-Art Technology", "Internet and World Wide Web" section).

The NCMEC's database-driven website reaches a global audience with images of and information about missing children, child-safety materials for families and law enforcement, and the CyberTipline, an online mechanism to report child sexual exploitation (NCMEC, "State-of-the-Art Technology", "Internet and World Wide Web" section). NCMEC's database, linked with 50 State missing-person clearinghouses and the FBI, is an invaluable resource shared with law enforcement throughout the world.

The process of identifying and tracking a missing child begins when the case is reported to local and state law enforcement officials. They register the case with the National Criminal Information Center (NCIC) and with the State's missing-person clearinghouse. Law enforcement officials do not *automatically* supply case information to non-profit organizations operating tracking databases. If they or the family of a missing child desire assistance from one of these organizations, they must contact the organization directly. According to The Lost Child (n.d., "To Report a Missing..."), a missing child assistance organization, the search databases typically record the address and contact information for the family, a detailed description of the child (including a photo), and information from the initial police report including the NCIC case number. This information is verified with law enforcement officials before being recorded in the database (The Lost Child, n.d.).

Databases are used to assist in the identification and tracking of missing children and companion animals. In both instances the database records family/owner contact information and a description of the lost child or pet. However, there is a

fundamental difference in how the two systems are employed. Companion animal databases are “inert” databases. Registration in a companion animal database (e.g., CAR, PETtrac™) occurs prior to an animal becoming lost. Children, on the other hand, are typically not enrolled in a database until they have been classified as missing. If a pet is missing, an owner may communicate that information to the database in which the animal is enrolled, but that communication does not initiate action on part of the organization. According to AVID (personal communication, July 7, 2002), the incident is noted in a hard-copy notebook called the “Hot-Sheet”, but the animal’s original record in the database is not altered and AVID takes no particular action. Until the animal is found and the microchip number is queried in the database, the database is not brought into service. In contrast, when a missing child is reported to authorities and registered in a database, a series of proactive events are triggered. For example, information (i.e., description, photograph) is disseminated to law enforcement and the general public, a physical search is conducted, trained investigators follow leads, and support for the family is provided. Before a child is found, databases play a key role by providing relevant groups (e.g., law enforcement, search groups, community organizations) with accurate and timely information. In the case of a missing pet, databases play a key role after the animal is found.

From tax records, to credit reports, to criminal records, there are many reasons to identify and track people. How it is done and by whom depends mainly on who is being tracked and why. There are instances where many organizations (private corporations, State and local governments, etc.) work independently and in isolation.

In other situations, multiple organizations will collaborate as part of a larger integrated network. Finally, other circumstances may require one organization, such as the Federal government, to assume full control and responsibility. Table 5 lists the identification and tracking systems (National ID, NCIC, IAFIS and NCMEC) discussed in Section 4 and compares characteristics of each to characteristics of the two main companion animal tracking databases, AVID and CAR.

The database systems in Table 5 share two common characteristics: centralized database architectures at the conceptual and internal level; and restricted access. *Centralization*, as used in Table 5, refers to the database management functionality and application program execution being completed at a single (or few) location (Elmasri & Navathe, 2000). As fairly large databases covering a wide geographic area, all of the databases would seemingly benefit from utilizing a centralized structure. Benefits of centralized database structures can include ease of management, low cost, high speed, and control of data integrity.

Similar access policies are likely due to the nature of the data being collected. *Access*, as used in Table 5, refers to a user's privilege and ability to view data in the database. Each of the databases in Table 5 record information relating to a person's (or pet's) identity or a person's criminal history. As a result of criminal records being used primarily by Law Enforcement and because identity information is often considered private information, the information in these data systems is not readily available to the general public. The only database listed in Table 5 that does not restrict access is the NCMEC. By granting and encouraging public access to the data

in the NCMEC database, the NCMEC hopes that communities and investigators will more easily identify and recover missing children.

Table 5 also indicates differences between government-owned identification databases and privately-owned identification databases. The three government-operated systems (National ID, NCIC and IAFIS) are comprised of data that is *involuntarily* collected. For example, the FBI does not require the consent of a convicted criminal to include his/her fingerprints in the fingerprint database. Conversely, the NCMEC, AVID or CAR do not have the authority to record an individual's, or pet's, identity in their respective databases without consent. Enrollment in the NCMEC, AVID and CAR databases is *voluntary*. The government-run systems in Table 5 also operate advanced (highly automated) systems in non-competitive environments. The private organizations (NCMEC, AVID and CAR) tend to operate *basic* (technologically and structurally simplistic) databases in competitive environments with low barriers to entry. Compared to the NCIC, IAFIS, and the NCMEC, the AVID and CAR identification systems are fairly new, both having started in the mid 1990s. Going forward, will the systems of AVID and CAR continue to uniquely serve the companion animal identification market, or will they become more similar to the NCIC, IAFIS, or the NCMEC? The next section will discuss the future of companion animal identification and tracking databases.

Table 5 - Database Comparisons

	*National Identification System	(NCIC) National Crime Information Center	(IAFIS) Integrated Automated Fingerprint Identification System	(NCMEC) National Center For Missing and Exploited Children	(AVID) American Veterinary Identification Devices	(CAR) Companion Animal Recovery
	National ID	NCIC	IAFIS	NCMEC	AVID	CAR
Purpose	<i>National Security</i>	<i>Law Enforcement, Public Safety</i>	<i>Law Enforcement, Public Safety</i>	<i>Child Recovery</i>	<i>Animal Recovery</i>	<i>Animal Recovery</i>
High-visibility Issue	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>
Public Safety Value	<i>High</i>	<i>High</i>	<i>High</i>	<i>High</i>	<i>Low</i>	<i>Low</i>
Community Economic Cost	<i>Low</i>	<i>High</i>	<i>High</i>	<i>Low</i>	<i>High</i>	<i>High</i>
Economic Value	<i>Low</i>	<i>Low</i>	<i>Low</i>	<i>Low</i>	<i>High</i>	<i>High</i>
Public Perception	<i>Negative/Neutral</i>	<i>Negative/Neutral</i>	<i>Negative/Neutral</i>	<i>Positive</i>	<i>Positive</i>	<i>Positive</i>
Ownership	<i>"unknown"</i>	<i>FBI -CJIS</i>	<i>FBI -CJIS</i>	<i>NCMEC</i>	<i>AVID, Inc.</i>	<i>AKC</i>
Private/Public	<i>government</i>	<i>government</i>	<i>government</i>	<i>private, non-profit</i>	<i>private, for-profit</i>	<i>private, non-profit</i>
Private/Public Partnership	<i>No</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>No</i>
Operates in a Competitive Environ.	<i>No</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Barriers to Entry	<i>High</i>	<i>High</i>	<i>High</i>	<i>Low to Medium</i>	<i>Low</i>	<i>Low</i>
Funding	<i>federally funded</i>	<i>federally funded</i>	<i>federally funded</i>	<i>private & federal</i>	<i>private</i>	<i>private</i>
Recipient of Donations	<i>No?</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>No</i>
Database Size (approx. records)	<i>> 250 mil.</i>	<i>< 100 mil.</i>	<i>< 100 mil.</i>	<i><1 mil.</i>	<i>> 2 mil.</i>	<i>> 2 mil.</i>
Centralized Database	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Database Technology	<i>?</i>	<i>Advanced</i>	<i>Advanced</i>	<i>Basic</i>	<i>Basic</i>	<i>Basic</i>
Remote Access	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>
Restricted "Read" Access	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>
Inert/Active	<i>Inert</i>	<i>both,inert/active</i>	<i>both,inert/active</i>	<i>active</i>	<i>inert</i>	<i>inert</i>
Voluntary/Involuntary Enrollment	<i>mandatory?</i>	<i>involuntary</i>	<i>involuntary</i>	<i>voluntary</i>	<i>voluntary</i>	<i>voluntary</i>
Enrollment Fee	<i>no</i>	<i>no</i>	<i>no</i>	<i>no</i>	<i>yes</i>	<i>yes</i>

Notes: *National Identity System in planning/development. Not an active system.

5. FUTURE OF COMPANION ANIMAL IDENTIFICATION AND RECOVERY TRACKING DATABASES

In the identification and tracking of missing children, considerable resources are made available both from private and public sources. Numerous organizations offer a version of a database tracking system, but one organization, the National Center for Missing & Exploited Children (NCMEC), has emerged as the central authority. The NCMEC, with its innovative use of technology, its established infrastructure, and its key governmental and corporate relationships, is the leader among non-profit organizations assisting in the search for missing children.

Are there any aspects of the existing system for tracking missing children that provide insight into the future makeup of the market for companion animal microchips and database tracking systems? Will the market migrate toward a single database service provider, or will database tracking alternatives expand beyond AVID and the AKC? Is there an “ideal” model (e.g., single, government administered database) that would likely provide a high level of service for animal owners?

There are many similarities in the events that surround a missing pet and a missing child, and although on a case-by-case basis both are important, the issue of missing children has been adopted more completely by society as a whole. A lost child is a high-visibility (see Table 5) issue with high public safety value; a lost pet is a low-visibility issue with little public safety value. As a result of society’s concern over each issue, more resources will be allocated for the plight of missing children than for lost companion animals.

Despite many entities, from private non-profit organizations to State agencies, which are willing to assist in locating a lost child, the market has apparently chosen to support a “single” organization, the NCMEC. The NCMEC’s widespread support from the Federal government and corporate America exceeds the support received by any other child-recovery organization. One reason for placing more resources with one organization may simply be to improve efficiencies and effectiveness. The NCMEC (n.d., “State-of-the-Art”) reports that by giving authorities the information/data they need in one location, recovery rates have been steadily increasing. A second reason for directing resources toward one organization is that the stakes are too high for any one data system to function in isolation. The chance of having search-officials querying data in location A, while key data was waiting in location B, is unacceptable given our ability to integrate technologies and systems at a national level. Imagine telling the parents of a missing child that that search efforts were ultimately unsuccessful because authorities in South Carolina were unaware of information available in North Carolina. Such an event is basically what the databases of the NCMEC, PETtrac™ and CAR are designed to overcome.

Today, animal care facilities are not forced to choose between numerous animal-tracking systems - a facility needs only to query two national tracking databases, PETtrac™ and CAR. Would pet owners be better served by the existence of a single database and tracking service? At the moment, there is no indication that having two databases, as opposed to fewer or more, provides pet owners with diminished service. Animal care facilities are well aware of the existence of both

PETtrac™ and CAR, and they indicate it is little trouble to simply query both databases. The chance of someone failing to check for a microchip at all is far greater than identifying an animal's microchip number but failing to discover the database in which it is enrolled. However, if the number of tracking systems were to rise, the task of finding an individual record could become more difficult. The United States is home to only two databases, but if the U.S. market resembled Europe's, the situation would be quite different.

In Europe, where permanent identification is mandatory, many countries operate their own, proprietary animal databases. These databases adequately serve their respective countries, but they are of little help when called upon to identify animals from neighboring countries. With many countries in close proximity to one another, and pet owners often traveling across borders, pets are often lost outside of their home country. To provide all European pet owners with a tool to assist in finding lost pets, the European Pet Network (EuroPetNet) has been established. EuroPetNet is an online accessible database that records microchip numbers from all European member databanks. It includes information about the particular database in which a chip is enrolled, but for protection purposes it does not provide owner details. For example, if we were to search the EuroPetNet database for microchip number 48790045678, it would provide the following information:

Table 6 - EuroPetNet Database: record example

Database Name:	<i>Danish Dog Register</i>
Address:	<i>Lyngbyvej 11,1 DK-2100, Copenhagen O</i>
Identification Hours:	<i>Working days, 10:00 to 14:00</i>
Spoken Languages:	<i>Danish, English</i>
Phone:	<i>45-70-277-477</i>
Email:	<i>dansk@hunderegister.dk</i>
Website:	<i>www.hunderegister.dk</i>
Online Search Capability:	<i>Authorized users</i>
Last Data Transfer to EPN:	<i>27/06/2002</i>

(Europetnet, n.d., “members” section)

This search result would confirm the animal’s registration with a database (Danish Dog Register) within the European Union. It would then be possible to directly contact the Danish Dog Register to gain contact information for the lost animal. Although EuroPetNet is not solely responsible for administering Europe’s only database, it is an example where the market seemingly benefits from a single system that is technologically, politically, and philosophically neutral. Having numerous proprietary databases (i.e., one or more per country) complicates the search process and could result in an animal not being identified.

Together, AVID Inc. and the American Kennel Club identify and track approximately 4 million companion animals. Although these two databases basically record the same information and provide the same service, the organizations that operate them are quite different. Why are two very different organizations competing to provide the same service?

For providing identification products and database services, AVID Inc., as a for-profit business, is rewarded with earned income, which is shared by its employees, owners and investors. For the same service, the American Kennel Club, as a non-

profit organization, is also rewarded with earned income. But the AKC's profits go to support the organization's ongoing mission, which is to maintain a registry for purebred dogs and preserve the registry's integrity. The AKC may indeed benefit financially from operating the Companion Animal Recovery database, but individuals or third-party investors do not share in those profits - all excess funds are reverted back into the operation of the organization. The non-profit status of the AKC does not imply or mandate that the revenue generated by the organization cannot exceed the cost of operation. It is important to understand that although the AKC is itself a non-profit organization, its role in animal identification and recovery is forged under a partnership with two for-profit companies: Destron Fearing, a manufacturer of microchips and scanners, and Schering-Plough, a distributor of animal care products. Although fundamentally different in their configuration, both AVID and the AKC benefit from the revenues generated by providing database services. Of the systems covered in Table 5, AVID and CAR are the only organizations that charge a fee to record data in their respective database. With an absence of federal funds (see *funding*, Table 5) and public donations, AVID and CAR rely on revenue/profits for their livelihood - a characteristic which will likely influence the field of companion animal identification and recovery in the future.

Despite both companies moving forward with administering and promoting their respective services, the market may ultimately choose to favor one company at the expense of the other. In this case the market is comprised of two customer sets: pet owners, and animal care facilities such as veterinarians and shelters. How will

these customers influence the outcome? Individual pet owners probably will not wield much influence, but veterinarians, on the other hand, will be very important.

Veterinarians purchase microchips and scanners, provide implantation procedures, and ultimately generate enrollment in a tracking database. Which database tracking service, PETtrac™ or CAR, depends almost entirely on which microchip brand is used by the veterinarian. Therefore, the more veterinarians and shelters featuring AVID brand microchips, the more animals will be enrolled in PETtrac™. Why do veterinarians choose to feature either AVID or HomeAgain™ products?

Both Avid and Schering-Plough (in conjunction with the AKC) aggressively market to veterinarians and shelters. Since there is little product (hardware) differentiation - both brands of microchips and scanners are based on the same technology and conform to the same universal standards - the two companies compete on price, service, and reputation. For most veterinarians and shelters the choice is simple; they select the company that offers the lowest price. “Does a relationship with company X translate into higher profits for our office and value for our customers?” For others, the choice may be based more on social values and goals; they choose the company with which they feel the most comfortable. “Is AVID, a manufacturer of chips and scanners really concerned with animal welfare? Does the AKC, with its affinity for purebred animals, actually understand the needs of our shelter?”

We have seen that there are two important factors in determining who manages database systems such as the National Instant Criminal Background Check System and the National Center for Missing & Exploited Children: *money*, and *why* the

information is being gathered and tracked. Because of the sensitivity and importance of the information, the FBI primarily oversees The National Instant Criminal Background Check System. On the other hand, the National Center for Missing & Exploited Children has become the main database system used to track missing children because financial resources have enabled them to build an infrastructure and offer services beyond what is offered by other missing children organizations.

Although as a society we spend countless hours and millions of dollars caring for and managing our pet populations, the issue of pet identification and tracking is not necessarily a matter of great public concern. For this reason, the *who* and *how* of pet identification and tracking will not likely follow the course of gun control or criminal fingerprinting. Nor, will it likely follow the evolution of missing children as represented by the public and private collaboration behind the National Center for Missing & Exploited Children. Instead, competitive market forces (i.e. profits/losses) will probably determine the future of companion animal identification and tracking - the business world's version of *survival of the fittest*.

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