

Home Technology Integration

A Technology Forecast

Implications for Community & Technical Colleges
in the State of Texas



TECHNOLOGY FUTURES INC.

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Acknowledgments

Many parties are interested in accelerating the diffusion of Home Technology Integration (HTI) products and services throughout Texas. As a result, progress in this area is occurring at a rapid rate across a broad range of technology sectors.

Developing a comprehensive technology forecast in an area such as HTI requires gathering relevant, accurate and timely insights from individuals involved in various aspects of the technology on a daily basis. Some of the most interesting and productive activities conducted in the development of this forecast involved a series of interviews with 16 different HTI stakeholders and experts. These individuals provided valuable information about events and decisions that might accelerate or deter the development of a vibrant HTI sector in Texas. Of this group, we would like to call special attention to seven individuals who went out of their way to provide timely and relevant input:

- **Ann Behler**—Former Director, Collin County Community College Convergence Technology Center.
- **David Macik**—Department Chair, Computer Maintenance Technology, Texas State Technical College Waco.
- **Steve Farabee**—Vice President of Operations, Time Warner Cable, Austin.
- **Kurt Scherf**—Principal Analyst, Parks Associates.
- **Billy Martin**—Director (Former CEO), Cortexa Technology.
- **Steve Mendiola**—Security Manager, Mesa Home Systems.
- **Ron Zimmer**—President & CEO, Continental Automated Buildings Association (CABA).

The authors sincerely appreciate these individuals taking the time and effort to contribute to this forecast.

In addition to the formal and informal interviews, Technology Futures, Inc. (TFI) utilized a 19-question industry survey to gather information and insights. The authors would like to sincerely thank the 26 individuals and companies that responded to the survey. The organizations that took part in the survey are listed in Appendix A, and a complete list of the 16 experts who were formally interviewed is provided in Appendix B.

The authors would also like to express their appreciation to Debra Robison of TFI for her efforts in editing and formatting this report and Helen Mary Marek for providing illustrations. Finally, the authors would like to thank the staff at Texas State Technical College Waco for preparing the report for final publication.

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Preface

In April 2006, the Texas State Technical College System (TSTC) contracted with Technology Futures, Inc. (TFI) to conduct an analysis that would provide conclusions and recommendations to be used by the Texas Leadership Consortium for Curriculum Development (CCD), the Texas Higher Education Coordinating Board (THECB), and Community and Technical College (CTC) curriculum decision makers of the state. It allowed them to make strategic and informed decisions regarding the development of new and/or updating existing educational programs related to workforce needs in the field of home technology integration (HTI).

This report presents the results of this analysis.

Report Organization

This report is organized into five chapters. Chapter One presents a series of observations gathered by the authors in the conduct of the project, an explanation of the methodologies used in the project and a series of recommendations. Chapter Two provides an overview of HTI, including projections of future trends, and a listing of the factors that will either drive or constrain HTI developments. Chapter Three presents an analysis of the employment opportunities for graduates of CTC HTI programs, including current and future demand for such graduates, probable salaries, the nature of HTI jobs and required knowledge, skills and abilities.

Chapter Four provides information to be used by CTC deans and other academic decision-makers in deciding whether or not to initiate an HTI program, and, if so, how such programs can be best started. This chapter also examines faculty and facility requirements, highlights the relevant experiences of CTCs currently offering HTI programs, and provides a listing of organizations that can provide useful advice and assistance. Chapter Five lists conclusions drawn by the authors on the general subject of HTI and its relation to the state's CTCs.

Finally, Appendix H provides a directory of over 100 Texas companies that specifically identify themselves as providers of HTI products and services. This list, which includes contact information for individuals within those companies responsible for hiring HTI technicians, will be especially useful to CTC decision makers trying to assess the need for HTI programs in their service areas and also in the development of local advisory committees.

Scope

The term “home technology integration” can have a wide range of meanings. In this report, the term is defined as the digital convergence of previously separate home technologies and systems, including communications (voice, telephony and intercom), entertainment (audio and video), computing (Internet access and data networks), integrated home automation control and home management (security, lighting, HVAC, energy management, etc.). Although this report focuses on the integration of technologies in single-family residences, the general findings are quite relevant to other areas such as multiple family dwellings, small businesses and recreational vehicles.

Supporting Input

The information, assessments and recommendations included in this report are based on five types of supporting inputs:

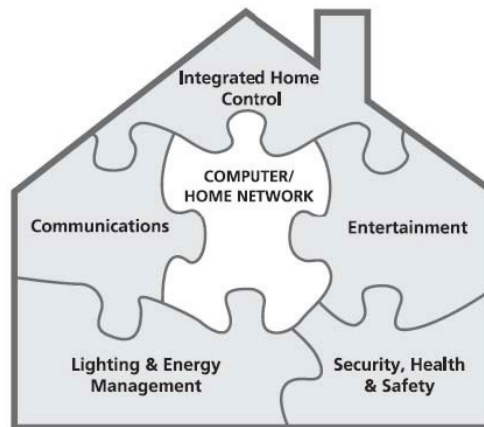
- Searches of relevant literature references;
- A specially designed survey of HTI organizations conducted by Technology Futures, Inc;
- A series of personal interviews with potential employers, academic authorities and relevant associations;
- A structured meeting of experts in the field and
- The experience of TFI in the HTI field.



Executive Summary

Home technology integration involves incorporating a wide variety of analog and digital technologies throughout the home into a single, mutually-supporting system. These integrated systems include communications (voice, telephony and intercom), entertainment (audio and video), computing (Internet access and data networks), integrated home automation control and home management (security, lighting, HVAC, energy management, management controls, etc.) systems.

Exhibit ES.1. Home Technology Integration Disciplines



Source: Internet Home Alliance

There is currently a demonstrated demand for home technology integration (HTI) technicians within the state of Texas. System integrators (employers) who design, install and troubleshoot these systems, have indicated that there is a lack of available skilled HTI technicians with a broad range of skills across the multiple home subsystems. There are also strong indications that this demand will increase over time as the cost of HTI-related equipment and services decreases and the market for HTI products and services continues to expand beyond large, custom-built homes into the mass-housing market.

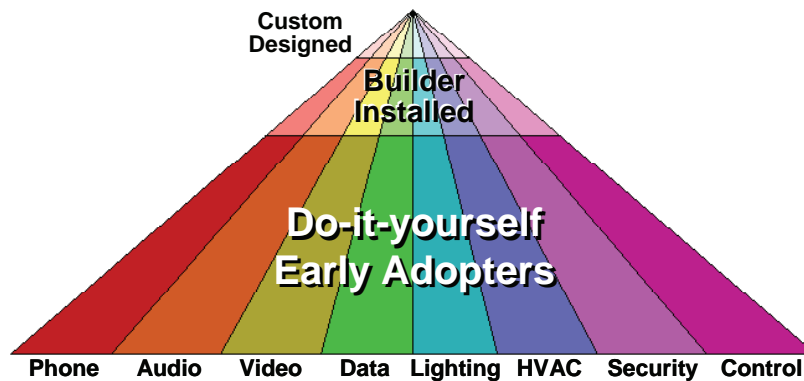
Because of these factors, there is a need for high-quality community and technical college (CTC) curricula in Texas. However, to ensure placement of graduates in high-paying jobs, college HTI programs should focus on systems design, systems integration, customer service and the necessary programming skills required for advanced HTI control systems. Colleges should avoid low-paying and low-skill installation (cable pulling) jobs.

HTI technician skills are transferable to commercial markets such as multiple resident dwellings, offices and retail outlets. This portability of basic skills will enhance the employment opportunities of HTI technicians.

Trends

Historically, market segmentation in the HTI industry follows a pattern of adoption from a small niche of high-end custom homes, to builder-installed wiring and systems in new homes, to do-it-yourself solutions for the retrofit of older homes.

Exhibit ES.2. HTI Market Potential



The larger and more modern the home, the more benefits are derived from technologies that automate functions to improve comfort, convenience and security. Therefore, it is not surprising that HTI began in high-end custom homes where security systems protect expensive contents and are integrated with surveillance cameras. The owners of such homes also found control of lighting, HVAC, window treatments, irrigation, and other systems to be useful because it allowed them to regulate these functions without having to physically traverse large distances. However, continuing advances in technology are opening both up- and down-scale markets. Because the number of existing homes is tremendously greater than the number of new homes, retrofitting existing homes represents a significant market opportunity.

Exhibit ES.3. Households in Texas

Total Housing Units	Total New Building Permits Issued
8,157,575	210,611

Source: U.S. Bureau of the Census

Surveys of homebuilders indicate that buyers are increasingly requiring—and builders are providing—more sophisticated home technology systems. The extent of this trend is reflected in Exhibit ES.4.

As the number and capability of these systems expand, there will be increasing value in integrating them effectively. This means that employment opportunities for HTI technicians are likely to continue to increase.

Exhibit ES.4. Technology Installation Rates In New-Home Construction (2002-2005)*

Technology	2002	2003	2004	2005
Structured Wiring	42.1%	59.0%	61.0%	49.0%
Monitored Security	17.7%	26.0%	28.0%	29.0%
Home Theater	9.2%	9.0%	8.0%	11.0%
Multi-room Audio	8.6%	12.0%	12.0%	15.0%
Lighting Controls	1.0%	7.0%	2.0%	7.0%
Energy Management	0.8%	8.0%	5.0%	11.0%
Home Automation	0.4%	7.0%	2.0%	6.0%

*As a percentage of homes built in specified years by surveyed builders who offer at least one technology. The falling percentage of homes installing structured wiring is indicative of the increasing pervasiveness of wireless home network systems.

Source: CEA, NAHB annual State of the Builder Technology Market ©TWICE 2006

Drivers and Constraints

The future of HTI will be impacted by a series of technical, social and economic drivers and constraints. Understanding these drivers and constraints and their impacts will assist in projecting future developments in this technology and, consequently, in the employment opportunities of HTI technicians.

A major driver for the increasing demand for HTI will be the increasing availability to homeowners of technologies that provide rich, high-value content, such as movies and music, through high bandwidth networks at decreasing costs.

Another trend that will enhance the growth of HTI is increasing standardization of HTI equipment, which will make it easier for system integrators, and even consumers, to mix-and-match individual components of their home technology networks. This is analogous to standardization in the PC world, where consumers can buy printers that interoperate with multiple brands of computers and operating systems.

In addition to technology and standardization drivers, there are a number of demographic, social, and economic factors that will undoubtedly influence home technology adoption and buying patterns. These drivers include:

-
- *Different generational attitudes.* The MySpace generation is at ease with digital devices. They demand that music and content be readily accessible through digital networks. As this age cohort ages and begins to start buying homes, they will demand the convenience of HTI systems.
 - *Telework & environmental awareness.* According to a 2006 study conducted by the Dieringer Research Group for the International Telework Association & Council, more than 12 million Americans telecommute full time, and an additional 10 million telecommute at least one day a week. Furthermore, the Dieringer study found that the total number of telecommuters has increased 10% since 2004. As the number of such workers continues to increase, they will provide a fertile market for high bandwidth data and video services that facilitate videoconferencing, email access, and data uploading and downloading. In many cases, the cost of establishing this infrastructure will be subsidized by employers. Therefore, for many homeowners, the infrastructure for HTI products and services will be available at no additional cost. This availability will be a driver for the adoption of HTI products and services.

The major constraints to mass adoption of HTI systems appear to be lack of customer awareness, lack of customer demand and poor marketing. Other constraints are:

- Lack of interoperability of equipment and effective standards;
- Many builders of spec (mass produced) homes are unwilling to incur the cost of installing HTI systems unless there is a clear indication that homeowners are willing to pay a profitable premium for such homes and
- Difficulty and expense in establishing HTI systems in homes with legacy three-phase electrical wiring.

Factors that could accelerate HTI system adoption are:

- Better marketing of the benefits of such systems to consumers;
- Increasing use of digital devices to monitor patient health remotely and lower health-care costs;
- Increasing use of energy management systems that allow homeowners to more efficiently utilize energy consuming devices in the home, especially heating, ventilation and air conditioning systems;
- Increasing numbers of telecommuters;
- Availability of low-cost, low-power wireless systems that eliminate the need for structured wiring (i.e., Ethernet) in the home and

- Killer applications, such as Microsoft Media Center, that compel manufacturers to develop and adopt interoperability standards.

HTI as a Career

The attractiveness of HTI as a career for CTC graduates will depend on a number of factors: the current and future demand for HTI technicians, projected salaries for both entry-level and experienced HTI technicians, promising work locations, the nature of the work, and the knowledge, skills and abilities (KSAs) associated with jobs.

Demand

The job title “HTI technician” is new and is not fully represented by existing standard occupational codes (SOC) or job titles. Thus, employment projections based on existing labor market information (LMI) data are uncertain. To gather an estimate of employment opportunities, Technology Futures, Inc. (TFI) conducted a survey in which potential Texas employers were asked to project hiring of HTI technicians within the next year and within the next three years. Twenty-six companies responded to the survey, and the results shown in Exhibit ES.5.

Based on this data, TFI projected that the 26 companies that responded would hire approximately 76 technicians within the next year, and approximately 205 within the next one to three years. Since the 26 respondents represent about 10% of the 250 identified potential employers, the total number of HTI technicians hired should be much greater than these numbers.

Exhibit ES.5. Projected Number of New HTI Technician Hires

Number of HTI Hired	Within One Year	Within One to Three Years
None	10%	10%
One to three	65%	15%
Three to 10	25%	55%
Ten to 20	—	10%
More than 20	—	10%

Source: TFI Survey (Spring 2006)

Estimated Salary Levels

TFI’s survey of potential employers asked respondents to indicate the salaries expected for both entry-level HTI technicians and those with three or more year’s experience. The lower range of salaries is representative of employment in lower-skilled technician positions that involve primarily

basic HTI installation activities, such as wire- and cable-pulling. The upper range of salaries is representative of employment in higher skilled positions that involve activities such as HTI system design, networking, and troubleshooting. The results of this survey are presented in Exhibit ES.6.

Exhibit ES.6. Projected Salary Levels for HTI Technicians

Salary Range	Entry-Level (% Respondents)	Experienced (% Respondents)
\$20,000 - \$25,000	45%	6%
\$25,000 - \$30,000	22%	11%
\$30,000 - \$35,000	22%	28%
\$35,000 - \$45,000	11%	33%
\$45,000 - \$55,000	-	22%

Based on these results, together with other data, the authors estimate that the average salary for entry-level HTI technicians is estimated to be about \$27,700 (\$13.32/hour), and for experienced HTI technicians, about \$37,700 (\$18.13/hour). It is important to note that HTI technicians with advanced programming skills in home automation systems can obtain significantly higher salaries (\$50,000 to over \$100,000). Certification for these systems is provided by manufacturers and distributors of these systems. Colleges considering HTI programs should encourage graduates to pursue these additional industry certifications for considerably higher pay and advancement.

Job Responsibilities

HTI technicians must possess a broad range of knowledge, skills and abilities across multiple technologies, standards and applications. Moreover, they must be capable of integrating these components into well-designed and functional solutions that meet customer (homeowner and homebuilder) specifications. The job responsibilities necessary to meet these requirements can be classified into three areas of responsibility: design, installation and support.

Design of Digital Systems. HTI designers must be familiar with the operating characteristics of all types of digital home equipment. Designers will have extensive contacts with various stakeholders, including broadband service providers, homebuilders and homeowners, equipment retailers and contractors who specialize in various HTI subsystems (such as control systems, audio/video equipment and security and surveillance suppliers).

Installation of Home Technology Systems. While consumer HTI technology such as X10 can often be installed by end-consumers with no formal training, only a small percentage of homeowners have the knowledge, time, or inclination

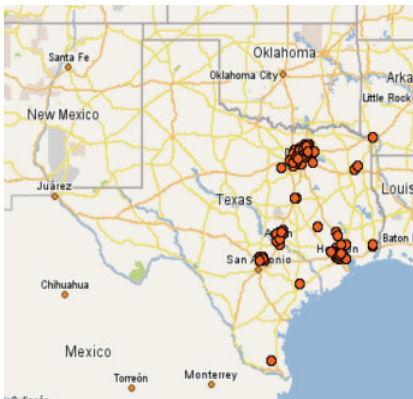
to install moderate to advanced HTI equipment—much less integrate mixed technologies into a functional HTI solution.

Supporting Existing Home Technology Systems. With any technology, there can be problems with equipment in the field. This problem will be especially acute in the area of HTI because consumers will have the ability to reconfigure the equipment in their home in any way they choose. Although this personalization of services is one of the many “selling points” of HTI, it can be problematic for technicians who are trying to troubleshoot problems.

Size and Location of Markets

A number of companies that provide HTI products and services have been established in the state, where the demand for HTI systems is greatest. A cluster map indicating the location of these companies is provided in ES.7.

Exhibit ES.7. Cluster Map of HTI Companies in Texas



The market for HTI technicians will be greatest in those areas where there are already existing companies designing and installing HTI products and services. These companies will need highly qualified technicians to perform these services. Therefore, as the map indicates, the demand for HTI technicians will be greatest in metropolitan areas such as Houston, Dallas/Fort Worth, Austin, and San Antonio (and neighboring suburban areas); less in smaller cities such as Denton, El Paso, and Galveston; and still less in the state’s small cities and towns.

Initiating an HTI Program

Current Programs

There are currently two different HTI one-year certificates being offered by CTCs in Texas: one by Texas State Technical College Waco and another by the three members of the Convergence Technology Center at Collin County Community College. Both programs are based on industry demand and

address core areas of need demonstrated within this report. Both programs use an industry-driven standard (CompTIA HTI+) as the basis for their curriculum. However, these programs are very different.

The Collin County HTI curriculum focuses on telecommunications and network administration and has one HTI-specific course. The Texas State Technical College Waco program focuses on telecommunications, HVAC, network administration, electrical, computer hardware, and customer service, and has three courses dedicated to HTI. Though, these two programs are very different, both serve an established industry demand. CTC academic decision-makers would be well advised to contact the directors of these programs when considering the initiation of HTI programs at their colleges. Notably, neither of these programs have conducted an HTI-specific DACUM nor PCAL industry skills analysis.

Faculty Qualifications

In general, faculty members should be familiar with both the subsystems involved in HTI, as well as the more advanced automation and control systems that interface these components into a working system. Ideally, such faculty should have previous or active industry experience in the design and installation of such systems. Moreover, faculty should have HTI industry certifications such as CompTIA HTI+ to ensure they have a complete understanding of the scope of HTI. Faculty may also pursue vendor-specific training and certification from companies such as AMX or Crestron.

Physical and Capital Costs

HTI training facilities should include all of the real-world equipment relevant to HTI as specified in industry certifications. This includes security systems, entertainment systems, heating/air conditioning systems, communication systems, audio/video/data networks, lighting and energy systems, and automation and control systems. These items are widely available through a number of distributors, and some colleges may find local industries willing to donate or sponsor the purchase of some equipment. The cost of establishing the still uncompleted HTI lab at Texas State Technical College Waco was approximately \$22,500. The lab consists of three lab stations for hands-on training in various HTI subsystems including structured wiring, HVAC programmers, audio/visual networks, security systems, and electrical/lighting controls and fixtures. The lab is currently functional, but additional HTI subsystems will be integrated with the existing lab stations to extend the range of training.

Industry and Education Partnership to Be Leveraged

There are a number of industry and education associations available to provide advice and assistance to CTCs considering initiation of HTI programs. Some of these groups have identified essential skill sets and developed curriculum for preparing highly qualified HTI technicians. These groups include:

Electronic Systems Industry Consortium

In 1999, the Continental Automated Buildings Association (CABA) became involved in an effort to create technician training materials in the HTI industry, particularly in the residential part of the market. The industrial groups included the Consumer Electronics Association, the Custom Electronic Design and Installation Association, the National Systems Contractors Association, the Building Industry Consulting Services International (BICSI), and Infocom International.

As a result, CABA and these five key industrial groups created the Electronic Systems Industry Consortium (ESIC). This Consortium believes that the shortage of qualified technicians was actually the limiting factor in the growth of the sector. In response, the ESIC created the Electronic Systems Integrators Report, published in April 2004.

Computing Technology Industry Association and the Internet Home Alliance

In 2002, the Computing Technology Industry Association created the Home Technology Integrator (HTI+) certification. The certification was the result of a partnership between CompTIA and the Internet Home Alliance, whose membership includes Cisco, Best Buy, and CompUSA. The HTI+ certification is a foundational certification that addresses knowledge and skills that industry believes that HTI technicians with one to two years of experience should have competence in. Both the Texas State Technical College Waco and Collin County HTI programs use the CompTIA defined knowledge and skills as the basis for their programs.

Timing for HTI Program Initiation

The results of this project indicate that there is currently a need for CTC HTI graduates. CTCs that initiate programs should prepare graduates for high-paying positions in the HTI field including positions such as system designers, network installers and system troubleshooters.

Conclusions

Based on the results of this project, the authors have come to the following conclusions:

- Although it does not appear likely that increasing the number of CTC trained HTI technicians will have a dramatic impact on the Texas economy or cause a significant number of companies to relocate to the state, the demand for such technicians appears to be growing, and HTI training can provide a number of CTC students with skills that would allow them to begin a career that offers attractive employment opportunities.
- Obviously, the market for HTI graduates will vary as a function of a number of economic indicators, among which, the strength of the new housing market is arguably the most important. Nevertheless, HTI is a field in which jobs cannot be transferred overseas, or even out of state. Most of this job growth will be in the large metropolitan areas of the state.
- One of the particularly interesting features about the HTI career field is that, currently, most integration companies are small. Therefore, there are unusually attractive opportunities for trained graduates to start their own business that can grow as the market for HTI products and services grows. As a result, CTCs initiating HTI programs might consider integrating an entrepreneurship course into their programs.
- The existence of effective HTI programs at CTCs will provide incumbent technicians employed in HTI-related fields an opportunity to enhance their skill base and, thus, their employment attractiveness. Such programs could also be valuable to displaced workers who have lost their jobs because of advances in technology or transfer of jobs to other countries.
- There is a wide range of salaries for HTI technicians. CTCs should develop HTI programs that emphasize the skills required for higher salaried positions such as designers and troubleshooters rather than for lower salaried positions such as installers.



Chapter One: Observations, Methodology, and Recommendations

Home technology integration involves incorporating a wide variety of analog and digital technologies throughout the home such as communications (voice, telephony, and intercom), entertainment (audio and video), computing (Internet access and data networks), integrated home automation control, and home management (security, lighting, HVAC, energy management, etc.) into a single, mutually-supporting system.

Observations

There is a demonstrated demand for home technology integration (HTI) technicians within the state of Texas. As a result, there is a need for high-quality community and technical college curricula to train HTI technicians.

The demand for skilled HTI technicians will continue to increase over time as the cost of HTI-related equipment and services decreases and the market for HTI products and services continues to expand beyond large, custom-built homes into the mass housing market.

System integrators (employers) indicate a lack of available skilled labor in the HTI sector and the need for trained HTI technicians with a broad range of skills across multiple home subsystems, including audio, video, networking, control systems, air conditioning, security and computer technology.

The increasing adoption of wireless and power-line broadband technologies and more accessible sales, installation, and support channels provided by major consumer electronics retailers will allow homeowners to easily retrofit older legacy homes. This will be the largest market for HTI-related devices, control systems, and high-bandwidth services.

In order to ensure high paying placement of graduates, HTI programs should focus on systems design, systems integration, customer services, and the necessary programming skills required for advanced HTI control systems. Colleges should avoid low-paying and low-skill installation (cable pulling) jobs.

Since HTI skills are transferable to commercial markets as well, the term “home” technology integration does not accurately reflect the transportability of these skills. HTI is an accepted industry term, but colleges might consider an alternative name such as “technology integration,” “digital technology integration,” or “digital systems integration.” The portability of these basic skills will enhance the employment opportunities of HTI technicians.

Methodology

The information, assessments, and recommendations included in this report are based on a number of supporting inputs, including a survey of potential Texas employers and a series of personal interviews with people from industry and academia.

The survey was designed primarily to target Texas employers who would be interested in hiring home technology integration (HTI) Technicians trained at community and technical colleges (CTCs). The survey included 19 questions involving primarily employment projections (salaries and demand) and required knowledge, skills, and abilities. Invitations to participate in the survey were sent electronically to 250 companies. Representatives of 27 companies responded to the survey, including companies involved in the provision of various home technology products and services, such as home security, audio/visual systems, air conditioning/heating, electrical wiring, electronic controls, and integrated systems. (For more information on this survey, see Appendix A.)

In this analysis, 16 formal interviews were conducted, in addition to a number of informal discussions. The individuals interviewed included the President and CEO of the Continental Automated Buildings Association (CABA); the Principal Analyst of a major HTI consulting firm; two independent HTI consultants; executives of Mesa Home Systems, Cortexa, Time Warner Cable, Motorola, and Friendly Home LAN (Israel); the Director and Program Manager of the Convergence Technology Center; the Director of the HTI Certification program at Tarrant County College; and the Department Head, Computer Maintenance Technology Department and the Director of the HTI Certificate Program at Texas State Technical College Waco. (For a full listing of the individuals interviewed, see Appendix B.)

Recommendations for CTC Academic Decision Makers

There are currently two different HTI one-year certificates being offered by CTCs in Texas: one by Texas State Technical College Waco and another by the three members of the Convergence Technology Center at Collin County Community College. Both programs are based on industry demand and address core areas of need demonstrated within this report. Both programs use industry-driven standards (CompTIA HTI+) as a guide for their curriculum. However, these programs are, in fact, very different.

The Collin County HTI curriculum focuses on telecommunications and network administration and has one HTI-specific course. The Texas State Technical College Waco program focuses on telecommunications, HVAC, network administration, electrical, computer hardware, and customer service, and has three courses dedicated to HTI. Though these two programs are very different, both serve an established industry demand. CTC academic decision

makers would be well advised to contact the directors of these programs when considering the initiation of HTI programs at their colleges. (For more information on these programs, see Chapter Four: Initiating an HTI Program, and Appendices C and D.)

For many of the state's CTCs, initiating an HTI program will involve a significant investment of time, money, and effort. This will be true whether the college opts for:

- 1) A multidisciplinary curriculum based on existing courses in related disciplines, augmented by a small number of integration courses or
- 2) An interdisciplinary curriculum in which all or most of the courses are developed specifically to support the HTI curriculum.

The latter approach will enhance the effectiveness of the overall curriculum, but will require a greater commitment of resources.

In reality, the question of whether or not a college should initiate an HTI curriculum embodies a number of subordinate questions:

- Is there a significant need for trained HTI technicians in the market the CTC serves?
- Is that need likely to increase, decrease, or remain constant for a significant period of time?
- Will salaries for HTI graduates be significantly greater than those for graduates in other programs?
- Will a sufficient number of students enter the program in the immediate future?
- Will student interest in entering the program continue in the future?
- What fraction of students entering the program is likely to graduate?
- How many incumbent workers will utilize the program to upgrade their skills, and what courses will appeal to them?
- What will be the real cost of initiating the curriculum in terms of time, money and effort?
- How can the initiation effort best be scheduled?
- How can the success or failure of these programs best be measured?

To answer these questions, CTC deans and other academic decision makers should consider conducting the following analyses:

-
- 1) Examine the home building patterns in their areas of responsibility. Data in this report shows that both the number of new homes built in the state and the average cost of these homes has been increasing steadily for at least 15 years and are likely to continue to increase. However, these increases may not apply to local areas. By reviewing new housing starts, average cost of these homes, the fraction of homes with advanced technology systems, and the average costs of these systems, projections can be made of current and future demands for HTI technicians.
 - 2) Identify, with the assistance of Appendix H, companies that provide HTI products and services in their CTC service area. These companies will be the employers of HTI technicians. The workforce demands of these employers will be essential to determining the demand for HTI technicians.
 - 3) Review the results of similar programs in the past. By this review, decision makers can determine the probability of success of an HTI curriculum. The individuals conducting this review should consider the special characteristics of HTI programs, (e.g., the fact that the programs will present students with special challenges, that there is little experience in the conduct of such programs in other CTCs, that job titles are not clearly defined, and that the nature of the market is changing). This review will provide insight into the costs/benefits of HTI program initiation, as well as suggesting specific actions that should be taken or avoided.
 - 4) Give consideration to exogenous events, decisions, or actions that might impact the HTI program. For example, there has been some discussion of the possibility of the state requiring HTI technicians to become licensed, as is required for trades such as electricians and plumbers. How would this impact a CTC HTI program? Other examples might include unexpected advances in technology, new government regulations, economic downturns, and changes in the housing industry structure. CTC decision makers should identify feasible events, decisions, and actions that might impact their HTI programs and analyze what the implications of these occurrences would have for their programs.
 - 5) After identifying the occurrences that might impact their HTI programs, decision makers should determine the early signs that these impacting events, decisions, and actions are impending and analyze what changes in the HTI program would be prudent in these situations. By considering such indications early, CTCs may be able to make necessary program modifications in a timely manner.
 - 6) Determine the mind set of individuals and organizations that will play a role in the success of the HTI programs (e.g., home builders, home technology installers, high school students, students currently enrolled in other CTC programs, equipment suppliers, lending agencies, and local real estate agents). CTCs are required to establish Advisory Committees

before initiating any new programs. Although these committees can be of value to the colleges, they may not reflect overall community views. In this market, perception is often reality. If home buyers, for example, are convinced that “everyone” has sophisticated integrated home systems, then the probability that more homes will have such systems increases. CTCs in areas where builders of master planned communities are using HTI (broadband) as a selling point might consider that building contractors in Keller, the community outside of Dallas in which Verizon is offering high bandwidth fiber optic access to homeowners (fiber-to-the-premises), specifically asked the Convergence Technology Center to establish training programs for HTI technicians.

Analyses of these types will require time and effort, and CTCs must balance the costs and benefits of the analyses. In many cases, CTCs may use imaginative approaches to conduct the analyses, such as using current students to conduct the analyses as part of their regular courses. Despite the effort involved, conduct of such analyses should materially increase the probability of a proper decision with regard to whether a given CTC should initiate an HTI program, and, if so, how that program can best be initiated.

Note: As part of this project, the authors submitted a recommendation to the Texas State Leadership Consortium for Curriculum Development (CCD) that the Consortium fund the design a curriculum (DACUM) project specifically targeted at Home Technology Integration. A discussion of the rationale behind this recommendation is included in Appendix E.



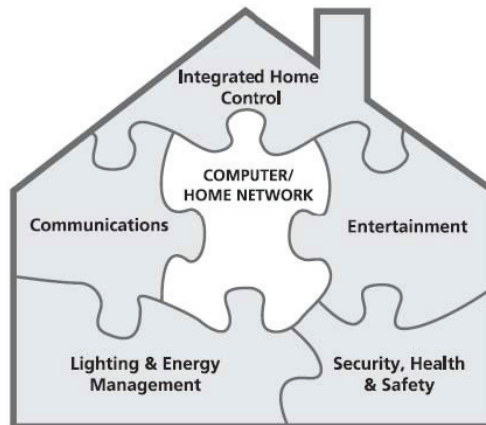


Chapter Two: Background

Definition

Simply stated, home technology integration involves incorporating a wide variety of analog and digital technologies into a single, mutually-supporting system. These integrated systems include communications (voice, telephony, and intercom), entertainment (audio and video), computing (Internet access and data networks), integrated home automation control, and home management (security, lighting, HVAC, energy management, etc.) systems. The intelligent integration of these previously distinct subsystems provides the homeowner with the ability to create homes that are safer, more comfortable, more enjoyable, and more efficient than they would otherwise be (see Exhibit 2.1). (For more information on HTI Technologies see Appendix F.)

Exhibit 2.1. Home Technology Integration Disciplines



Source: Internet Home Alliance

Billy Martin, Director and ex-CEO, Cortexa Technology

Homeowners are living increasingly digital lifestyles. To Cortexa, it means three things:

Digital media sharing. Involves the digital capturing, storage, and rendering of items such as pictures, music, movies, and recorded television programs. Homeowners want to be able to store these items and “move” them across the home in a convenient and easy way across disparate platforms.

Home control. In an integrated manner, homeowners can control all of the disparate home subsystems such as HVAC, lighting, security, irrigation, home access, etc.

Completely Internet-enabled home. When homeowners are not home, they can still control and access all of the home’s subsystems as if they were in their living rooms. This includes access to computers even when they are away.

HTI Applications

As noted in Exhibit 2.1, home technology integration involves the convergence of once-separate applications in the general areas of information, telecommunications, entertainment and control. This section will define these applications in more detail.

Tim Woods, Vice President, Ecosystems Development, Internet Home Alliance

For the foreseeable future, we anticipate that the market will consist of two [at least] functional networks in the home: a PC-centric network and a consumer electronics-centric network. There won’t be a high demand for bridging these networks until the foundation for each of these three ecosystems [career, entertainment, and family] has been laid. This means there is a substantial opportunity for market entrants to develop point products that allow consumers to migrate to an increasingly integrated network environment.

Information

In early 2005, the General Accounting Office estimated that about 70 percent of U.S. households had a PC and nearly half had two or more. However, only 14 percent of households and 20 percent of online households had a home data network. The relatively low penetration of data networks is surprising since they are fairly inexpensive and allow users to share Internet access, data files, disk storage, and/or printers across multiple rooms (Internet Home Alliance, 2005).

Almost all home data networks use Ethernet and Internet protocols, including wireless Ethernet or Ethernet over electric power mains, home phone wiring, or coaxial TV cabling. The use of these protocols makes it relatively easy to bridge between the different media and route signals throughout the house without installing new wires. For example, even if

CAT-5 cabling is installed around the baseboard of a home office to establish reliable Ethernet connectivity between two PCs, a wireless router can connect systems in other rooms without the need for running wires through walls.

Forrester Research predicts the market for home data networks will grow from 10 million households in 2003 to more than 46 million in 2009 (Forrester Research, 2004), driven by falling PC prices, multi-PC households, and the fact that some 70 percent of U.S. households already have Internet access, with over 25 percent having broadband. In 2003, over 80 percent of home networks were based on wired Ethernet and less than 30 percent used Wi-Fi, but, by 2005, the price of wireless adapters had fallen to the point that half of home networks were wireless (Internet Home Alliance, 2005).

Electronic devices are increasingly becoming connected to the Internet. Today, telephones such as VoIP (voice over Internet protocol) phones, media receivers, and consumer electronics devices utilize IP and Ethernet protocols to communicate over data networks. This increasing connectivity will drive the demand for local area networks and pervasive wireless communications.

Telecommunications

Today's consumers have more options for home telephone service than in the past. They can order local and long-distance phone services from incumbent or competitive local exchange carriers (ILECs or CLECs), establish cellular service, or subscribe to a VoIP service through their Internet connection.

Depending on their choice in telecommunications technologies, it can become easier or more difficult for consumers to integrate those technologies with other home technologies. For example, if their telecommunications service provider offers both television programming and VoIP phone service, caller ID information can be displayed on the TV set. A TV connected to the same network as phones and then fitted with a Web camera can become a videophone that is less expensive than a standalone videophone, since the most expensive component, the screen, is already present.

**Jeff Cove, Vice President for Alliances and Business Development,
Panasonic**

The key to unlocking the exciting potential of digital entertainment devices, including broadband-delivered entertainment, is the home network. At Panasonic, we're committed to delivering products that harness the power of in-home networks and digital media technologies.

Some system integrators have reported difficulties using VoIP technology with home security and monitoring equipment. Because of the added complexity of Internet connections, traditional copper-pair telephone lines can provide a more compatible, and often more reliable, connection. These issues will likely subside as industry standards, compatibility, and reliability of devices and protocols continue to improve.

Entertainment

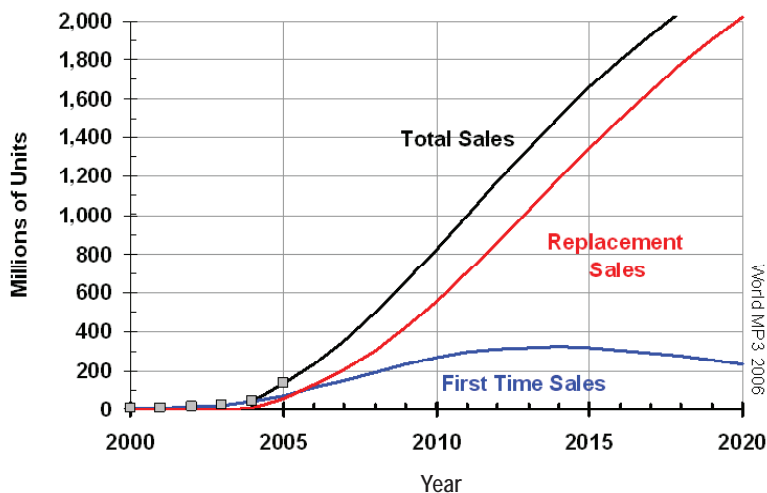
Digital entertainment—audio and video—is having a profound effect on content, consumer electronics, distribution services, and delivery networks, including access and home network technologies. When content is stored digitally, it can be transmitted quickly, encrypted to protect the rights of content creators, combined with other digital information such as data and phone calls, and distributed over digital networks.

While nearly 25 percent of Internet households have a data network and 36 percent say they are very interested in a multimedia network, only two percent actually had a multimedia network when surveyed in 2005. That gap between interest and adoption is a huge opportunity that PC and consumer electronics (CE) manufacturers are each trying to address (Parks Associates, 2005).

Digital Music

Compressed digital music can be downloaded or streamed live across the Internet or through satellite radio services, stored on a home PC, converted into other digital formats, sent to consumer entertainment devices that are connected to home networks, and copied onto portable devices that extend the HTI concept outside of the home. About 20 percent of U.S. households, for example, have a portable MP3 player, with the iPod being the most popular model (about 40 percent market share). Nearly half of online households say they would like to play digital audio files in their car (Internet Home Alliance, 2005).

Exhibit 2.2. Worldwide Sales of Personal MP3 Players (Including Integrated Devices)



Source: Technology Futures, Inc.

Video Entertainment

Digital television and digital music are going through a similar transformation. Consumers are moving from analog VCRs for recording and time-shifting programs at home to DVD players that offer better sound and image quality and Digital Video Recorders (DVRs) that automate recording and have the ability to pause live TV or skip commercials. TV programs can be received from over-the-air broadcasters, cable multiple system operators (MSOs), satellite services, new phone company entrants to the IPTV market, and as downloads or live streams across the Internet.

If someone was watching a DVD movie in the family room and wanted to retire to the bedroom to see the rest of it, the person would not need a home network since he or she could simply insert the DVD in another player that the person had bought at the grocery store for \$29. However, if the movie is recorded on a DVR or PC, the person would be able to stream the program through the Internet or over coax cable.

Digital Video

Whether displayed on a TV or computer, video communications to, from, and within the home is a driver of high-bandwidth networks and the foundation of several killer applications, including:

Video on demand (VOD). With VOD, individuals can view TV programs or access movies at any time without prerecording them on a DVR. Broadcasters such as ABC/ Disney, CBS Broadcasting, CNN, MTV, and NBC Universal have created their own online channels. In the early part of 2006, CableVision announced plans to offer subscribers a service that would record programming to the company's servers. Subscribers would then have the option of accessing the content at-will. However, in May 2006, several television networks and movie studios, including CNN and Disney, sued CableVision arguing that remote access to stored content constituted a retransmission that violated copyright agreements. The case is still pending.

Video gaming. While several players can be connected to a single game console, there is a clear trend toward networked or online gaming, where players compete against each other on their own individual consoles or form teams to achieve a common objective. As of 2005, 40% of U.S. households and 59% of online households had a video game system, with Sony's Playstation 2 leading the home console market and Nintendo's GameBoy Advance SP leading the handheld market (Internet Home Alliance, 2005).

Telemedicine. Physicians can conduct diagnostics and monitor the health of their patients remotely using HTI technologies. The touted advantages of such systems include lower health-care costs and the ability for the aging population to live unassisted in their own homes.

Telework. The ability to work at home with the same capabilities available as in the office has many benefits to employers, workers and society. Telework programs can help employers reduce real estate costs, improve productivity, hire the most qualified workers no matter where they live and ensure continuity of operation in the event of disasters. Societal benefits could eventually include reduced traffic congestion during peak commute times (with related savings in fuel consumption), reduced costs of building more roads and pollution control. Individual benefits include work and life balance, as well as new opportunities for disabled workers and persons who want to stay at home with their children. High-speed networks that support the ability to send video mail, make video calls and hold virtual meetings with image quality almost as good as being there are the foundation that makes telework possible.

The Entertainment Hub

Exhibit 2.3. Microsoft Windows Media Center



Source: Microsoft Corporation

Entertainment servers can act as a central repository for music, video and photos in the home. A server could be any number of devices in the home including a Windows Media Center PC, an enhanced set-top box, an interactive game console, or some other device. However it is implemented, the server would allow consumers to access prepackaged content or produce and structure content according to their own individual needs. Ideally, this server would network seamlessly with existing PC and CE devices within the home, including portable devices and allow for format transcoding that

allows the content to be viewed across disparate platforms.

Entertainment servers can also be networked with home automation controllers. For example, Home Automation, Inc. has developed a software package called Home Control that can be run on a Windows Media Center computer. The program allows homeowners to control various home management systems such as those for lighting, temperature, and security control through the company's HAI Omni Controller.

Automation, Control and Security

Home automation, control and security products that conform to industry standards give consumers the option of connecting their lighting, alarm and HVAC controls into integrated systems that multiply the value of the individual systems. For example, in an integrated system:

- A control network could integrate lights with a security system to establish a "lived in" look when homeowners are not in the home. The same system could light an exit path and flash signals to first responders in emergencies.
- The same motion sensors that trigger a security alarm when homeowners are away from the home could determine if a person is going downstairs to the kitchen at night so that a pathway of light can safely show the way.
- Programmable thermostats function like stand-alone HVAC controllers and automate temperature settings by the time of day. However, a communicating thermostat that is connected to a smoke detector can respond to an alarm and shut down all the ventilation systems in a home so that a fire is not fed oxygen and poisonous fumes are not distributed.

By connecting security and entertainment networks, a Web camera could detect movement, start recording images on a DVR, send an email alert with attached images, and respond to remote commands from a mobile phone or other Internet device. With remote access, any device on the network, including zooming, panning and rotating the camera, could be controlled.

This example shows how the value of "point products" designed for one function is magnified when the products are networked and integrated with other functions. Similarly, the value of a lawn sprinkler system is enhanced by the ability to access weather information across the Internet from nearby schools or the National Weather Service. Sprinklers could even turn on automatically to scare away deer or burglars in response to an outside motion sensor that also turns on lights.

The possibilities for home automation, control and security are vast, but usually require consumer awareness and professional installation. The

emergence of consistent networking standards will help drive costs down and enable manufactures to introduce products that are easier for consumers to install and network on their own. For example, a fully automated professionally installed home automation system composed of components from a company such as AMX or Crestron can easily cost anywhere from \$20,000 to \$30,000 for a 3,000 square foot home. On the other hand, do-it-yourselfers can start building an off-the-shelf system for the same home with technologies such as X-10 for as little as \$49 (Razor Thought, 2004).

Kurt Scherf, Principal Analyst, Parks Associates

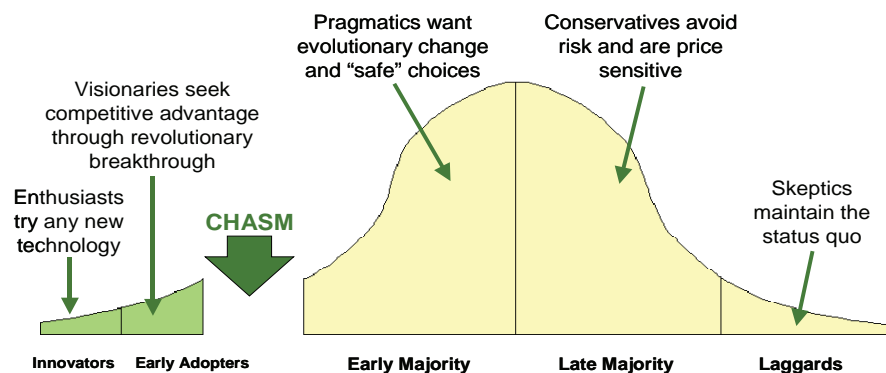
The market for home security and safety services will take on a new face, thanks in large part to such innovations as broadband Internet connectivity, emerging communications solutions, and affordable and reliable do-it-yourself products.

Future of HTI

Expanded Interest

Historians point to 1966 and Jim Sutherland's hand-built home automation system as the beginning of the HTI industry. His ECHO IV (Electronic Computing Home Operator) computer lived in the kitchen and automated many household chores. Forty years later, in 2006, high-speed data and entertainment networks have emerged, crossing the chasm separating early adopters and the high-growth early majority. This has helped to focus consumer attention on technology integration with the control applications that have not yet made that jump and remain largely limited to custom designs in high-end new homes and do-it-yourself projects from early adopters. Now, it appears that even home controls are poised to finally move from niche markets and mass-market growth (see Exhibit 2.4).

Exhibit 2.4. Adoption of New Technology



Source: Geoffrey Moore, *Crossing the Chasm*

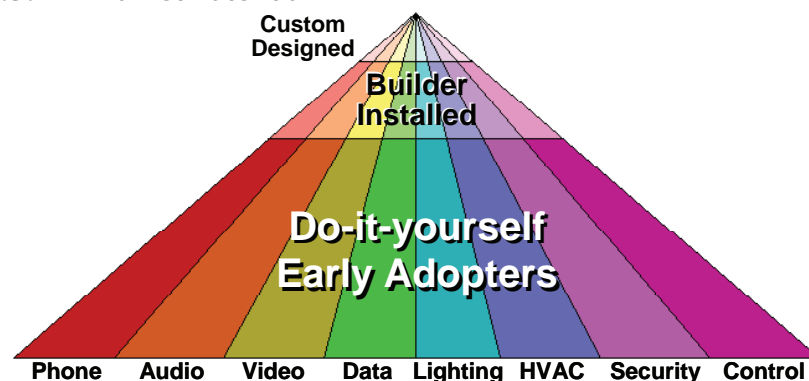
New research from the Internet Home Alliance identified the critical mass of consumers that have adopted fundamental technologies needed for the connected home (multiple PCs, broadband Internet, home networks, and Web-enabled mobile devices). Their survey of approximately 1,800 online consumer households also found that 42 percent of online U.S. households tend to be early adopters with serious interest in HTI, while the other 58 percent were classified as mass market consumers, less likely to adopt new technologies (Internet Home Alliance, 2005). Systems such as the Windows Media Center PC represent a move away from expensive proprietary hardware systems toward less expensive and more commodity-like platforms such as the PC.

Market Segmentation

For each application, market segmentation in the HTI industry historically aligns by size, cost and age of homes, ranging from the small niche of high-end custom homes, to builder-installed wiring and systems in new homes, to do-it-yourself solutions to retrofit older homes where there largest market potential lies.

The larger and more modern the home, the more benefits are derived from technologies that automate functions to improve comfort, convenience and security. Therefore, it is not surprising that HTI began in high-end custom homes where security systems protect expensive contents and are integrated with surveillance cameras. The owners of such homes also found control of lighting, HVAC, window treatments, irrigation and other systems to be useful because it allowed them to program these functions without having to physically traverse large distances. However, continuing advances in technology are opening both up- and down-scale markets. Because the number of existing homes is tremendously greater than the number of new homes, retrofitting existing homes represents a significant market opportunity (see Exhibit 2.5).

Exhibit 2.5. HTI Market Potential



High-End Homes with Custom Designed Systems

The simple task of turning off lights at night in a 10,000 square foot home can be burdensome, so automatic lighting controls are easily justified. High-end homes may also rely on custom solutions and proprietary technologies when mass-market products cannot support the needs of very large homes. Technology integration costs in high-end homes average \$25,000 to \$30,000 and can easily exceed \$100,000 when subsystems are centrally controlled (Parks Associates, 2006).

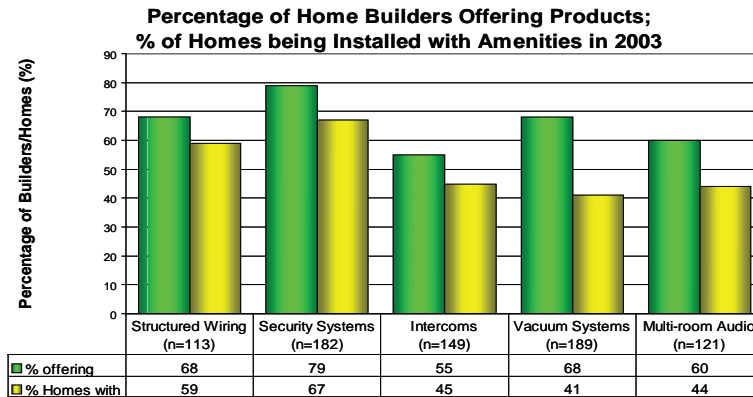
While most homes today have one or two zones of HVAC, high-end homes could have 10 or more zones and depend on products designed for commercial office buildings: boilers, chillers, compressors, dampers, humidifiers, etc. To control a large number of lights, appliances, and entertainment devices, custom designers may also select proprietary lighting controls from Lutron and electronic home automation and controls from AMX and Crestron, companies that established themselves in the commercial market and found a niche in high-end homes.

Even though custom controls offer rich configuration options not available for mass markets, they are generally more expensive and complex. Significant effort is required to make custom technologies easy to use for homeowners. Moreover, to keep such systems running reliably requires a great deal of ongoing support. All of this keeps these systems from moving down-market, and they remain only available to high-end consumer and commercial applications.

Builder-Installed Wiring & Systems

According to Parks Associates, home builders have become a major channel for digital technology. A 2004 survey of some 400 mainstream builders found that a home theater or multi-room audio system is just as important to the sale of a new home as is a playroom, and even more important than a pool. Because of increasing consumer demand, more than half of these builders install a security system as a standard feature, as well as a minimal amount of structured wiring for telephone, Ethernet and cable or satellite television. Moreover, some are starting to integrate security with lighting, HVAC and other systems (see Exhibit 2.6).

Exhibit 2.6. Percentage of Home Builders Offering Products and Percentage of Homes Being Installed with Amenities in 2003

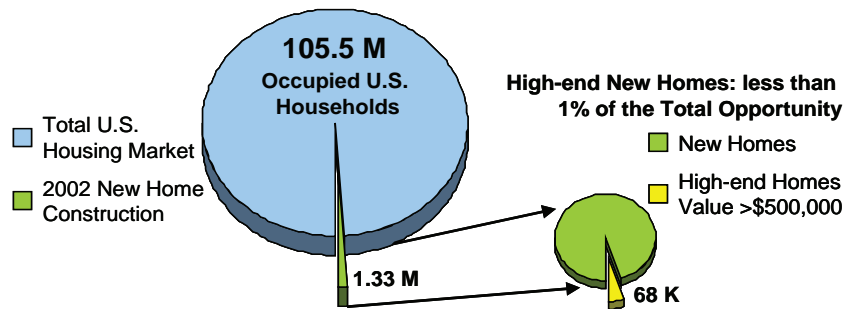


Source: Parks Associates

Do-It-Yourself Systems

According to the National Association of Home Builders, by far the largest HTI opportunity is in the retrofit of existing households, either with do-it-yourself systems that consumers install themselves, or through professional installers that do it for them (see Exhibit 2.7).

Exhibit 2.7. HTI Market Opportunities



Source: U.S. Department of Commerce

In just five years, the cost of Wi-Fi adapters for wireless data networks has fallen from \$250 to less than \$15, allowing consumers to install this technology on their own without the hassle of running wires. Moreover, the basic cost of home controllers is also quite affordable. Do-it-yourself consumers can even set up a simple home automation system for a few hundred dollars, using controllers and modules that sell for less than \$15.

Early adopters of home automation first embraced products based on X-10, the de facto industry standard introduced in 1978 for sending control signals across the electric power mains. X-10 products are still popular because they are relatively inexpensive and easy to install. But the X-10 protocol cannot scale upward to serve the needs of larger

homes. For example, X-10 signal strength often becomes an issue in larger homes, requiring the use of repeaters to strengthen signal broadcasts. Additionally, large numbers of “noisy” devices such as refrigerators and air conditioner compressors can often cause interference that makes the devices unreliable.

New Technologies Can Scale Up- and Down-Market

Evidence suggests that the technology differences between these distinct market segments are starting to blur, as new industry standards appear with the ability to reliably control thousands of devices and thus scale up- and down-market. The adoption of industry standards accepted worldwide will expand market opportunities for manufacturers and drive down prices. The use of Internet protocols makes it easier for applications to communicate with each other.

Fundamental Trends

As indicated in Exhibit 2.8, home builders offered more systems that can be used for HTI purposes in 2005 than in 2004 in all categories except structured wiring. (Home builders suggest that structured wiring’s decline might be attributable to the plethora of inexpensive wireless networking technologies.)

Exhibit 2.8. What Builders Offer*

Technology	Standard	Optional	Both	2005 Total	2004 Total
Structured Wiring	46%	23%	13%	82%	88%
Monitored Security	8%	64%	8%	80%	78%
Multi-room Audio	1%	70%	3%	74%	68%
Home Theater	1%	63%	5%	69%	59%
Automated Lighting Controls	1%	41%	3%	45%	41%
Home Automation	NA	37%	5%	42%	39%
Energy Management	4%	37%	5%	46%	41%

*As a percentage of builders who in early 2006 said they offered at least one technology in 2005.

Source: 2006 State of the Builder Technology Market developed by CEA, NAHB ©TWICE 2006

Given the fact that buyers are choosing additional digital equipment, it seems reasonable to assume that there will be increasing need for integrating this equipment for most effective utilization. This means that employment opportunities for HTI technicians are likely to continue to increase.

Drivers and Constraints

The future of home technology integration will be impacted, to a great degree, by a series of technical, social and economic drivers and constraints. Understanding these drivers and constraints and their impacts will assist in projecting future developments in this technology and, consequently, in the employment opportunities of HTI technicians.

Drivers—Advances in Technology

One of the key drivers for the increased use of HTI systems will be advances taking place in digital technologies. These include the following:

Increasing value of shared information. As the number of networks in the digital home increases (e.g., data, phone, intercom, television, whole-house audio, controls, security, surveillance, irrigation and radio), the value of these diverse networks is enhanced by connecting them in meaningful ways and by bridging between different network media and protocols.

Fiber optics. As fiber is extended closer to the home, the “last mile” connection gets shorter and gains capacity even when using legacy copper or coaxial cabling. As a result, very-high-speed broadband access (>24 Mb/s) capable of supporting services such as IPTV will become available to more homeowners.

Embedded processors. As electronics continue to be increasingly embedded in materials, low-cost sensors and actuators will become smart networked point devices that allow the “smart home” to sense and gather measurements in its environment and react to that stimuli.

Solid-state memory. Increases in the capacities of storage devices will support more complex and capable HTI equipment. Digital cameras and music players have already dramatically driven demand for solid-state memory.

Mobility. Third-generation wireless networks now offer broadband performance in the United States, with speeds of about 1 Mb/s. That is enough to support Internet radio, video broadcasting and videoconferencing on a cellular phone. This mobility trend will influence the evolution of home networks by extending HTI outside the home.

“No new wires” technologies. Networking standards utilizing legacy cabling (electric power line, phone line and coax) can replace or supplement the need for specialty wiring (i.e. Cat5), thus expanding the HTI market opportunity to include retrofit of existing homes.

Wireless. Wi-Fi, WiMAX and other wireless standards offer mobility and other alternatives to special cabling.

Broadband Internet. Consumers demand and can choose among competing high-speed Internet alternatives that include DSL (digital subscriber line), cable modem, wireless, broadband over power lines and fiber optics.

Adaptive systems. Devices will continue to get smarter, giving networks the ability to discover new devices, self-configure and self-heal. Software-defined radio technologies will allow wireless devices to sense and connect to networks using different frequencies and protocols, whether they are home networks or mobile networks.

Mass customization. Information technology that learns consumer preferences is enabling personalization and driving toward markets of one. TV advertising, which was greatly impacted by the TiVo concept, is moving in a direction enabled by video-on-demand services that place interactive and personalized ads to encourage online buying. The effect of this is a need for home networks and two-way information flow between the subscriber, service provider and advertiser.

Kurt Scherf, Principal Analyst, Parks Associates

The addition of incremental value-added services to basic triple-play service bundles in the U.S. will boost monthly revenue per subscriber to \$206 by 2010.

Drivers—Standardization

Another trend that will enhance the growth of HTI is the increasing standardization of HTI equipment. A number of major industry players have joined to create industry standards that will allow digital home products to move down-market from high-end custom homes to mass-market retrofits. (For more information on standardization activities, see Appendix G.)

Non-Technical Drivers

In addition to technology and standardization drivers, there are a number of demographic, social and economic factors that will undoubtedly influence home technology adoption and buying patterns.

- *Generational attitudes.* Young adults are quite familiar with digital technology including broadband networks, home theater systems and digital music downloads. Thus, they are more attuned to the technologies associated with the digital home.

-
- *Telework & environmental awareness.* Employees working from home offices on employer time ensure continuity of operations and reduced commuting time. Telecommuting also gives companies access to a larger pool of skilled workers, including stay-at-home mothers, disabled workers who find travel difficult and others, who are unable to relocate from distant cities or countries. According to a 2006 study conducted by the Dieringer Research Group for the International Telework Association & Council, more than 12 million Americans telecommute full time, and an additional 10 million telecommute at least one day a week. Furthermore, the Dieringer study found that the total number of telecommuters has increased 10 percent since 2004. As the number of such workers continues to increase, they will provide a fertile market for high bandwidth data and video services that facilitate videoconferencing, e-mail access and data uploading and downloading. In many cases, the cost of establishing this infrastructure will be subsidized by employers. Therefore, for many homeowners, the infrastructure for HTI products and services will be available at no additional cost. This availability will be a driver for the adoption of HTI products and services.

Jeff Dean, Internet Business Solutions Group, Cisco

Insurance companies could make home health-care successful by paying for the broadband connection and appropriate devices, because it reduces their costs, hospital visits, etc.

Constraints

While there are a number of technical, social and economic factors that will drive the increased usage of HTI products and services, there are several constraints that may act to decelerate their diffusion. Overcoming these constraints has the effect of turning them into drivers.

HTI systems can be quite expensive. A number of companies providing such services have indicated that homeowners are typically prepared to pay a total of 2 to 3 percent of the cost of a new home on such technologies. In a new home that costs \$200,000, that represents about a \$4,000 to \$6,000 investment. Exhibit 2.9 demonstrates typical installation prices for various HTI subsystems. The installation price of a single subsystem, such as home lighting controls, can easily reach that amount. The cost of HTI subsystems must continue to decline if wide-scale adoption is to be achieved.

Exhibit 2.9. Typical Installation Prices to Consumers*

System	2004	2005
Home Automation	\$6,900	\$6,700
Home Theater	\$4,800	\$6,200
Lighting Controls	\$5,500	\$6,100
Structured Wiring	\$1,000	\$2,600
Multiroom Audio	\$1,300	\$2,500
Energy Management	\$1,800	\$2,200
Monitored Security	\$1,100	\$1,400

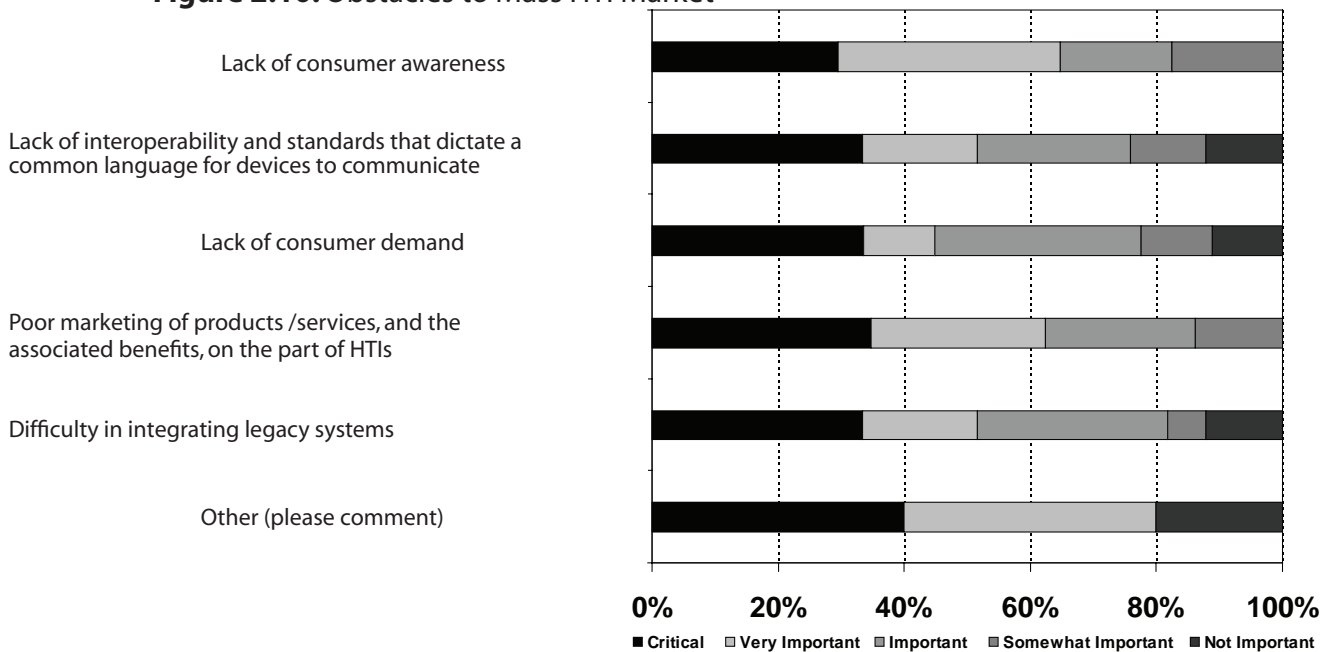
*"Typical price" reported by surveyed builders who offer at least one technology.

Source: 2006 State of the Builder Technology Market developed by CEA, NAHB ©TWICE 2006

In the TFI/TSTC survey, respondents were asked to list what they believed had been the most important obstacles to the mass adoption of HTI systems. The reasons offered are presented in Exhibit 2.10. More than half of the respondents listed lack of customer awareness, lack of customer demand and poor marketing as critical or very important factors. All of these factors reflect that a major reason that HTI has not become more common is that the general public is not aware of the nature and value of HTI.

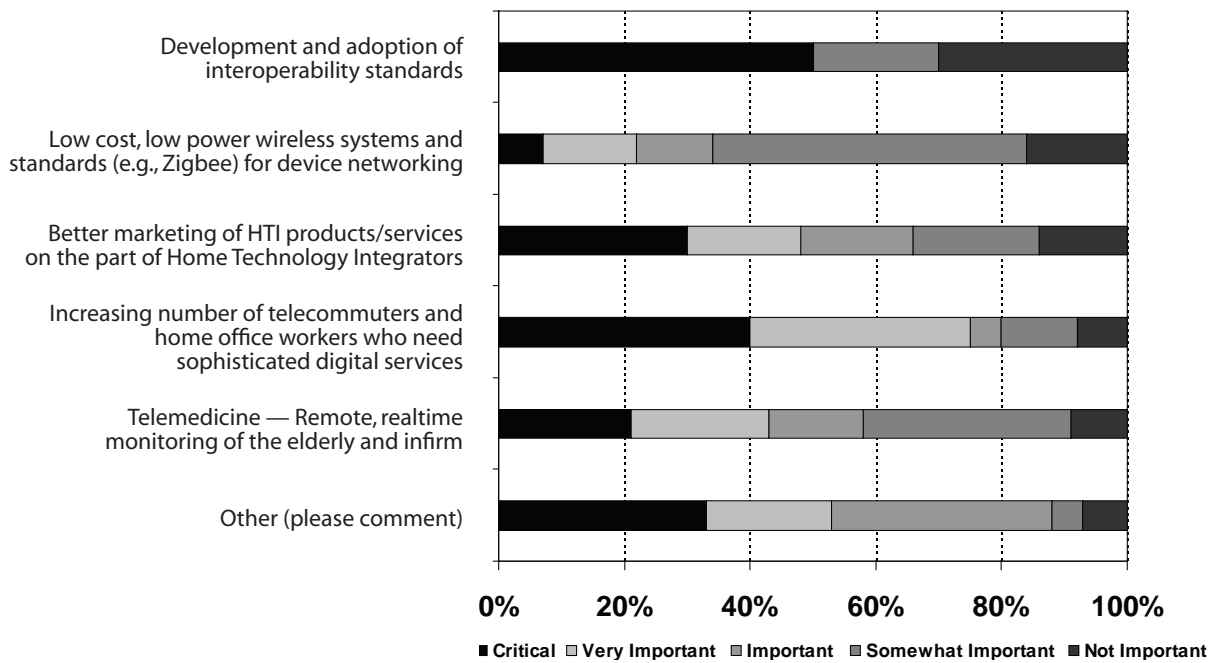
Other restraints to mass HTI application identified in the survey results were the difficulty in establishing HTI systems in homes with legacy wiring and a lack of interoperability of equipment and effective standards. Each of these restraints was listed by just under half of the respondents.

Figure 2.10. Obstacles to Mass HTI Market



The importance of the lack of customer awareness as a deterrent to HTI adoption is reinforced by the results of another survey question in which respondents were asked what could be done to accelerate the adoption of HTI. Approximately three-quarters of respondents indicated that better marketing would be critical or very important in achieving this end (see Exhibit 2.11).

Exhibit 2.11. Factors that Would Accelerate Adoption of HTI Systems







Chapter Three: HTI as a Career

The attractiveness of HTI as a career for graduates depends on a number of factors: the current and future demand for HTI technicians, projected salaries for entry-level and experienced HTI technicians, promising work locations and the nature of the work and the knowledge, skills and abilities (KSAs) associated with their jobs. All of these factors are addressed in this chapter.

Demand

The drive toward integrated home systems is resulting in the need for technicians who are skilled both in the individual systems involved and in how these systems can be most effectively combined—that is to say a “home technology integration technician.”

Number of Jobs That Will Require HTI Technician Skill Sets

The job title “HTI technician” is new and is not fully represented by existing standard occupational codes (SOC) or job titles. Thus, employment projections based on existing labor market information (LMI) data are necessarily uncertain. Projections concerning the employment opportunities for such technicians must be developed indirectly. One approach is to survey prospective HTI employers about their hiring intentions. In a survey of potential employers, TFI asked respondents to project the number of HTI technicians that they would hire within the next year and within the next three years. The results of this survey are presented in Exhibit 3.1.

Exhibit 3.1. Projected Number of New HTI Technician Hires

Number of HTI Hired	Within One Year	Within One to Three Years
None	10%	10%
One to three	65%	15%
Three to 10	25%	55%
Ten to 20	—	10%
More than 20	—	10%

Source: TFI Survey (Spring 2006)

TFI used the data in Exhibit 3.1 to estimate that the total number of new employees to be hired by the 27 companies that responded to the survey would be approximately 76 within the next year and approximately 205 within the next one to three years.

For this estimate, TFI assumed two new hires for companies projecting one to three new hires, 6.5 for projections of three to 10 new hires, 15 for projections of 10 to 20 new hires, and 25 for projections of more than 20 new hires.

Total Number of Hires = Sum [Expected Hires x (Percentage of Respondents who expected to hire that many technicians) x Total Number of Survey Respondents]

Total Number of Hires within One Year = $[(2 \times .65 \times 26)] + (6.5 \times .25 \times 26) = 33.8 + 42.25 = 76$

Total Number of Hires within One to Three Years = $[(2 \times .15 \times 26) + (6.5 \times .55 \times 26) + (15 \times .1 \times 26) + (25 \times .1 \times 26)] = 7.8 + 92.95 + 39 + 65 = 205$.

Since the 26 respondents represent about 10% of the number of identified potential employers, the authors believe that the total number of HTI technicians who would be employed, if they were available, will be larger than these calculations indicate.

A second approach is to examine the number of employees in standard occupational codes (SOCs) directly related to HTI. The authors were able to identify several HTI-related occupations within the SOC database. These data are presented in Exhibit 3.2 and provide a useful reference for comparison. However, it is important to note that these positions tend to focus on the lower-paying installation and repair technicians and do not include the more attractive and considerably higher-paying HTI design occupations or properly trained and certified HTI technicians.

Exhibit 3.2. Related Employment Projections

Title	2002 Jobs	2012 Jobs	Total Increase	New Jobs per Year	Attrition Jobs/Year
Audio and Video Equipment Technicians	4,627	5,680	1,053	113	105
Electronic Home Entertainment Equipment Installers and Repairers	3,062	3,339	277	60	28
Security and Fire Alarm Systems Installers	3,197	3,827	630	61	63
Total	10,886	12,846	1,910	234	196

Source: Labor Market & Career Information, Texas Workforce Commission

According to these data, approximately 430 of these related positions will be created each year; 234 of these 430 positions will be new jobs and the other 196

will be created through attrition (e.g., resignations and retirements). Some of these jobs will apply to HTI graduates. The authors were unable to find any other relevant Labor Market & Career Information (LMI) data from which to base employment estimates for HTI. Therefore, the industry survey data is probably a better source of information. (A listing of Texas companies involved in HTI-related products and Services is presented as Appendix H.)

Future Demand

An article in the March 27, 2006 edition of *Twice* magazine reported on a survey of hundreds of builders nationwide conducted in early 2006 by the Consumer Electronics Association (CEA) and the National Association of Home Builders (NAHB). Among other items, the survey indicated that:

- A growing percentage of new homebuilders has begun to offer custom installed audio/video systems, and the adoption rate by new-home buyers has grown as well.
- Rates of digital equipment installation are rising because builders realize that home technologies are important to successfully market new homes. Eighty-six percent of builders agree that home technologies are very important or somewhat important to marketing homes.
- One-third of builders who install home technology believe home technology not only helped them sell new homes, but also boosted their revenues in 2005. This fraction is up from one-fourth and one-fifth in surveys conducted during the previous two years.
- Builders offer a variety of reasons for offering home technologies, ranging from a simple need to compete to differentiating their business to boosting profits. Many builders also indicate that the homebuyer or architect is asking for the technologies. The builders are becoming more involved with home technologies as a means to compete and differentiate themselves.
- To compete effectively, many builders have reached out to somewhat nontraditional partners with new-home builders working more closely with custom home technology installers, retailers and service providers to collaborate on offerings and installations. These specialists are better equipped to guide builders on which technologies can best boost their profits.

The results of this and earlier surveys are shown in Exhibit 3.3. Although there is scatter in the data, the installation rates for home technology products have increased in all categories over the last three years. Given the increasing interest of homeowners in such products, the authors believe that the demand for HTI technicians will also increase.

Exhibit 3.3. Technology Installation Rates In New Home Construction* (2002-2005)

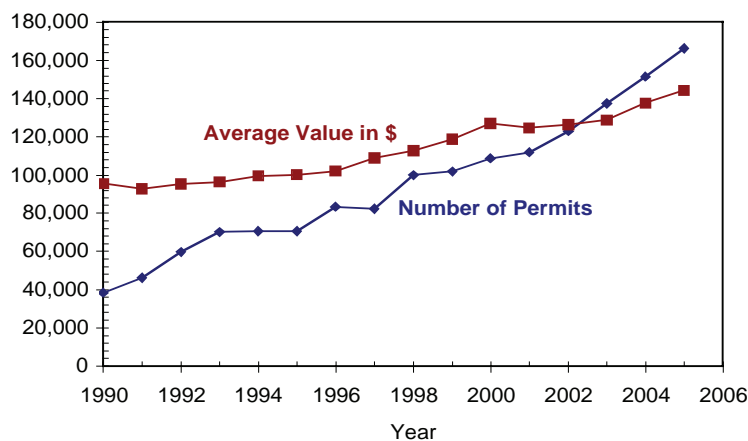
Technology	2002	2003	2004	2005
Structured Wiring	42.1%	59.0%	61.0%	49.0%
Monitored Security	17.7%	26.0%	28.0%	29.0%
Home Theater	9.2%	9.0%	8.0%	11.0%
Multi-room Audio	8.6%	12.0%	12.0%	15.0%
Lighting Controls	1.0%	7.0%	2.0%	7.0%
Energy Management	0.8%	8.0%	5.0%	11.0%
Home Automation	0.4%	7.0%	2.0%	6.0%

*As a percentage of homes built in specified years by surveyed builders who offer at least one technology

Source: CEA, NAHB annual State of the Builder Technology Market ©TWICE 2006

The total market for HTI products and services in new homes and the number of HTI technicians employed is related to the number of new homes constructed each year (i.e., as the number of houses built increases, the number of individuals who will be required to install HTI equipment increases). Moreover, the more expensive the home, the more likely it is that the homeowners will demand and builders will include digital equipment. Although the new home housing market is volatile, Exhibit 3.4 indicates that, in Texas, the number of new permits and the average cost of these homes has been growing steadily for the last 15 years.

Exhibit 3.4. Texas Home Building Permits



Source: Texas A&M Real Estate Center

With regard to the previous comment about the relationship between the cost of a home and the extent of digitization, decreases in the cost of digital equipment is resulting in the increased utilization of such systems in lower-priced homes.

Martin Slagter, Director and ex-President, Cortexa Technology

Cortexa believes that the combination of home control and media center is where the mass market for the home technology integration products is going to be. The price point to establish such services is \$4,000 to \$6,000, which begins to open the HTI market to \$200,000 homes. This figure represents about 2 to-3 percent of the cost of a new home.

Estimated Salary Levels

TFI's survey of potential employers asked respondents to indicate the salaries that they expected to pay both entry-level HTI technicians and those with three or more year's experience. The results of this survey are presented in Exhibit 3.5.

Exhibit 3.5. Projected Salary Levels for HTI Technicians

Salary Range	Entry-Level (% Respondents)	Experienced (% Respondents)
\$20,000 - \$25,000	45%	6%
\$25,000 - \$30,000	22%	11%
\$30,000 - \$35,000	22%	28%
\$35,000 - \$45,000	11%	33%
\$45,000 - \$55,000	-	22%

Based on these results, the average salary for entry-level HTI technicians is estimated to be about \$27,700 (\$13.32/hour), and for experienced HTI technicians, about \$37,700 (\$18.13/hour). These figures correlate well with the salary projections of David Macik, who heads the Texas State Technical College Waco HTI program. Macik indicated that he expects the salaries of HTI technicians to be about \$33,000 (\$15.86/hour) after 18 months of experience.

Best Buy and other electronic retailers have established teams to assist customers in the instillation of home technologies. Although these companies are reluctant to discuss the salaries of these employees, the authors found from a secondary source that the salaries for members of Best Buy's "Geek Squad" average:

- Counter Intelligence, \$14 per hour
- Senior Counter Intelligence, \$21 per hour
- Double agents, \$22 per hour
- Special agents, \$42 per hour

The same source indicated that the salaries for employees of Apple's "Genius Bar" range from \$50,000 to \$75,000, depending on their skill set and specific geographic market.

It is important to note that HTI technicians with advanced programming skills in home automation systems (e.g., AMX and Crestron) can obtain significantly higher salaries (\$50,000 to over \$100,000). Certification for these systems is provided by manufacturers and distributors of these systems. Colleges considering HTI programs should encourage graduates to pursue these additional industry certifications for considerably higher pay and advancement.

Job Responsibilities

HTI technicians must possess a broad range of knowledge, skills, and abilities across multiple technologies, standards, and applications. Moreover, they must be capable of integrating these components into well-designed and functional solutions that meet homeowner and homebuilder specifications. The job responsibilities necessary to meet these requirements can be classified into three areas of responsibility: design, installation, and support.

The CompTIA HTI+ certification defines the industry-derived knowledge, skills, and abilities HTI technicians should possess. These standards are from a North American focused job/task assessment and form the foundation that an HTI technician with one or two years of experience is expected to know. These skills apply to all three areas of responsibility listed above; however, HTI designers will require additional advanced skills to obtain higher salaried positions.

Note: A complete listing of these KSAs (33 pages) can be found at http://www.comptia.org/certification/HTI/hti_si_objectives.pdf and http://www.comptia.org/certification/HTI/hti_rs_objectives.pdf.

These documents cover topics related to:

- Computer networking fundamentals
- Audio/video fundamentals
- Home security and surveillance systems
- Telecommunication standards
- Home lighting control
- HVAC management
- Water system controls
- Home access controls

Design of Digital Systems

HTI designers must be familiar with the operating characteristics of all types of digital home equipment. Designers will have extensive contacts with various stakeholders including broadband service providers, homebuilders and homeowners, equipment retailers, and contractors who specialize in various HTI subsystems, such as control systems, audio/video equipment, and security and surveillance suppliers.

Home automation and control systems provide the brains of most HTI installations. Common automation systems include AMX, Crestron, HAI (Omni and Omni II), OnQ Technologies (HMS), RCS (Commstar), Elk Products, and JDS (Stargate). These systems can require advanced programming capabilities, extensive familiarity with electricity and low-voltage devices, and high-level critical thinking and problem-solving skills.

Designers must understand the capabilities and limitations, as well as how to program, integrate, and troubleshoot these various systems. Designers must be able to design HTI solutions within the capabilities and limitations of the products, services, and infrastructure available for a particular project. Items that potentially have to be considered include project cost, availability of broadband access, wiring infrastructure, and unique customer requirements. Designers must also be able to explain the cost/benefit realities of various types of equipment and services to potential customers. Because of these broad technical and high-skill requirements, HTI technicians may also have employment opportunities as sales or sales support staff.

HTI designers may be employed by broadband service providers, consumer equipment retailers, homebuilders, and custom system integrators. HTI technicians with advanced programming and design capabilities may also find lucrative employment as a self-contractor or start-up business.

Martin Slagter, Director and ex-President, Cortexa Technology

Digital home technician positions may present an opportunity for female techs. Women in households often make decisions about technology purchases. As a result, female techs/sales persons may be quite effective in this market.

Additional Design-Related HTI Knowledge, Skills, and Abilities

- Designing and documenting specifications for basic to advanced home technology solutions, structured wiring installations, and home automation control.
- Designing, documenting, and writing custom programs and scripts for home automation control systems.

-
- Using design applications, such as AutoCAD Electrical, Visio, etc., to help builders and homeowners design home networks and develop wiring diagrams, fixture, and equipment schematics.
 - Outlining HTI project scopes, budgets, equipment lists, components, and services, including existing and new sources.
 - Educating homeowners about the capabilities and limitations of HTI systems, including system performance and installation and maintenance costs.
 - Assisting homeowners in the “future proofing” of their homes. This includes issues related to structured wiring and modular network design, which allows individual components in the network to be subtracted and added over time, while maintaining the same network infrastructure.

Don Shafer, Scheduling Manager, Mesa Home Systems

The primary responsibility of the designers whom Mesa employs is sales. Therefore, they must have a general knowledge of the various subsystems that can be integrated in a home environment. The designers typically are trained in how the various HTI subsystems fit together. Their starting pay is in the mid-30s and can go up to the mid-40s with incentives.

Billy Martin, Director and ex-CEO, Cortexa Technology

A major focus of companies in the home technology integration area is design. They must ensure that their products are simple to install and simple to support. Hardware manufacturers want to be able to troubleshoot products over the Internet, not on-site.

If there is a problem with a subsystem, the first person the homeowner is likely to call is the HTI technician. Therefore, technicians who work for the integrator must have knowledge of all of the subsystems that interface with the HTI network. Technicians must have good networking skills.

Installation of Home Technology Systems

While consumer HTI technology such as X10 can often be installed by end-consumers with no formal training, only a small percentage of homeowners have the knowledge, time, or inclination to install moderate to advanced HTI equipment—much less integrate mixed technologies into a functional HTI solution. As the HTI market increases, there will be a continuing need for technicians who can install and interconnect this equipment. Installers are typically paid less than design and support technicians and are commonly entry-level positions.

Because the number of existing “legacy” homes is so much greater than the number of new homes started each year, retrofitting these homes with integrated systems represents a much larger potential market than installing

such systems in new homes. However, retrofitting existing homes so they can access many digital home products and services can be challenging and expensive. For example, many of these homes do not have Ethernet or other structural wiring for high-bandwidth, high-speed networking activities such as video streaming. Installing structural wiring along baseboards, under carpet, through walls, and above ceilings is labor intensive and expensive. New wireless and power-line technologies such as 802.11x and HomePlug can reduce the cost of structural wiring, thereby increasing the sale of HTI technologies to retrofit markets. Installers working in the retrofit market must be able to work in both traditional structured wiring environments, as well as with new wireless and other network layer technologies. Moreover, they must understand the benefits and limitations of each.

Employers of HTI installers include security companies, high-end audio and video companies, and full-service system integrators often working as subcontractors to homebuilders, homeowners, and commercial clients. These companies will often design or accept wiring diagrams and specifications the installer will follow onsite. At the lower end of the market, consumer electronics retailers, such as Best Buy and CompUSA, may provide HTI sales, consulting, and onsite installation services similar to existing support services such as Geek Squad and CompUSA's installation teams. These groups provide advice to consumers and also sell, support, and install equipment.

Don Shafer, Scheduling Manager, Mesa Home Systems

Mesa employs installers. These are the employees who actually run the wiring in homes. This is a low paying job, but it is essential that all techs start at this level to understand how designs are practically installed in the home. Network administration/operating system expertise, however, is a more rare skill. Techs with those skills demand a higher premium because the controls and audio worlds are becoming IP-based. These devices can be found and addressed on a network just like a computer or printer. It is helpful when audio networking and control system installers understand networking and Internet protocols.

Billy Martin, Director and ex-CEO, Cortexa Technology

For home technology systems to reach the mass market, they must be standardized. They must be plug-and-play and require a low-cost technician (\$15 to \$20/hour).

Supporting Existing Home Technology Systems

With any technology, there can be problems with equipment in the field. These problems will be especially acute in the area of HTI because consumers will have the ability to reconfigure the equipment in their home in any way they choose. Although this personalization of services is one of the many "selling points" of HTI, it can be problematic for technicians who are trying to troubleshoot problems.

Kurt Scherf, Principal Analyst, Parks Associates

In a recent study, we found that about 50 percent of home (PC) network users have had some kind of trouble with their networks. Some of the problems are simple, but some are quite complex.

Many HTI employers provide customers with support contracts or hourly support calls. Supporting these customers can be as simple as replacing a malfunctioning component within a system or debugging custom automation code to solve a problem or improve a design. HTI support technicians must be able to read and interpret wiring diagrams since this will be necessary to troubleshoot home technology systems. This may be particularly difficult since the “as built” system may be quite different from the planned one. In addition, there is the possibility that the homeowner may have made modifications to the system that are not recorded. Therefore, HTI technicians must not only be able to read the wiring diagram, but must also be able to recognize and respond to differences between plans and actualities.

Mid- to low-market HTI consumers may increasingly rely on HTI support services from major consumer electronics retailers such as Best Buy and CompUSA. These volume sellers have expressed plans to expand existing end-user consulting, installation, and support services into the HTI market. HTI support technicians employed by these companies will experience similar challenges to those working for professional system integrators. In addition, these technicians will be working with a wide variety of consumer electronics equipment and often without the benefit of wiring diagrams or formal schematics. Technicians must be knowledgeable in the wide variety of subsystems that make up HTI systems in order to isolate problems.

Jed Johnson, Senior Director of Systems Engineering, Motorola

Connected home business service providers have a problem with supporting any device that allows a consumer to change its configuration. It becomes a support nightmare. If a service provider delivers a product and there are no changes to the way it is configured, then they know how to support it. Otherwise, the troubleshooting issues that arise can be quite problematic.

Another talent required of a troubleshooter is familiarity with a wide range of HTI equipment. While the designer and the installers have the luxury of using specific, selected equipment, troubleshooters must deal with any number of equipment models and types. They must know, not only the characteristics of any equipment that they may find on-premises, but also be able to determine what alternate equipment can be used if the original equipment cannot be duplicated.

Steve Farabee, Vice President of Operations, Time Warner Cable Austin

Troubleshooting can get quite complex, and Time Warner does not have the advanced network administration technicians for that task at individual customer sites. Time Warner does not want to get into the business of troubleshooting home data networks.

Finally, troubleshooters must understand how the HTI system itself can be modified if major changes are required or desired by the customer.

Steve Mendiola, Security Manager, Mesa Home Systems

Troubleshooting and service tech personnel are typically more advanced technicians. These technicians, who are compensated at a higher level, can troubleshoot problems at the network or programming level (e.g., why are my lights coming on in the daytime and not at night). These techs advance themselves through a demonstration of expertise in the systems that they are working on.

Since HTI technicians are often involved in designing systems for potential customers' homes, it is important that the technicians possess excellent communication and interpersonal skills. They will interact extensively with the public and are at the front lines of an HTI company. They must have the ability to explain HTI technology and its challenges to both advanced customers and those less technically literate.

Size and Location of Markets

The market for home technology integration activities and the employment opportunities of HTI technicians fall generally into two categories: (1) new home construction and (2) retrofit of existing homes. Exhibit 3.6 illustrates that the number of existing homes far exceeds the number of homes constructed each year.

Exhibit 3.6. Households in Texas

Total Housing Units	Total New Building Permits Issued
8,157,575	210,611

Source: U.S. Bureau of the Census

A number of companies that provide HTI products and services have been established in Texas. A cluster map indicating the location of these companies is provided in Exhibit 3.7.

Exhibit 3.7. Cluster Map of HTI Companies in Texas



The market for HTI technicians will be greatest in those areas where there are already existing companies designing and installing HTI products and services. These companies will need highly qualified technicians to perform these services. Therefore, as the map indicates, the demand for HTI technicians will be greatest in metropolitan areas like Houston, Dallas/Fort Worth, Austin, San Antonio and neighboring suburban areas; it will be less in smaller cities like Denton, El Paso and Galveston, and still less in the state's small cities and towns.

Kurt Scherf, Principal Analyst, Parks Associates

Demand for HTI will be hit-and-miss over the next five years. It will start in high growth areas around the state like Austin where there are high-end, master planned communities. Another area of interest is Keller in the Dallas region where Verizon is installing fiber-to-the-curb, which will give residents high-speed, high-bandwidth Internet access (>5 Mb/s).

Ron Zimmer, President & CEO, Continental Automated Buildings Association

The various HTI training programs are still not even close to providing enough qualified technicians to fill the expected need for technicians as the industry grows. There is a tremendous future or marketplace for technical schools that provide the type of training that produces qualified HTI technicians. Most of this growth will be in urban areas.



Chapter Four: Initiating an HTI Program

In this chapter, information is presented to assist CTC academic decision makers in determining whether or not to initiate an HTI program in their colleges and, if so, how that can best be accomplished. Specific information includes a review of current programs, an examination of faculty and facility requirements, a listing of organizations that may provide advice and assistance, and a comment about appropriate timing of program initiation.

Current Programs

In Texas, HTI certificates are now being offered at Texas State Technical College Waco and at the three colleges associated with the Convergence Technology Center (Collin County Community College, Tarrant County College and El Centro College). The authors were not able to identify any CTC-type programs in the country that were superior to these two programs.

Texas State Technical College Waco

Texas State Technical College Waco offers a Certificate of Completion in HTI. The program includes 12 classes, involving 40 credit-course hours. The program was established in fall 2005, and, as of spring 2006, there are 12 students enrolled. David Macik, director of the program, expects that students will begin graduating from the program in spring 2007.

The program is part of the CompTIA/Cisco HTI+ Certification program and is an approved, Regional Cisco HTI training site. Texas State Technical College Waco uses the Cisco certification curriculum materials in their introductory HTI course to provide an overview of the topics covered in the program. The curriculum is presented in Exhibit 4.1.

All of the courses in the Waco program are WECM approved, except for CPMT 2370 (Home Automation) and CPMT 2371 (Audio/Video Networks), which are considered Local Needs Courses. Descriptions of each course are presented in Exhibit 4.2.

Exhibit 4.1. Texas State Technical College Waco HTI Certificate

First Semester	Course Number	Course Title	Credits
	EECT 1300	Technical Customer Service	3
	CPMT 1303	Introduction to Computer Technology	3
	CPMT 2302	Home Technology Integration	3
	CETT 1402	Electricity Principles	4
Semester Total			13
Second Semester			
	EECT 1340	Telecommunications Transmission Media	3
	ELPT 1329	Residential Wiring	3
	HART 1303	A/C Control Principles	3
	CPMT 1345	Computer Systems Maintenance	3
	ITSY 2301	Firewalls and Network Security	3
Semester Total			15
Third Semester			
	EEIR 1307	Introductory Security Systems	3
	CPMT 2370*	Home Automation	3
	CPMT 2371*	Audio/Video Networks	3
	CPMT 1349	Computer Networking Technology	3
Semester Total			12
HTI Certificate Total			40

* Denotes Local Needs Course

Source: Texas State Technical College Waco

Exhibit 4.2. Texas State Technical College Waco HTI Course Descriptions

Example of Existing and WECM Course	Description
<i>Telecommunications</i>	
EECT 1340 Telecommunications Transmission Media	Fundamentals of telecommunications media, including installation, maintenance and troubleshooting. Topics address media characteristics and connectorization.
<i>HVAC</i>	
HART 1303 Air Conditioning Control Principles	HVAC and refrigeration controls; troubleshooting of control components; emphasis on use of wiring diagrams to analyze high and low voltage circuits.
<i>Network Administration</i>	
CPMT 1349 Computer Networking Technology	Networking fundamentals, terminology, hardware, software and architectures.
<i>Network Security</i>	
ITSY 2301 Firewalls and Network Security	Identify elements of firewall design, types of security, security threats and responses to security attacks. Use best practices to design, implement and monitor a network security plan.
<i>Electrical</i>	
CETT 1402 Electricity Principles	Principles of electricity, including proper use of test equipment, A/C and D/C circuits, and component theory and operation.
EEIR 1307 Introductory Security Systems	Security system components, installation, maintenance, troubleshooting and repair procedures.
<i>Computer Hardware</i>	
CPMT 1303 Introduction to Computer Technology	Fundamentals of computer hardware and software.
<i>Home Technology Integration</i>	
CPMT 2402 Home Technology Integration	Integration and maintenance of various home technology subsystems. Includes home automation, security and surveillance, home networks, video and audio networks and structured wiring.
CPMT 2371 Audio/Video Networks	Design, install, and maintain residential audio systems, video networks and other related home entertainment equipment.
CPMT 2370 Home Automation	Design, installation and maintenance of home automation equipment- lighting, HVAC and appliance control.
<i>Customer Service</i>	
EECT 1200 Technical Customer	Principles of customer service in a technical service environment.

(For more information on the Texas State Technical College Waco HTI program, see Appendix C. CTC academic decision makers are advised to pay particular attention to the “Suggestions for New HTI Programs” section of this Appendix.)

Convergence Technology Center

Collin County Community College, El Centro College (Dallas County Community College District), and Tarrant County College have established HTI programs as a part of their collaborative efforts through the NSF-funded Convergence Technology Center. The programs will begin offering Certificates of Completion in HTI in Fall 2006. Although there will be slight variations, for the most part, the three colleges are using skill-based curricula designed to teach the knowledge and skills outlined by the CompTIA HTI+ certification.

In this regard, the colleges are very similar to the Texas State Technical College Waco program. However, a comparison of the two sets of curricula reveals that the Texas State Technical College Waco program has a greater number of courses that address the fundamentals of various HTI subsystems like HVAC controls and security systems, while the three programs of the Convergence Technology Center put much more emphasis on networking.

Ann Behler, PI, Regional Convergence Technology

Our Convergence Technology Regional NSF Center is creating curriculum to address both the Enterprise and the Home Market technician. Specifically for HTI, though, I don't think we need more than one or two courses. We certainly do not need a full four to six courses addressing HTI.

The Tarrant County College HTI Certificate is presented in Exhibit 4.3, and the courses are described in Exhibit 4.4.

Exhibit 4.3. Tarrant County College HTI Certificate

First Semester	Course Number	Course Title	Credits
	CPMT 1405	IT Essentials I: PC Hardware and Software	4
	ITCC 1402	CCNA1: Networking Basics	4
	ITCC 1406	CCNA2: Router and Routing Basics	4
	SPCH 1321	Business and Professional Communication	3
	Semester Total		15
Second Semester			
	CPMT 2302	Home Technology Integration	4
	EECT 1407	Convergent Technologies: Convergence +	4
	ITNW 1448	Implementing and Supporting Operating Systems	4
	ITNW 1448	Implementing and Supporting Servers	4
	Semester Total		16
Third Semester			
	ITNW 1451	Fundamentals of Wireless	4
	CPMT 2370	Fundamentals of Information Security	4
	Semester Total		8
	HTI Certificate Total		39

Source: Tarrant County College

Exhibit 4.4. Tarrant County College HTI Course Descriptions

Example of Existing WECM Course	Description
<i>Telecommunications</i>	
EECT 1407 Convergent Technologies	A study of telecommunications convergent technologies, including telephone, LAN, WAN, wireless, voice, video and internet protocol.
<i>Network Administration</i>	
ITCC 1402 CCNA 1: Networking Basics	The basics of networking, including network terminology, local area networks (LANs) and wide area networks (WANs). Topics include network protocols like TCP/IP, Open System Interconnection (OSI) models, cabling and routers.
ITCC 1406 CCNA 2: Router and Routing	An introduction to basic Cisco router configuration for local area networks. Topics include initial router configuration for TCP/IP, management of Cisco IOS and router configuration files, routing protocols, and access control lists.
ITNW 1448 Implementing and Supporting Client Operating Systems	Install and configure network clients; set up users, groups, policies, and profiles; configure hardware components and applications; set up and maintain a logon security and security for files and printers; configure clients in multiple environments, including Microsoft, TCP/IP, and Novell Networks. Implement dial up networking and tune system performance.
ITNW 1454 Implementing and Supporting Servers	Development of skills necessary to implement, administer and troubleshoot information systems that incorporate servers in a networked computing environment.
ITNW 1451 Fundamentals of Wireless LANs	Designing, planning, implementing, operating and troubleshooting wireless LANs (WLANs).
<i>Network Security</i>	
ITSY 1400 Fundamentals of Information Security	Basic information, security goals of availability, integrity, accuracy and confidentiality.
<i>Home Technology Integration</i>	
CPMT 2302 Home Technology Integration	Integration and maintenance of various home technology subsystems. Includes home automation, security and surveillance, home networks, video and audio networks and structured wiring.

(For more information on the Convergence Technology Center’s HTI program, see Appendix D. CTC academic decision makers are advised to pay particular attention to the “Suggestions for New HTI Programs” section of this Appendix.)

Faculty and Facility Requirements

Faculty Qualifications

The faculty required for the conduct of a successful HTI program can be divided into two general categories:

- 1) Instructors involved primarily in teaching courses in individual, HTI-related subjects, like heating/air conditioning, audio/visual systems and computer repair. These instructors will require only minimum training to understand how these individual systems can be designed to accommodate effective integration.
- 2) Instructors involved in teaching courses in the integration of individual systems. These instructors will require special training in the system, unless they have had relevant experience in this area.

In general, faculty members should be familiar with both the subsystems involved in HTI, as well as the more advanced automation and control systems that interface these components into a working system. At least some faculty should have HTI industry certifications, such as CompTIA HTI+, to ensure they have a complete understanding of the scope of HTI. Faculty may also pursue vendor-specific training and certification from companies like AMX or Crestron.

The Cisco Learning Institute and the Convergence Center at Collin have initiated “train the trainer” programs related to HTI, and CompTIA/Cisco has provided a one-week “Teach the Teachers” training course for instructors at Texas State Technical College Waco. Collin County had 16 faculty members from three different colleges that participated in a week-long HTI training exercise conducted by Sunset Learning.

Physical and Capital Costs

HTI training facilities should include all of the real-world equipment relevant to HTI as specified in industry certifications. This includes security systems, entertainment systems, heating/air conditioning systems, communication systems, audio/video/data networks, lighting and energy systems, and automation and control systems. These items are widely available through a number of distributors, and some colleges may find local industries willing to donate or sponsor the purchase of some equipment.

The HTI program at Texas State Technical College Waco has integrated many of these systems into their training laboratories, which are housed in a preexisting on-campus duplex. The lab supports three stations for hands-on training. Each set of equipment costs approximately \$8,300, totaling just

under \$25,000 for the program. Exhibit 4.5 provides a list of the equipment and its estimated cost.

The laboratory at the college is still not complete.

Exhibit 4.5. HTI Laboratory Equipment

HTI Lab Equipment, Texas State Technical College Waco, Home Technology Integration. Lab equipment for three lab stations for hands-on training. Each station consists of the following items:

Station	Equipment	Cost
1	HTI Lab Bundle from Cisco Learning	\$5,500
	Home automation controller (HAI OmniLT) Structured media center (wall panels) Miscellaneous X10 electrical/lighting controls and fixtures HVAC programmable thermostats and temperature sensors Indoor and outdoor security cameras Miscellaneous security sensors (motion, door, window, heat, etc.) Video network equipment, cable, and connectors Whole house audio system with speakers, cables, and connectors Tools and test equipment Automation software	
2	Digital Video Recorder/Software for Security & Surveillance	\$1,800
3	Home Theater Equipment	\$1,000
	High-Definition Television Home Theater (Audio) System DVD/VCR Players Cables and Accessories	
	Total Cost (each Station)	\$8,300
	Total Cost (3 Stations)	\$24,900

Industry and Education Partnership to be Leveraged

Electronic Systems Industry Consortium

In 1999, the Continental Automated Buildings Association (CABA) became involved in an effort to create technician training materials in the HTI industry, particularly in the residential part of the market. The industrial groups included the Consumer Electronics Association, the Custom Electronic Design and Installation Association, the National Systems Contractors Association, the Building Industry Consulting Services International (BICSI) and Infocom International.

As a result, CABA and these five key industrial groups created the Electronic Systems Industry Consortium (ESIC). According to Ron Zimmer, the

President & CEO of CABA, the consensus thinking of the consortium at that time, which is still widely held today, was that there was a lack of qualified technicians who could actually install, integrate and operate digital technology within residential and office buildings. In fact, there was a strong belief that the shortage of qualified technicians was actually the limiting factor in the growth of the sector. In response, the ESIC created the Electronic Systems Integrators Report, published in April 2004. The purpose of the report was to create a picture of the need and opportunity for home technology integrators. (This report is only available to members of CABA.)

ESIC found that there were a number of technical schools that were interested in creating programs related to low-voltage cabling and systems. However, it was very difficult for these schools to marshal the resources necessary to develop a curriculum that met the needs of the industry. Therefore, the industry came together in the Electronic Systems Technician Initiative (ESTI), and provided subject matter experts (SMEs), who in turn created core curricula at three different levels: Level 1, Level 2 and Level 3. These curricula were provided to the technical schools at low cost. As a result, a number of schools, particularly Lincoln Tech in Chicago, have embraced the curriculum and graduated qualified students. Textbooks for this curriculum were provided through an organization with which ESIC has contracted.

Computing Technology Industry Association and the Internet Home Alliance

In 2002, the Computing Technology Industry Association created the Home Technology Integrator (HTI+) certification. The certification was the result of a partnership between CompTIA and the Internet Home Alliance, whose membership includes Cisco, Best Buy and CompUSA. The HTI+ certification is a foundational certification that addresses knowledge and skills that the industry believes HTI technicians with one to two years of experience should have competence in. Both the Texas State Technical College Waco and Collin County HTI programs use the CompTIA-defined knowledge and skills as the basis of their programs.

Anticipated Timing of Curriculum

The interviews and survey that were conducted as part of this report indicate that there is currently a market for CTC HTI graduates. Therefore, there are no reasons why HTI programs should not be initiated at any CTC in which local needs justify initiation.



Chapter Five: Conclusions

In the last decade, there has been a growing interest in the use and integration of various technologies within the home. HTI systems promise to provide homeowners with a means of creating mutually supporting systems that provide security and comfort, facilitate access to entertainment and media content and encourage energy savings. Interest in HTI systems is strong, not only in Texas, but also throughout the entire United States. As the demand for HTI products and services expands, the need for technicians to design, install, network and troubleshoot such systems will increase as well.

Although it does not appear likely that increasing the number of CTC-trained HTI technicians will have a dramatic impact on the Texas economy or cause a significant number of companies to relocate to the state, the demand for such technicians appears to be growing and HTI training can provide a number of CTC students with skills that will allow them to begin a career that offers attractive employment opportunities.

Job growth in the field will continue for many years, and it is obvious this is a field in which jobs cannot be transferred overseas or even out of state. Most of this job growth will be in the large metropolitan areas of the state.

One of the particularly interesting features about the HTI career field is that most integrating companies are currently small. Therefore, there are unusually attractive opportunities for trained graduates to start their own businesses that can grow as the market for HTI products and services grows.

The existence of effective HTI programs at CTCs might provide incumbent technicians employed in HTI-related fields an opportunity to enhance their skill base and, thus, their employment attractiveness. Such programs could also be valuable to individuals who have lost their jobs because of advances in technology or transfer of jobs to other countries.

There is a wide range of salaries for HTI technicians. CTCs should develop HTI programs that emphasize the skills required for higher-salaried positions such as designers and troubleshooters, rather than for lower-salaried positions like installers.



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Appendix A: Survey

A major source of information for this project was a survey conducted by Technology Futures, in conjunction with the Texas State Technical College System. The 27 survey participants represented a wide range of Texas companies and one out-of-state company that employs HTI technicians. This appendix contains a copy of the survey and a list of survey participants.

Survey Questions

Home Technology Integration: Survey of Trends, Technologies and Workforce Needs

The purpose of this survey is to assess and highlight important industry, market and technology trends, as well as determining the workforce and curricula needs of the home technology integration industry in Texas. The results of the survey will be reviewed by key decision makers in the state's community and technical college and economic development organizations. Your participation will help ensure that your organization has the skilled workforce required to effectively compete in the global 21st century.

I. Information about Your Organization

1) Contact and company information

First Name	<input type="text"/>
Last Name	<input type="text"/>
Title	<input type="text"/>
Email	<input type="text"/>
Organization Name	<input type="text"/>
Organization URL	<input type="text"/>
City	<input type="text"/>
Zip Code	<input type="text"/>

2) Please select the areas in which your organization plays a role.
(Check all that apply)

- Telephony
- Internet Access
- Home Entertainment Systems
- Cable Television
- Satellite Services
- PC and Data Equipment and Networking
- Home Security and Safety Systems
- Heating, Ventilation and Air Conditioning
- Home Automation Systems
- None of the Above
- Other (please specify)
If you selected other, please specify: _____

3) What is the primary business of your company?

	Primary	Secondary	None
Installing Dealer, Home Systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Installing Dealer, Custom Audio/Visual Systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Installing Dealer, Home and Building Automation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Installing Dealer, Security/Alarms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Installing Dealer, Satellite Television Systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Installing Telecommunications Cabling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Installing Contractor, Electrical	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Installing Contractor, HVAC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Systems Integrator, Home	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Systems Integrator, Commercial	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Retailer (Consumer Electronics and Home Appliances)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Telecomm/Cable Operator	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Consultant (Design and Engineering)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please comment)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Additional Comments _____

4) Which of the following types of buildings are included in your organization's typical client base?

	Primary	Secondary	None
Custom-Built, Single-family, Residential Homes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Production-Built, Single-family, Residential Homes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Multi-Unit Residential Dwellings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mobile homes and recreational vehicles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Commercial Buildings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Industrial Facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please comment)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Additional comments: _____

5) What kinds of technicians does your organization currently employ or plan to employ in the next three years?

	Primary	Secondary	None
Audio and Video Equipment Technicians	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electronic Home Entertainment Equipment Installers and Repairers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Security and Fire Alarm Systems Installers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heating, Air Conditioning and Refrigeration Mechanics and Installers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Home Appliance Repairers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electrical and Electronic Engineering Technicians	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electricians	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electrical and Electronic Equipment Mechanics, Installers & Repairers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Telecommunications Equipment Installers and Repairers, Except Line Installers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Telecommunications Line Installers and Repairers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Additional comments: _____

6) What is the total number of technicians of these types that your organization currently employs?

- None
- 1-5
- 6-20
- 21-50
- 51-100
- 101-500
- More than 500

II. HTI Technicians

HTI Technicians are people who are well versed in the individual skills required in the installation, calibration, maintenance and repair of the various types of home technology equipment and, in addition, have the ability to integrate the equipment into an efficient, economical and reliable system.

7) For your organization, would you consider such technicians as:

- Extremely valuable
- Very valuable
- Somewhat valuable
- Not particularly valuable
- Of little or no value

8) Of the technicians listed in Question 6, what percent do you believe are currently qualified to be HTI technicians?

- None
- 10%
- 25%
- 50%
- 100%

Additional comments: _____

-
- 9) If such technicians were available, how many entry-level technicians would you employ immediately?
- None
 - 1-2
 - 3-10
 - 11-20
 - More than 20
- 10) If such technicians were available, how many entry-level technicians would you employ within the next three years?
- None
 - 1-2
 - 3-10
 - 11-20
 - More than 20
- 11) What is or what would you expect to be the average starting salary of entry-level HTI Technicians in your organization?
- \$20,000 - \$25,000 (\$9.60 - \$12.00/hr)
 - \$25,000 - \$30,000 (\$12.00 - \$14.40/hr)
 - \$30,000 - \$35,000 (\$14.40 - \$16.80/hr)
 - \$35,000 - \$45,000 (\$16.80 - \$21.65/hr)
 - \$45,000 - \$55,000 (\$21.65 - \$26.45/hr)
 - More than \$55,000 (More than \$26.45/hr)
- 12) What would you expect to be the average salary of entry-level HTI Technicians in your organization after three years?
- \$20,000 - \$25,000 (\$9.60 - \$12.00/hr)
 - \$25,000 - \$30,000 (\$12.00 - \$14.40/hr)
 - \$30,000 - \$35,000 (\$14.40 - \$16.80/hr)
 - \$35,000 - \$45,000 (\$16.80 - \$21.65/hr)
 - \$45,000 - \$55,000 (\$21.65 - \$26.45/hr)
 - More than \$55,000 (More than \$26.45/hr)

13) How important is it that HTI technicians possess the following skills in order to be successfully employed?

	Critical	Very Important	Important	Somewhat Important	Not Important
Home Network Systems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Design and Engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Home Network Systems Installation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electrical Safety, Standards, Codes and Associations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knowledge of Analog and Digital Signaling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wireless Network Installation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Internet Standards and Protocols (IP,TCP)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
AC/DC Circuits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Residential Telecommunications Cabling Standards and Practices (twisted pair, coax, shielded fiber)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Control Processors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electronic Testing and Equipment Knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
General Knowledge of the function of various HTI Subsystems – Home Automation, Security, Telecommunications, Water Controls, HVAC, Lighting Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Additional comments: _____

14) What would these technicians' primary duties involve?

	Primary	Secondary	None
Pre-installation planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Equipment installation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cable installation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Calibration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maintenance and repair	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Providing home-technology installation and calibration advice to homeowners	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assisting homeowners in the installation and calibration of home-technology equipment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please comment)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Additional comments: _____

15) What technical certifications would provide credibility to potential HTI Technicians?

	Critical	Important	Not Important
Two-year Associates degree in Home Technology Integration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
One-year Certificate in Home Technology Integration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Two-year Associates degree in Electronics Technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
One-year Certificate in Electronics Technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Two-year Associates degree in Network Systems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
One-year Certificate in Network Systems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Two-year Associates degree in Telecommunications Technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
One-year Certificate in Telecommunications Technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CEDIA Level I Installer Certification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Microsoft Certified Systems Engineer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cisco Certified Network Associate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CompTia A+ Certification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CompTia Network+ Certification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CompTia Home Technology Integration Certification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Consumer Electronics Association MECP Basic Installer Certification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electronics Technicians Association Certified Electronics Technician	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electronics Technicians Association Certified Network Systems Technician	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
National Electronic Service Dealers Association Certified Electronics Technician	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Professional Service Association Certified Appliance Professional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Certification in a Specific Vendor's Product (e.g. Creston Certification)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Additional comments: _____

16) What, in your judgment, has been the best source of fully qualified technicians for your organization during the past three years?

Community and Technical Colleges	<input type="radio"/>
Proprietary Trade Schools and Technical Institutes (e.g. Devry, ITT)	<input type="radio"/>
Online Universities	<input type="radio"/>
Apprenticeship Programs	<input type="radio"/>
Hiring Away from Competitors	<input type="radio"/>
Vendor Training	<input type="radio"/>
Other	<input type="radio"/>

If you selected other, please specify: _____

III. Success of HTI Market in Texas

There have been many challenges to the mass deployment of HTI systems in Texas homes and throughout the United States. Currently, most of the demand for the systems is in custom high-end homes (cost > \$500,000).

17) What do you feel have been the biggest obstacles to the mass adoption of home-technology integration systems in the state of Texas?

	Critical	Very Important	Important	Somewhat Important	Not Important
Lack of consumer awareness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of interoperability and standards that dictate a common language for devices to communicate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Poor marketing of products/ services, and the associated benefits, on the part of Home Technology Integrators	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Difficulty in integrating legacy systems (e.g. 10 year old HVAC systems, homes without existing structured wiring)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please comment)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Additional comments: _____

18) What factors do you feel will accelerate the adoption of HTI systems in the state of Texas?

	Critical	Very Important	Important	Somewhat Important	Not Important
Development and adoption of interoperability standards	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Low cost, low power wireless systems and standards (e.g., ZigBee) for device networking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Better marketing of HTI products/services on the part of Home Technology Integrators	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing number of telecommuters and home office workers who need sophisticated digital services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Telemedicine – Remote, realtime monitoring of the elderly and infirm (e.g. heart rate, blood pressure, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please comment)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Additional comments: _____

19) Please feel free to comment on any matters that you feel are essential to the issue of Home Technology Integration and workforce development in the state of Texas. _____

20) I am available for telephone or in-person interviews.

Yes

No

Texas State Technical College and Technology Futures, Inc. thank you for your participation.

Survey Respondents

Organization	Location
Texeleco	Buda (Austin)
Richardson Electronics	Houston
Joe Swartz Electric Co., Ltd.	Houston
Infinity Security Group	Houston
SBT Designs	San Antonio
Dominion Home Networks	San Antonio
Belden	Richmond (Indiana)
Goodyear Custom Audio Video	Beaumont
Synergy Residential	Waco
Mainline	Dallas
Audio Video Designers, LP	Katy (Houston)
LMD Electrical Contractors, LP	Richardson (Dallas)
Baish Electric Company, Ltd.	San Antonio
Halco Life Safety Systems	Houston
Home Theater Concepts	Roanoke (Fort Worth)
Audio Video Guys	Houston
Networked Lifestyle Communications	McKinney (DFW)
TACCA Texas	Austin
Petri Electric	Richardson (Dallas)
Residential Technology Services	San Antonio
Rustic Creek LLC	Kingwood (Houston)
Premier Home Technologies, LP	Houston
DM Home Entertainment	Carrollton (DFW)
Sunset Fire & Security	Willis (Houston)
Sound Logic Integrations	Kilgore (Longview)
Living Home Solutions	Round Rock (Austin)



Appendix B: Experts Consulted

A series of personal and telephone interviews were conducted by the authors during the course of this project. The information, opinions and insights gathered during these interviews had the characteristics of being authoritative, timely and relevant. The authors conducted a total of 16 formal interviews and a number of informal interviews. The people with whom formal interviews were conducted, together with a brief synopsis of the subjects covered during the interviews, are listed below.

Ann Behler—*Former Director, Collin County Community College Convergence Technology Center.* Ann provided valuable information about the HTI and Convergence Technology Associates and Certificate programs at Collin, including information concerning the PCAL7 and DACUM process conducted for both of these programs.

Ann Blackman—*Program Manager, Collin County Community College Convergence Technology Center.* Ann provided information concerning HTI curriculum and faculty development efforts that the Center is conducting on the middle school, high school and college level.

Tom Dean—*Department Chair, Computer Networking and Systems Administration, Texas State Technical College Waco.* Tom was instrumental in establishing the college's HTI program. He provided information about the HTI program at the college, including information concerning specific technologies in which the program expects students to achieve competency by graduation.

Steve Farabee—*Vice President of Operations, Time Warner Cable–Austin.* Steve provided information about the training and duties of troubleshooters and field technicians in the Time Warner Cable cable installation environment. Steve also provided insight into new bundled services (e.g., Sprint cellular service) that Time Warner will offer that will have an effect on the demand for HTI products and services.

Jed Johnson—*Lead Systems Architect for Connected Home Business, Motorola.* Jed provided information about Motorola products in the Home Technology Integration space including mobile phones, set top boxes, wireless products that extend audio distribution and DSL cable modems. Jed also provided insight concerning broadband service providers' view of home networking systems that consumers have the ability to reconfigure.

David Macik—*Department Chair, Computer Maintenance Technology, Texas State Technical College Waco.* David provided valuable information about the HTI program at the college, including information concerning the cost of laboratory facilities, the expected KSAs of graduates and potential employers. David also provided information about the college's activities as a training site for the Cisco Learning Institute's HTI program.

Billy Martin—*Director (Former CEO), Cortexa Technology.* Cortexa Technology is an Austin-based designer and builder of home automation products. Billy provided information about the demand for HTI products and services in the mass home market. Billy also provided information concerning the profile of the technician workforce that would have to be developed to support growth in this segment of the market.

Steve Mendiola—*Security Manager, Mesa Home Systems.* Mesa Home Systems is a custom home integrator that designs and installs interoperational automation, lighting control, security, audio, video, and home theater and communication systems. Steve provided valuable information about the KSAs of the technician workforce that he uses to install and troubleshoot these systems. Steve also provided information about vendor-specific training in the HTI area.

Aaron Rigdall—*CEO, Friendly Home LAN of Israel.* Aaron's company has developed a software product that makes it easier for broadband service providers to install DSL service for their customers. Aaron provided valuable information concerning the cost structure (number and cost of technicians per installation) that service providers must achieve in order to reach profitability in the mass market.

Kurt Scherf—*Principal Analyst, Parks Associates.* Parks Associates is a market research firm that provides industry and consumer research in the areas of digital technology. Kurt provided insight into the current and future demand for HTI technicians in Texas, especially in regions like Keller, where Verizon is offering homeowners "fiber to the premises."

Dan Shafer—*Scheduling Manager, Mesa Home Systems.* Dan provided valuable information about the role of designers in the HTI sales process. Dan also provided insight into the demand for HTI products and services by market segment.

Martin Slagter—*Director (Former President), Cortexa Technology.* Martin provided information concerning the demand for HTI products and services in Texas. He also provided information about the technician workforce that would be required as HTI expands to the mass home market.

Debbie Smith—*Co-Owner, Mesa Home Systems*. Debbie provided information about the attitude of homebuilders towards the installation of HTI products in new homes. Debbie also provided information concerning her company's efforts to create demand for HTI products in model homes.

David Waks and Sandy Teger—*"Broadband Gurus," Broadband Home Central*. Waks and Teger are a husband and wife team that uses their home as a test bed for HTI technologies. David was a co-founder of Prodigy Services Corporation, a pioneer along with AOL and CompuServe in online content provision. Sandy was an employee of AT&T for 20 years. Sandy and Dave provided valuable information concerning the installation, operation and performance of various HTI technologies.

Ron Zimmer—*President & CEO, Continental Automated Buildings Association*. CABA is an industry association dedicated to providing information, education and networking opportunities related to home and building automation. Ron provided valuable information about CABA's efforts through the Electronic Systems Industry Consortium to create two-year HTI technician training programs.



Appendix C: TSTC Waco HTI Program

For a number of years, TSTC Waco has conducted programs in technical areas related to Home Technology Integration (HTI), such as air conditioning repair, electrical systems, security systems, computer maintenance and computer programming. Considering the increasing interest in the integration of the various home technologies, the decision was made to initiate an HTI program, and in fall 2005, a formal HTI program was established.

Description of Program

As of spring 2006, there were 12 students enrolled in the program. The program currently offers a one-year HTI Certificate, which encompasses a total of 12 classes. (The curriculum for this program is presented in Chapter One, Figure 1.7.) The first group of students is expected to graduate in Spring 2007. It is anticipated that the program will be expanded to offer an AAS degree in the next couple of years.

The program resides in the Computer Maintenance Technology Department and is part of the CompTia/Cisco HTI+ Certification program. The TSTC Waco program is an approved, Regional Cisco HTI training site.

The curriculum covers all the subclasses of technology integration in the home environment. This includes home networking (data), home entertainment systems (audio, video) and security systems. A big driver in this arena has been the desire of homeowners to remotely monitor their security systems through the Internet.

The typical student in the program has a computer maintenance or computer networking background, although there are other students without this background who have entered the program.

The program is very compressed and highly interdisciplinary. HTI students must be familiar with cabling, including twisted pair, coax, triax (electrical/lighting), and analog signal (gates), as well as wiring standards and computer networking.

Faculty

All faculty members of the program have backgrounds in HTI-related technologies. Moreover, CompTIA/Cisco spent a week training TSTC Waco instructors on their curriculum in a “Teach the Teachers” course.

Laboratory Facilities

The program currently uses an on-campus duplex for training purposes. Half of the duplex contains demo lighting controls and a home theater system. The other half of the duplex contains working labs where students do hands-on projects (i.e., cable installation, etc.). The program has already spent \$20,000 on equipment for the lab, which is still not complete.

Employment Opportunities

Since no students have graduated from the program, it is hard to develop expected salary figures for entry-level HTI technicians. However, the director of the program expects their salaries to mirror those of graduates of the computer maintenance technology program, i.e., \$33,000 after 18 months of experience. The Cisco/CompTIA HTI certificate that graduates will receive during the program should increase their employment attractiveness.

Many students (six out of 12) in the program are completing internships at Best Buy (Geek Squad). These students are installing home networking systems and home theater systems.

The HTI program director expects the initial demand for students to be from retailers that sell computer networking equipment and home entertainment systems (e.g., Lowe's, Home Depot, Best Buy). Eventually, the demand for HTI graduates should shift to homebuilders (or their subcontractors), who need technicians that can install turnkey cabling.

Replication

The HTI program director believes that it will be fairly easy for other community and technical colleges in the state to replicate the TSTC HTI program into their existing computer hardware and network installation/administration programs.

Lamar Institute of Technology (Beaumont) has expressed an interest in establishing an HTI program. Another program that has expressed an interest in HTI concepts is the recreational vehicle (RV) program. Apparently, there is a strong interest on the part of consumers to integrate digital technologies and entertainment systems into high-end RV builders who are looking to hire techs capable of performing technology integration tasks.

Suggestions for New HTI Programs

The faculty of new HTI programs must understand networking, hardware and low-voltage cabling (e.g., coax, Cat 5, speaker wire) and have the facilities for lab work.

Note: The information presented in this appendix is based on phone interviews with Dr. Tom Dean (Department Head, Computer Maintenance Technology Department, TSTC Waco) on May 10, 2006, Mr. David Macik (Department Head, Computer Maintenance Technology Department, TSTC Waco) on May 19, 2006; and on a personal interview with Mr. Macik on June 29, 2006.



Appendix D: Convergence Technology Center

In 2004, the Collin County Community College (Collin), in partnership with El Centro Community College (El Centro) and the Tarrant County Community College (TCCC), was awarded a four-year, \$2.43 million grant by the National Science Foundation to establish the Convergence Technology Education Center. The purpose of the Center is to combine the strengths of regional educational institutions together with local business and industry partners to create a Convergence Technology AAS degree and Certificate program at community and technical colleges.

The Center has four primary goals:

- Develop convergence technology and interoperability curriculum to meet workforce needs,
- Equip regional faculty to teach convergence technology,
- Recruit and attract underserved populations into the field of convergence technology and
- Function as a Regional Distribution Center.

Early in its organization, the Center defined the skills needed to perform the job functions of a Convergence Technician and an HTI Technician, using and augmenting the skills from the National Skills Standards Board (now Global Skills Xchange).

Description of Program

There are two different foci for Center: (1) Convergence Technology that concentrates on larger business enterprises and (2) Home Technology Integration that concentrates on residences and small businesses. In the early days of the program, more emphasis was placed on Convergence Technology, and programs for the award of a Convergence Technology AAS degree were launched at all three Center colleges in fall 2005. Currently, the Center is more Home Technology oriented in terms of faculty training and the activities. For example, Tarrant County Community College is currently offering a Home Technology Integration Certificate.

The programs at all three Center colleges are basically the same, and all are following the same Southern Association of Colleges and Schools (SACS) guidelines. One of the biggest challenges for the Center has been getting the

faculty of the three colleges to agree on the basic requirements and learning objectives for each course. However, this process is essentially complete, and the current courses have received WECM approval. The Center is asking that CPMT 2371 (Advanced Home Technology Integration) be granted WECM approval. (This course is very similar to the CPMT 2371 [Audio/Visual Networks] course that TSTC-Waco has asked to receive WECM approval.)

Articulation agreements are currently in process between Collin County Community College and the University of North Texas (UNT) to transfer courses under the Convergence Technology degree program into UNT's engineering program.

Program Specifics

Curricula

The Center used skills defined by the National Skills Standards Board (Global Skills XChange) in Network Devices and Network Infrastructure and from CompTIA, which administers a certification in HTI+, as a basis for the skills validated. It also added additional skills they felt necessary for the emerging job of Convergence Technician. The Center used the Performance Criteria Analysis (PCAL 7) process in validating Convergence Technology and Home Technology Integration skills.

Faculty

The Center faculty comes from a variety of backgrounds including telecommunications, networking and network security. The Center uses individualized workshops throughout the year to train faculty. Recently, 16 faculty from the three colleges participated in a weeklong training exercise conducted by Sunset Learning. The training was in CVoIP, which is Cisco's version of voice over Internet protocol.

In July 2006, a Working Connections Conference offered five tracks for college faculty training. These tracks include Home Technology Integration (resources and learning activities), VoIP, CCLinux, Gaming, and Getting Results (pedagogy workshops specifically for faculty in science and engineering areas, plus instruction on the use of podcasting for classroom learning purposes).

Relations with Industry

From the beginning, CTC has realized the importance of interaction with local industry. An early step was the establishment of a Business Advisory Council to assist in the planning and operation of the Center. The Council helped develop the curriculum for Convergent Technologies, examining existing courses that the

three colleges offer, and determining what new courses needed to be added. In this process, the Council noted that there was a strong demand for convergence training in the Metroplex area.

The Council meets quarterly and includes 87 business participants, representing 62 different organizations, educational institutions and agencies. Key businesses involved in this activity included: Accudata Systems, ACT, Advanced Technologies Consulting, Cisco, CompTIA, CompUSA, Course Technology, CSC, EDS, McGraw-Hill, North Central Texas Workforce Board, Nortel, Primo Microphones, Realsolutionz Technology Services, Soundstage, Synergy Concepts, System Soft, Telecom Electric Supply, Texas A&M University Health Science Center, Baylor College of Dentistry, Texas Instruments, and Vertical Resources.

Student Recruitment

From the outset, the Center has been aggressively involved in the recruitment of students and public relations. Recruitment activities include a media campaign, latte and pizza nights, Tech Day, and summer workshops for high school faculty and advisers.

Latte night is geared toward reaching young women who traditionally would not consider entering a technology field. By providing an event that attracts women, presenting female mentors and role models, and providing college staff who can give participants information on how to enroll in this area, it is believed that the event will attract a population of students who would not normally attend a technology recruiting event.

Pizza night is geared toward both genders and undeclared college majors who may not have considered technology as a degree major. Minority and female role models will speak to the students and provide information on how to prepare for and enter this field.

Tech Day focuses on high school students and undeclared college majors and will go more in depth on convergence technology and the options open to graduates.

The Center works with GlobalEDGE Tech Prep and regional school districts to offer high school students technology programs and to obtain college credit. In GlobalEDGE Tech Prep, there are 7,200 students taking Tech Prep Classes in 21 school districts, with an articulation agreement in place with each district.

Replication

The Center spent the first two years developing the degree and certificate programs. The goal now is to ensure that course materials are put together in such a way that other colleges can pick them up and implement them. The leaders of the Center are anxious to make the lessons that they have learned available, not only to CTCs in Texas, but also to other states across the country.

Suggestions for New HTI Programs

- The synergy of college districts working concurrently on HTI programs can save a great deal of time because of the ability to share information and expertise across a wide range of topics.
- There are distinct advantages in having articulation agreements between CTCs and universities. However, there are significant difficulties articulating workforce programs to university academic programs in Texas.
- In recruiting high school and underrepresented populations to convergence technology, different techniques need to be employed in recruiting females and minorities. Being aware of gender and ethnic differences in learning styles, and the different reasons for entering technology fields, helps shape recruiting materials and recruiting events.
- CTCs are encouraged to contact the Center about any questions they have about starting HTI programs (Ann Blackman, phone: 977-377-1582, email: ablackman@cccd.edu, or Mike Harsh, phone: 972-548-6876, email: mharsh@cccd.edu).

Note: This section is based on a telephone interview with Dr. Ann Blackman, Program Manager, Convergence Technology Center, Collin County Community College on June 16, 2006; and a report by the Convergence Technology Center to the National Visiting Committee, dated March 23, 2005.



Appendix E: Recommendation to the CCD

As part of this project, the authors prepared a report for the Texas Leadership Consortium for Curriculum Development. In this report, the authors recommended that the Consortium fund the design a curriculum (DACUM) project specifically targeted on Home Technology Integration. The rationale for this recommendation is outlined below.

There are currently two different HTI, one-year certificates being offered by CTCs in Texas: one by Texas State Technical College Waco and another by the three members of the Convergence Technology Center at Collin County Community College. Both programs are based on industry demand and address core areas of need demonstrated within this report. Both programs use industry-driven standards (CompTIA HTI+) as a guide for their curriculum. However, these programs are, in fact, very different.

The Collin County HTI curriculum focuses on telecommunications and network administration and has one HTI-specific course. The Texas State Technical College Waco program focuses on telecommunications, HVAC, network administration, electrical, computer hardware and customer service, and has three courses dedicated to HTI.

Obviously, these two programs are very different, although both serve an established industry demand. Therefore, the issue is not whether one program is better than the other, but, rather, is any additional curriculum development necessary to meet the needs of the HTI industry in Texas?

The Collin County Convergence Center has obtained a \$2.47 million grant from the National Science Foundation to develop and distribute the Convergence associate degree, and the HTI certificate will be included in this effort. The Center has conducted a PCAL 7 for convergence and has included HTI in this analysis. As noted earlier, this curriculum focuses on network administration and telecommunications.

The Texas State Technical College Waco HTI certificate focuses on the various subsystems of HTI, but has not yet conducted an industry DACUM. The college has developed two new HTI-specific courses as Local Needs. Based on these facts, the authors recommend the following:

Because an HTI-specific DACUM has not been conducted in Texas, and because the demand for HTI technicians explained within demonstrates a substantial workforce need, the authors believe that the conduct of a DACUM specifically focused on HTI would be valuable for CTCs considering the initiation of HTI programs.

Although the CCD is being dissolved, the authors believe that it would be advantageous for some other state body to consider this recommendation.



Appendix F: HTI Physical Layer Technologies

HTI technicians will design, install and integrate home technologies composed of many different subsystems. One of the most important aspects governing the performance of these systems is the infrastructure (both wireless and wireline) used to transmit data between the various subsystems and the Internet.

Therefore, HTI technicians must have a fundamental understanding of the advantages and disadvantages of the various technologies that can be used to create this infrastructure. They must also be aware of continuing technological advances that will impact its performance. In the following paragraphs, a number of current and emerging data infrastructure technologies are discussed.

Structured Wiring

According to Parks Associates, over 60% of new homes today include structured wiring, a cabling standard that calls for Cat 5e cable and RJ45 sockets for voice and data communications, and RG6 coaxial cabling for video. The cables are run in a “star” formation, terminating at a central patch panel for maximum flexibility and the ability to accommodate future changes. Structured wiring is one way to “future-proof” a digital home, but the high-speed data networks that rely on Ethernet and require Cat 5 cabling are giving way to Ethernet derivatives that run over existing coaxial cable, phone lines, three phase electrical wiring, or wireless.

Existing Coax

Many U.S. homes have coaxial cabling (coax) already installed that can be used to receive analog or digital cable television. Since many of these homes have coax in more than one room, the Multimedia over Coax Alliance (MoCA) developed a technology that utilizes this infrastructure as a home network for sending data and digital entertainment along with cable TV programming. With high-speed (270 Mb/s, certified in Home Networking Products by MoCA certification board in 2005), quality of service (QoS), and the built-in security of a shielded, cable connection and added encryption, MoCA has the necessary elements to distribute movies and TV programs throughout the home to any coax outlet. The MoCA network can also be used as a backbone for wireless access points that extend the range of wireless throughout a large home. MoCA does not interfere with TV programming on the same cable since it uses different frequencies.

Existing Phone Lines

The Home Phonenumber Networking Alliance recently introduced HomePNA 3.0, a no-new-wires home networking specification that provides data rates up to 240 Mb/s with guaranteed QoS, thus allowing service providers to offer multimedia services throughout the home wherever there is a phone outlet. Because products based on this specification can carry video, but phone outlets may not be located by TV sets, the latest 3.0 version also works across coax cabling.

Existing Power Line

Local electric codes dictate that each wall will have an electric power outlet so homeowners will not trip over extension cords that run across doorways. As a result, U.S. homes have vastly more power outlets than phone and cable outlets, and that makes power line an ideal carrier for network signaling. The long runs of unshielded wires, however, are subject to interference, making power line a challenging medium.

The X-10 protocol has successfully used the power line carrier for low-speed control signals since its introduction in 1978. It became the de facto standard for control networks, because it was first to market with an affordable price that has continued to fall over time. Because X-10 can only address 256 devices, and sometimes has reliability problems handling “noise” from interference on the line, it serves only a small niche of do-it-yourself home automation hobbyists. UPB (universal power line bus) and Insteon are newer power line control standards that address these issues, and can, therefore, scale upward to support larger homes. Insteon also supports portable control devices with its wireless support.

Other new power line technologies have emerged to support high-speed data networking over the electrically noisy power line, thanks to semiconductor advancements and innovative signal processing that mitigates interference. With more capabilities and the ability to scale up and down market, the price of these new products should eventually fall to X-10 levels, making power line an ideal alternative when running wires is too difficult.

The HomePlug power line alliance has developed a specification for modulating high-speed data networks onto the power line, with the ability to support speeds up to 14 Mb/s, and with encrypted security and QoS for data and VoIP applications. A newer HomePlug AV standard will support 100 Mb/s or more, which is enough for HDTV streaming. The group is also working on a HomePlug BPL standard that allows electric utilities to offer broadband services over the power grid.

With HomePlug, simply plugging into the wall outlet can enable a network connection.

Wireless

Wireless networks are ideal for constructing portable, mobile networks with multiple configurations. There are a number of wireless standards that are important to the HTI market:

- 1) ZigBee and Z-Wave are ideal standards when low cost is a priority. They are meant for low-speed control applications that do not need to send much data or send it often, like alarm sensors or light controls. Because the transmit power is low, even a small hearing aid-sized battery can last for years. To extend the range throughout the entire household, these competing standards each rely on the wireless mesh concept, where devices act as receivers and transmitters so signals can jump from one to the other until they reach their destination. This concept will enable large sensor and control networks without any wires.
- 2) Wi-Fi (wireless fidelity) is a brand describing technologies based on the IEEE 802.11 standards that allow devices to access networks wirelessly through access points. The geographical regions that encompass areas where a signal from the access point can be reliably received, and transmitted to, are called hotspots. These access points can be connected in a wireless mesh network that can offer access over a large geographical region (e.g., municipal wireless networks). Wi-Fi is already popular among many homeowners as a way of extending Internet access, wirelessly, throughout their homes. But, applications for the technology are expanding to include telephone (VoIP over Wi-Fi), entertainment (streaming media), and even home control. Wi-Fi standards continue to evolve. The technology is already widely used in public hotspots (e.g., Starbucks), and will soon be in cars as well (allowing the ability to seamlessly move between access points at high speeds).
- 3) WiMAX (Worldwide Interoperability for Microwave Access) is a brand of technologies describing the IEEE 802.16 standard. WiMAX is a possible last-mile wireless broadband access solution that is described by many of its supporters as an alternative to cable and DSL. In August 2006, Sprint announced that the company would spend \$2.5 to 3 billion to deploy a 4G wireless broadband network in the United States using the WiMAX 802.16e standard by 2008. Other partners in the network deployment will include Samsung, Intel and Motorola.
- 4) Ultra-wideband (UWB) is an emerging standard that spreads its energy across a wide band of unlicensed frequency spectrum (3.1 GHz to 10.6 GHz). The result is very high communication speeds over relatively short distances, along with characteristics that may prove beneficial for certain applications.

Bandwidth performance will continue increasing, with analysts predicting gigabit per second speeds in five to 10 years by using increasingly higher frequencies and shorter wavelengths. As that occurs, the trade-off will be range, since signal strength at high frequencies diminishes with distance or through materials. This probably means that wireless networks will continue to need to interconnect with wired networks, whether over structured wiring, cable, phone lines or power lines.



Appendix G: Industry Support of HTI Standards and Associations

Important Trend

Of the various trends in the HTI industry today, one of the most important is the enhanced coordination of a number of companies, both large and small, in supporting new standards that scale up and down market. By taking leadership roles, they join with others in industry associations to drive specific technologies and the overall industry. Exhibit E.1, developed by CAZITech Consulting, presents a list of the major players in this trend.

Exhibit G.1. Companies in the HTI Industry

COMPANIES	Promote Specific STANDARDS						Promote the INDUSTRY				
	MoCA	Home-PNA	Home-Plug	Wi-Fi	ZigBee	Z-Wave	AHAM	CABA	CEA	DLNA	IHA
AMX					X			X	X		X
Carrier						B	X	X			
Cisco/Linksys	B	X	B	B	X			B	X	X	B
Crestron								X	X		
Echelon								B	X		
GE			B				B	X	X		
Hewlett-Packard		X		X	X				X	B	B
Honeywell					B	X		B	X		
IBM				X	X			X	X	B	B
Intel			B	B		B		X	X	B	
Leviton			X	X	X			B	X		
LG Electronics				X	B		X		X	X	X
Lutron								X	X		
Microsoft				B				B	X	B	B
Motorola/Freescale	B	X	B	B	B	X		X	X	X	X
Panasonic	B	X	B	X		X	B	B	X	B	B
Philips				B	B			X	X	B	
Samsung			B	X	B		X		X	B	
Sanyo			X	X			X		B	X	
Sharp			B	X			B	X	X	B	
Sony			B	B					X	B	
Texas Instruments				B	B				X	B	
Vantage Controls					X	X		B	X		
Whirlpool							B	X			B

B = Board Member or other leadership role X = Active Member X = No longer a member (2006 vs. 2002)

From this chart, you can notice which companies are taking leadership roles, and in which standards, as well as which standards and associations have the most industry support.

General Knowledge Sources

General industry knowledge is available from the various associations that drive overall industry growth, including:

- Association of Home Appliance Manufacturers (www.aham.org),
- Continental Automated Buildings Association (www.caba.org),
- Consumer Electronics Association (www.ce.org),
- Digital Living Network Alliance (www.dlna.org) and
- Internet Home Alliance (www.internethomealliance.org).

Technical Knowledge Sources

Technical details about important standards are available from the organizations that promote those specific standards, including:

- Multimedia over Coax Alliance (www.mocalliance.org),
- HomePlug Powerline Alliance (www.homeplug.org),
- Home Phone line Networking Alliance (www.homepna.org),
- Wi-Fi Alliance (www.wi-fi.org),
- ZigBee Alliance (www.zigbee.org) and
- Z-Wave Alliance (www.z-wavealliance.org).



Appendix H: Company Directory

This appendix lists companies that provide Home Technology Integration services. These Texas companies include retailers of HTI equipment, custom home technology system integrators, electricians, and home theatre and audio system installers. Information on all companies comes from their own Web sites.

Retailers

Best Buy

Location: Retail stores all over the state

Contact: David Gallagher

Contact E-mail: david.gallagher@bestbuy.com

Company URL: <http://www.bestbuy.com/>

Description: Best Buy is North America's number-one specialty retailer of consumer electronics, personal computers, entertainment software and appliances. Geek Squad is the company's technical support arm, which provides IT consulting services to consumers. Geek Squad has 11,000 agents in its 770 North American stores.

CompUSA

Location: Dallas (Corporate), Retail stores all over the state

Contact: Sammy Saloum

Contact E-mail: sammy_saloum@compusa.com

Company URL: <http://www.compusa.com>

Description: CompUSA is America's leading installer of computer networks within the home. The company also offers its customers a complete lifestyle solution through a digital entertainment department that blends its expertise in technology and home entertainment solutions. In 2004, the Computing Technology Industry Association (CompTIA) and CompUSA announced that key CompUSA home entertainment sales and home service technicians were being trained as Home Technology Integrators. CompUSA set an initial minimum requirement of two CompTIA HTI+ certified technicians in each of its 20, whole-systems installation teams across the country.

Fry's (also online retailer Outpost.com)

Location: Dallas/Fort Worth region, Houston and Austin

Contact: Corporate Headquarters

Contact E-mail: feedback@frys.com

Company URL: <http://www.frys.com>

Description: Fry's is a specialty retailer of software, consumer electronics and computer superstores headquartered in San Jose, California. There are four stores in the Dallas/Fort Worth area, three in the Houston region, and one in Austin.

Radio Shack

Location: Fort Worth (Corporate). Retail stores all over the state

Contact: Pete Griffin

Contact Phone: (817) 415-3011

Company URL: <http://www.radioshack.com>

Description: Radio Shack, based in Fort Worth, is one of the largest consumer electronics, specialty retailers in the United States and a growing provider of a variety of retail support services. Radio Shack stores sell a number of HTI devices, including a number of X-10 enabled products.

Online Retailers

Amazon.com

Location: Seattle, Washington (Corporate Headquarters)

Company URL: <http://www.amazon.com>

Description: Amazon.com began as an online bookstore, though it soon diversified its product lines, adding DVDs, music CDs, computer software, video games, electronics, apparel, furniture, food and other items.

J&R.com

Location: New York City, New York (Corporate Headquarters)

Company URL: <http://www.jr.com>

Description: J&R.com is an online retailer that sells mass-market audio, video, computers and digital cameras.

Custom Home System Integrators, Electricians and Home Theatre Installers

A/Dd/a Inc. dba AD systems

Location: Houston

Contact: Utz Baldwin

Contact E-mail: utz@addainc.com

Company URL: <http://www.addainc.com/>

Description: Established in 1990, A/Dd/a Inc. specializes in the design and development of emerging technologies serving both residential and corporate clients. The company installs automated systems including lighting control, HVAC control, access control, distributed audio and video, home theater, infrastructure wiring for new homes, local area networks and data display.

All Around Security & Sound

Location: Granbury (DFW area)

Contact: Marcus Villanueva

Contact E-mail: ric@allaroundsecurity.com

Company URL: <http://www.allaroundsecurity.com/>

Description: All Around Security installs and monitors residential and commercial alarm systems.

ARM Entertainment Solutions

Location: McKinney (DFW)

Contact: John Grimes

Contact E-mail: Sales@ArmEntertainment.net

Company URL: <http://www.armentertainment.net/>

Description: ARM consists of two divisions: ARM Entertainment Solutions and ARM Home Security and Communications, Inc. The company designs/integrates low-voltage systems and sells/install custom electronics. The company's projects include whole-house audio, theater room, structured wiring, lighting control, central vacuum, security, fire alarm, and other low voltage systems that are tailored for each homeowner.

Audience, Inc.

Location: Allen (DFW)

Contact: Jim Womeldorph

Contact E-mail: im@audiencetech.com

Company URL: <http://audiencetech.com/>

Description: Audience, Inc. is a full-service residential design and installation team. The company provides customized state-of-the-art audio and video systems.

Audio Systems Plus, Inc.

Location: Garland (DFW)

Contact: John Schell

Contact E-mail: service@audiosystemsplus.com

Company URL: <http://www.audiosystemsplus.com/>

Description: Audio Systems Plus is a custom systems integrator of home theater, audio/video, security and lighting systems.

Audio Video

Location: College Station

Contact: Mike Bellott

Contact E-mail: mike.b@audiovideobcs.com

Company URL: <http://www.audiovideobcs.com/>

Description: Audio Video is a specialty electronics retailer in College Station. The company designs and installs home theater systems, audio and video distribution systems, home networks, lighting control systems and home automation systems.

Audio Video Designers

Location: Katy (Houston)

Contact: James Greene

Contact E-mail: thehifidoc@sbcglobal.net

Company URL: <http://www.hifidoc.com/>

Description: Audio Video Designers offers design and installation for complete home theater design, distributed sound systems, satellite dishes, phone systems, computer networking and home automation systems.

Audio Video Designs

Location: Austin

Contact: Bill Blaylock

Contact E-mail: bill@avdesignsaustin.com

Company URL: <http://www.avdesignsaustin.com/>

Description: Audio Video Designs is a systems integrator of custom home theaters, distributed multi-room audio/video, lighting control systems, automation and home data networking systems.

Audio Video Guys

Location: Houston

Contact: Milton Krueger

Contact E-mail: info@audiovideocalibrations.com

Company URL: <http://www.audiovideocalibrations.com/>

Description: Audio Video Guys specializes in the calibration of audio and video systems.

Audio Video Innovations

Location: McKinney (DFW)

Contact: Chris Honas

Contact E-mail: info@avinnovations.net

Company URL: <http://www.avinnovations.net/>

Description: Audio Video Innovations is a custom design and installation company. The company specializes in home theaters, media rooms and accessories, multi room audio/video, lighting systems, home automation, surround systems, structured wiring, computer networks and phone systems.

Audio Video UNPLUGGED

Location: Farmers Branch (DFW)

Contact: Andy Harwell

Contact E-mail: andyharwell@avunplugged.net

Company URL: <http://www.avunplugged.net/>

Description: Audio Video UNPLUGGED provides sophisticated audio/video systems to luxury homeowners and builders. The custom-designed networks include everything from home movie theaters to music, lighting and security systems and range in price from \$20,000 to \$250,000—with some topping \$600,000.

AVS Specialty

Location: Grand Prairie (DFW)

Contact: Kurt Affleck

Contact E-mail: akurt64@aol.com

Company URL: <http://www.avsspecialty.com/>

Description: AVS Specialty provides audio, video and security systems.

Baish Electric Company, Ltd.

Location: San Antonio

Contact: Vann Riley

Contact E-mail: vriley@baishelectric.com

Company URL: <http://www.baishelectric.com/>

Description: Independent electrical contractor that also installs structured wiring and home technology integration systems.

Bjorn's

Location: San Antonio

Contact: Karise Ward

Contact E-mail: kariseward@bjorns.com

Company URL: <http://www.bjorns.com/>

Description: Provider of audio, video, home theater, and home-entertainment-related equipment for sale to retail customers. The company also provides design and installation of custom in-home audio/video systems.

Complete Integration

Location: Spring (Houston)

Contact: Gale Tynefield

Contact E-mail: mail@completeintegration.net

Company URL: <http://www.completeintegration.net/>

Description: Complete Integration is a custom integration firm that specializes in providing solutions for both residential and commercial low voltage projects. These projects include security, closed circuit television, home theater, media rooms, whole-house audio, and whole-house lighting control systems such as Crestron.

Core Integration Systems

Location: Cedar Hill (DFW)

Contact: Theo Kirk

Contact E-mail: info@coreisys.com

Company URL: <http://www.coreisys.com/>

Description: Core Integration Systems is a custom electronic design and installation firm specializing in home theater and distributed audio systems. The company also offers complete networking, automation and home lighting systems.

Cortexa Technology

Location: Austin

Contact: Billy Martin

Contact E-mail: bmartin@cortexatechnology.com

Company URL: <http://www.cortexatechnology.com/>

Description: Cortexa Technology is an Austin-based company that has developed a solid-state home automation controller called the Cortexa 7202. The 7202 is capable of controlling a number of HTI subsystems including: lighting, security, HVAC, audio/video devices, surveillance cameras and irrigation systems.

Custom Audio Concepts

Location: Frisco (DFW)

Contact: Phil Canzano

Contact E-mail: info@customaudioconcepts.net

Company URL: <http://www.customaudioconcepts.com/>

Description: Custom Audio Concepts specializes in custom audio/video sales, installation and service.

Custom Electronics, Inc.

Location: Austin

Contact: James Pratt

Contact E-mail: james@customelectronicsinc.com

Company URL: <http://www.customelectronicsinc.com/>

Description: Custom Electronics engineers, designs and installs multi-room audio/video systems, lighting controls, home theaters, telecommunications and other electronic systems in residences, professional offices and other places where high-quality sound and video are required.

Customized Home Theater Systems

Location: Dallas

Contact: Payman Pahlavan

Contact E-mail: payman@chtsystems.net

Company URL: <http://www.chtsystems.net/>

Description: Customized Home Theater Systems provides high-end media rooms and automation systems for high-end clients.

Dallas Sight and Sound

Location: Dallas

Contact: Jesse Adkins

Contact E-mail: careers@dallassightandsound.com

Company URL: <http://www.dallassightandsound.com/>

Description: Dallas Sight and Sound specializes in designing, installing and servicing the following systems for new or existing homes or businesses: structured wiring systems, surround sound systems, dedicated home theaters and screening rooms (acoustics, seating, interiors, etc.), multi-purpose surround rooms (family rooms, game rooms, etc.), distributed audio and video, telephone and intercom systems, access control systems (gate, front door, etc.), networks and network devices (wired or wireless), lighting control systems, home automation systems and security systems.

Design Cinema Privee

Location: Dallas

Contact: Darren Kammer

Contact E-mail: dallas@designcinema.com

Company URL: <http://www.designcinema.com/>

Description: Design Cinema Privee provides the designs and build out specifications for home theaters.

Diem Digital Interiors LLC

Location: Lewisville (DFW)

Company URL: <http://www.diemdi.com/>

Description: Diem Digital Interiors is a designer and installer of home theater, whole-house audio, and home automation systems. Specializing in custom home electronics systems, the company offers products and a wide variety of integrated services, from home theater, whole-house audio, structured wiring and wireless networking to MP3 distribution, home automation, lighting controls, custom furniture, phone systems and cameras.

DM Home Entertainment

Location: Carrollton (DFW)

Contact: Mike Oborny

Contact E-mail: mike@dmhe.net

Company URL: <http://www.dmhe.net/>

Description: DM Home Entertainment's services include custom home theater design and installation, whole-house pre-wire, security, central vacuum systems, intercom and professional lighting.

Dominion Home Networks

Location: San Antonio

Contact: Freddie Solombrino

Contact E-mail: freddie@dominionnetworks.com

Company URL: <http://www.dominionnetworks.com/>

Description: Dominion Home Networks specializes in the installation of lighting control, home automation and security systems.

EC Home Systems

Location: Houston

Contact: Human Resources

Contact E-mail: ecweblink@eccents.com

Company URL: <http://enterprise-concepts.com/>

Description: EC Home Systems provides system integration services for home and business clients. Their services include the design, integration and automation of multimedia and building management systems.

Edwin Jones

Location: Richardson

Contact: Edwin Jones

Contact E-mail: edwin@edwinjones.com

Company URL: <http://www.fedco.com/>

Description: Edwin Jones represents a wide range of lighting, dimming and control system manufacturers. For over 30 years, the company has been providing lighting control solutions for theatrical and architectural applications for customers throughout Texas and Oklahoma.

Electronic Interiors

Location: Dallas

Contact: President

Contact E-mail: david@electronicinteriors.net

Company URL: <http://www.electronicinteriors.net/>

Description: Electronic Interiors designs and installs cinema rooms, local area networks and closed-circuit television.

Encompass Home Systems

Location: Austin

Contact: Bill Sheets

Contact E-mail: bill@encompass-austin.com

Company URL: <http://www.encompass-austin.com/>

Description: Encompass Home Systems designs and installs custom residential entertainment systems and lighting control systems.

Enthusiasts Choice A/V Systems

Location: McKinney (DFW)

Contact: Grant Wilson

Contact E-mail: info@enthusiastschoice.com

Company URL: <http://www.enthusiastschoice.com/>

Description: Enthusiasts Choice is a custom designer and installer of home audio and visual systems.

Eric Grundelman, Inc.

Location: Mesquite

Contact: Eric Grundelman

Contact E-mail: eric@coolav.com

Company URL: <http://www.ericgrundelman.com/>

Description: Eric Grundelman specializes in the custom electronic design and installation of home entertainment and automation systems.

Goodyear Custom Audio Video, Inc.

Location: Beaumont

Contact: John Goodyear

Contact E-mail: Info@Goodyearcav.com

Company URL: <http://www.goodyearcav.com/>

Description: Since 1972, Goodyear has been selling and installing audio and video systems in southeast Texas and southwest Louisiana for both new construction and existing homes. The company provides complete home theater systems, structured cabling systems, security, computer networking, home automation and integrated telecommunications. As a full-service contractor, the company also sells electronics products.

Granite Security Systems

Location: Austin

Contact: Susan Sumners

Contact E-mail: granitesecurity@bigplanet.com

Company URL: <http://www.greenelectronicsolutions.com/home.html>

Description: Granite Security Systems designs and installs security and fire alarm systems.

Green Electronic Solutions

Location: Rowlett (DFW)

Contact: Brian Green

Contact E-mail: greeninfo@greenelectronicsolutions.com

Company URL: <http://www.greenelectronicsolutions.com/home.html>

Description: Green Electronic Solutions designs and installs media rooms, vacuum systems, whole-house audio, phone, lighting control, intercom and security systems.

Halco Life Safety Systems

Location: Houston

Contact: Marjorie Adams

Contact E-mail: Madams@halcolss.com

Company URL: <http://www.halcolss.com/default.html>

Description: Halco Life Safety Systems assists clients in the design, implementation, installation, and service of low-voltage life safety and commercial systems.

H Com International

Location: Plano (DFW)

Contact: Human Resources

Contact E-mail: sales@HCOM-INTL.com

Company URL: <http://www.hcom-intl.com/>

Description: H Com specializes in the sales and installation of products, including digital cameras, computer products, accessories, computer games and software.

Heavenly Home Theater

Location: Dallas

Contact: Anthony McCormack

Contact E-mail: inquiry@heavenlyhometheater.com

Company URL: <http://www.heavenlyhometheater.com/>

Description: Heavenly Home Theater is a custom home theater installer in the Dallas metroplex. They not only design and install home theater and equipment, but also pre-wire, lighting, whole house audio, central vacuum and furniture.

Hi-Tech Homes

Location: Keller (DFW)

Contact: Chris Poulan

Description: Hi-Tech Homes specializes in home theater systems.

Hodges Multimedia, LLC

Location: Grapevine (DFW)

Contact: Dale Hodges

Contact E-mail: hodgesav@ev1.net

Company URL: <http://www.hodgesav.com/index2.html>

Description: Hodges Multimedia is an audio/video company that specializes in both residential and light commercial projects.

Home Automation Technologies

Location: Addison (DFW)

Contact: Marvin Williams Jr.

Company URL: <http://www.hatweb.org/hat/page1.htm>

Description: Home Automation Technologies specializes in the design and installation of home automation, structured wiring and custom home theatre systems.

Home Cinema & Sound

Location: Dallas

Company URL: <http://www.hcands.tv/>

Description: Home Cinema & Sound designs and installs home entertainment and automation systems. The company also develops lighting concepts, reliable security systems, and automated climate control for residential and small business clients.

Home Entertainment by D-Tronics

Location: McAllen

Contact: Edgar Martinez

Contact E-mail: edgar@homeentertainmentbydtronics.com

Company URL: <http://www.homeentertainmentbydtronics.com/>

Description: Home Entertainment by D-Tronics designs and implements the following systems: structured wiring, surround sound, distributed audio/video, telephone and intercom, custom-made cabinets or shelves and lighting controls.

Home Technology Integration

Location: Austin

Contact: Brett Terwilliger

Contact E-mail: brett@hti-austin.com

Company URL: <http://www.hti-austin.com/>

Description: Home Technology Integration installs custom home theater and home audio systems. The company designs and installs audio/video systems comprised of big screen TVs, projection devices, surround sound amplifiers, infrared control systems, and speaker systems. The company's specialties also include structured wiring, security, whole-house distributed audio systems, home theater systems, lighting control, home automation, and central vacuum systems.

Home Theater Concepts

Location: Roanoke

Contact: Cary Adkins

Contact E-mail: Info@hometheaterconcepts.net

Company URL: <http://www.hometheaterconcepts.net/>

Description: Home Theater Concepts provides home electronics installations, satellite installations, residential media/theater room design, whole-house music distribution, new construction low voltage wiring and remote control automation.

Home Theater Design Group

Location: Carrollton (DFW)

Contact: Brad Griffin

Contact E-mail: thxdude2002@aol.com

Company URL: <http://www.h-t-d.com/index.php>

Description: Home Theater Design Group provides full-service installations.

Home Theater Solutions

Location: Arlington

Contact: Mark Hudgens

Contact E-mail: info@affordhometheater.com

Company URL: <http://www.affordhometheater.com/index.html>

Description: Home Theater Solutions' expertise covers a wide range of audio/video installations including dedicated theaters, media rooms, distributed audio and lighting control.

Home Theater Store

Location: Houston, Dallas/Fort Worth, and Austin

Contact: Mihir Mody

Company URL: <http://www.hometheaterstore.com/>

Description: The Home Theater Store sells and installs high-end home theater and audio/video systems.

Hometronics

Location: Dallas

Contact: Greg Margolis

Contact E-mail: greg@hometronics.com

Company URL: <http://www.hometronics.com/>

Description: Hometronics is a group of design and installation professionals dedicated to designing and installing home theaters, audio/video, lighting control and home automation systems.

Houston Audio/Video (Custom Integration Designers)

Location: Houston

Contact: Steve Joyner

Contact E-mail: steve@cidesigners.com

Company URL: <http://www.cidesigners.com/>

Description: Custom Integration Designers specializes in the design of custom integrated systems such as Crestron, AMX, Lutron and Vantage.

Illuminations Lighting Design

Location: Houston

Contact: Faisal Manzoor

Contact E-mail: faisal@illuminationslighting.com

Company URL: <http://www.illuminationslighting.com/>

Description: Illuminations Lighting Design is a full-service design, building firm that specializes in residential and commercial indoor and outdoor lighting installation, service and maintenance, as well as home automation, home theaters and lighting control systems.

Infinity Security Group

Location: Houston

Contact: Brian McKinney

Contact E-mail: isgbrian@aol.com

Company URL: <http://www.infinitysecurity.com/>

Description: Infinity Security Group is a full service low-voltage specialty company. Areas of specialization includes security, fire and camera systems.

InHome Solutions

Location: Dallas

Contact: Bill Scaling

Contact E-mail: support@inhomesolutions.com

Company URL: <http://inhomesolutions.com/index.htm>

Description: InHome Solutions provides home area network solutions. The company uses a variety of different technologies (wireless, telephone line, power line, Ethernet, coaxial, and USB) to provide for their customers' home networking needs.

InterActive Home, LLC

Location: Lewisville (DFW)

Contact: Troy Stepp

Contact E-mail: troys@interactivehome.net

Company URL: <http://www.interactivehome.net/>

Description: InterActive Home designs and installs audio/video, HVAC, and home control systems. In addition, the company also provides Internet and home networking solutions for clients.

Intercontinental Theater and Sound

Location: The Woodlands (Houston)

Contact: William Elsik

Contact E-mail: info@theaterandsound.com

Company URL: <http://www.theaterandsound.com/>

Description: Intercontinental Theater and Sound provides custom installed home theater systems and multi-room audio/video systems.

Intuitive Homes, Inc.

Location: Houston

Contact: Human Resources

Contact E-mail: careers@intuitivehomes.com

Company URL: <http://www.intuitivehomes.com/>

Description: Intuitive Homes is a home automation firm that designs and installed home technology integration solutions for clients.

IQ Integrated Systems

Location: Longview

Contact: Marc Bally

Contact E-mail: corporate@iq-is.com

Company URL: <http://www.iq-is.com/>

Description: IQ Integrated Systems designs and installs automation and control products for the commercial and consumer markets. The company's products include structured wiring, lighting control, security and fire systems, home theater, closed circuit television and distributed audio systems.

Jobe Systems

Location: Conroe (Houston)

Company URL: <http://www.jobesystems.com/>

Description: Jobe Systems is a custom residential and commercial audio/video electronics integration firm. Jobe Systems designs and installs high-end theater and integration systems that operate with a single-user interface. The company's products also include Lutron lighting systems.

Joe Swartz Electric Co., LTD

Location: Houston

Contact: Gordon Stewart

Contact E-mail: gordon.stewart@joeswartzelectric.com

Company URL: <http://www.audiovideocalibrations.com/>

Description: Joe Swartz is an electrical contractor that specializes in the installation of electrical wiring, structured wiring, light fixtures and ceiling fans.

Krystal Clear Audio-Video

Location: Dallas

Contact: Steve Faller

Contact E-mail: info@kcaudio.com

Company URL: <http://www.kcaudio.com/>

Description: Krystal Clear carries a wide selection of high-end audio/video equipment. The company is also recognized for providing media room and music room design and acoustic consultation services. The company offers a wide range of services from collaborating with architects on the actual design of a media room or music room to making material specifications, including cabinet design for optimal equipment placement.

Living Home Solutions

Location: Austin

Contact: Paul Luper

Contact E-mail: pluper@sbcglobal.net

Company URL: <http://www.altuit.com/webs/livinghomesolutions/LHS/>

Description: Living Home Solutions offers "personalized" home automation convenience and living assistance aids. The company's featured products include lighting and appliance control systems and remote control for convenience or disability aid.

LMD Electrical Contractors

Location: Richardson (DFW)

Contact: Michael DeRuby

Contact E-mail: miked@lmdelectrical.com

Company URL: <http://www.lmdelectrical.com/>

Description: LMD Electrical Contractors is an electrical contractor in the Dallas/Fort Worth area. The company also installs structured wiring and home technology integration systems.

Lone Star Audio Video

Location: Rockwall (DFW)

Contact: Jeb Lewallen

Contact E-mail: lonestaraudiovideo@sbcglobal.net

Company URL: <http://www.lonestaraudiovideo.com/>

Description: Lone Star Audio Video is a designer of home theater systems.

MMCS

Location: Seagoville

Contact: David Montgomery

Contact E-mail: david@mmcs.us

Company URL: <http://www.mmcs.us/>

Description: MMCS installs structured wiring and home automation systems. The company also installs the HTI network and trains the homeowner in its use after installation. The company provides in-home computer and network troubleshooting services.

Matt Panter Home Theater

Location: Waco

Contact: Matt Panter

Contact E-mail: mpanter@hotmail.com

Company URL: <http://panterhometheater.com/>

Description: Matt Panter is a custom audio/video and home theater business, based in Waco. The company also pre-wires homes with structured wiring systems to meet current and future Internet access needs.

Media Design, Architects of Electronics

Location: Benbrook (DFW)

Contact: Brent Huskins

Contact E-mail: huskins@charter.net

Company URL: <http://www.mediadesigncenter.com/>

Description: Media Design is a full-service provider.

Media Design Inc.

Location: Houston

Contact: Bubba Scherer

Contact E-mail: bubbas@mediadesigninc.com

Company URL: <http://www.mediadesigninc.com/>

Description: Media Design designs, installs and services electronic systems in homes and businesses. The integration of audio, video, communication (telephone) and lighting control systems is the company's core business.

Mesa Home Systems

Location: Austin

Contact: Steve Mendiola

Contact Phone: (512) 258-2599

Company URL: <http://www.mesahome.com>

Description: Mesa Home Systems is a custom home integrator that designs and installs interoperational automation, lighting control, security, audio, video, home theater and communication systems. The majority of Mesa's business is new homes.

Modern System Concepts, Inc.

Location: Katy (Houston)

Contact: Mark Popkowski

Contact E-mail: info@modernsys.com

Company URL: <http://www.modernsys.com/>

Description: Modern System Concepts is a full-service, low-voltage system integrator. The company offers design, installation and maintenance in both residential and commercial markets. Products include audio/video, fire, security and voice/data systems.

Multimedia Solutions

Location: Farmers Branch (DFW)

Contact: John Carter

Contact E-mail: multimediasolutions@yahoo.com

Company URL: <http://www.m-s-i.net/>

Description: Multimedia Solutions provides homeowners and businesses with industry expertise and solutions in the areas of home theater systems, home automation systems and security systems.

Networked Lifestyle Communications

Location: McKinney (DFW)

Contact: John Laney

Contact E-mail: networkedlifestyle@sbcglobal.net

Company URL: <http://www.networkedlifestyle.com/>

Description: Networked Lifestyle provides homeowners with solutions in the areas of high-speed Internet (broadband), home automation, media rooms, surveillance systems, satellites, TiVo and full multi-room audio/video distribution.

Omni1st Integrated Systems

Location: Burleson (DFW)

Contact: Chris Richardson

Contact E-mail: jobs@omni1st.com

Company URL: <http://www.omni1st.com/index.shtml>

Description: Omni1st specializes in commercial and residential consulting, design, installation, inspection and contracted maintenance and monitoring for the following electronic systems: automation and structured wiring, security, fire alarm and sprinkler supervision, intercom and multi-room home audio/video, access control and conference room, audio/video, HVAC thermostat, lighting control, audio/video home theater and surround sound, Internet and closed circuit television cameras and recorders.

Petri Electric

Location: Richardson (DFW)

Contact: Chuck Petri

Contact E-mail: cpetri@petri-electric.com

Company URL: <http://www.petri-electric.com/>

Description: Petri Electric is a full-service contracting firm specializing in commercial and industrial electrical construction and service.

Powell Home Electronics

Location: Carrollton (DFW)

Contact: Kurt Mazanet

Contact E-mail: Kurt@PowellHomeElectronics.com

Company URL: <http://www.PowellHomeElectronics.com>

Description: Powell Home Electronics designs custom home theaters, smart home systems and security systems.

Premier Home Technologies

Location: Houston

Contact: Eric Herleth

Contact E-mail: eherleth@premierhometechnologies.com

Company URL: <http://www.premierhometechnologies.com/>

Description: Premier Home Systems is a custom systems integrator that specializes in whole house audio, home theater, home control and automation, networking and communication, lighting control and security systems.

Residential Technology Services

Location: San Antonio

Contact: Human Resources

Contact E-mail: Info@wiremyhome.net

Company URL: <http://www.residentialtechnologyservices.com/>

Description: Residential Technology Services is a custom system integrator that specializes in structured wiring and home automation systems.

Richardson Electronics, Ltd.

Location: Houston

Contact: Ken Jones

Contact E-mail: kjones@rell.com

Company URL: <http://www.rell.com/>

Description: Richardson Electronics is a provider of engineered solutions, serving the RF and wireless communications, industrial power conversion, security and display systems markets. The company delivers engineered solutions for its customers through product manufacturing, systems integration, prototype design and manufacture, testing and logistics.

Rustic Creek LLC

Location: Kingwood (Houston)

Contact: Scott Bourquin

Contact E-mail: scottb@rusticcreek.com

Company URL: <http://www.rusticcreek.com/>

Description: Rustic Creek is a custom systems integrator of electronics for residential and corporate applications. The company designs and installs services for a wide array of projects including: home theaters, home automation and lighting control, corporate presentation systems, videoconference systems and recording studios.

SBT Designs

Location: Bexar County

Contact: Steven Shepard

Contact E-mail: info@sbt designs.com

Company URL: <http://www.sbt designs.com/>

Description: SBT Designs is engaged in the design, sales, installation and service of automatic control, accent lighting, and renewable energy (solar/wind) products and systems for residential and light commercial structures.

Slapshot Electric, Inc.

Location: Dallas

Contact: Michael Zollicoffer

Contact E-mail: mezslapshot@sbcglobal.net

Company URL: <http://www.slapshotinc.com/>

Description: Slapshot Electric is a full-service electrical contractor specializing in commercial and industrial construction. The firm also sells, designs and installs home theater systems.

Sound Ideas Audio Video

Location: Fort Worth

Contact: Jay Hornsby

Contact E-mail: jhornsby@sihometheater.com

Company URL: <http://www.sihometheater.com/>

Description: Sound Ideas Audio Video is a designer and installer of custom home theater and distributed audio/video systems.

SoundImage

Location: Houston

Contact: Tom Korman

Contact E-mail: tech@soundimageinc.com

Company URL: <http://www.soundimageinc.com/>

Description: SoundImage designs high-end digital home theater systems. The company also designs and installs home automation and lighting control systems.

Sound Towne

Location: Texarkana

Contact: Robert Cullom

Contact E-mail: rob@soundtowne.com

Company URL: <http://www.soundtowne.com/>

Description: Sound Towne designs, installs and maintains custom audio/video systems. The company also provides structured wiring solutions for the residential and small business market.

Starpower Home Theater

Location: Dallas

Contact: Human Resources

Contact E-mail: dmp@star-power.com

Company URL: <http://www.star-power.com/>

Description: Starpower offers design and installation services for custom home theaters and a full spectrum of audio, video and automation systems for both home and commercial applications. Starpower's home services include design, engineering, programming and management of projects including the coordination of construction and installation of home theater, entertainment, security or home automation systems.

Stereo East

Location: Frisco (DFW)

Contact: Ray Tranka

Company URL: <http://www.stereoeast.com/>

Description: Stereo East is a provider of structured wiring and home theater solutions.

Suburban TV-Home Theatre Gallery

Location: Beaumont

Contact: Danny Ramsey

Contact E-mail: danny@subtv.com

Company URL: <http://www.subtv.com/>

Description: Suburban TV-Home Theatre Gallery provides multi-room audio/video systems, new home pre-wiring, phone systems and entertainment centers.

Sunset Fire & Security

Location: Willis

Contact: Jay Brumfield

Contact E-mail: jbrumfield@sunset-fire-security.com

Company URL: <http://www.sunset-fire-security.com/>

Description: Sunset is a provider of fire and security systems, including closed circuit television monitors.

Synergy Residential

Location: Waco

Contact: Paul Gerhardt

Contact E-mail: paulg@synergyresi.com

Company URL: <http://www.synergyresi.com/>

Description: Designer and installer of home entertainment, home automation, cable television, home security and HVAC systems.

TASC Design

Location: Conroe (Houston)

Contact: Steven Spruell

Contact E-mails: info@tascdesign.com

Company URL: <http://www.tascdesign.com/>

Description: TASC Design is a custom system integrator of various home technology integration products.

Technovations

Location: San Antonio

Contact: Eric Cathcart

Contact E-mail: info@technovationsusa.com

Company URL: <http://www.technovationsusa.com/>

Description: Technovations is a custom system integrator of home automation, lighting, and home theater systems.

Texas Air Conditioning Contractors of America

Location: Austin

Contact: Todd McAlister

Contact E-mail: todd@tacca.org

Company URL: <http://www.tacca.org/>

Description: The Air Conditioning Contractors of America-Texas is a voluntary organization of HVAC contractors and their employees.

Texas Integrated Systems/Texas Electric Company

Location: Buda (Austin)

Contact: Rod Mueller

Contact E-mail: rodm@texeleco.com

Company URL: <http://www.texeleco.com/TIS/TIS.html>

Description: Texas Integrated Systems provides turnkey low-voltage design and installation for high-end residential audio, video, and entertainment systems. Texas Electric Company is an electrical contractor.

Theaters by Design

Location: Lewisville (DFW)

Contact: Mark Taylor

Contact E-mail: mtaylor@theatersbydesign.com

Company URL: <http://www.theatersbydesign.com/>

Description: Theaters by Design specializes in theaters/media rooms, multi-room audio/video, telephone/intercom, home automation and lighting control systems.

UltraMedia, Inc.

Location: Richardson

Contact: Patrick Murray

Contact E-mail: pat@ultramedia.biz

Company URL: <http://www.ultramedia.biz/>

Description: UltraMedia offers custom design and installation of home entertainment and automation systems.

Universal Electronics

Location: Hurst (DFW)

Contact: Human Resources

Contact E-mail: universal@universal-electronics.com

Company URL: <http://www.universal-electronics.com/>

Description: Universal Electronics is a high-end, custom electronics company. The company designs and installs home theater rooms, home automation systems, whole house stereo and video, and other high-end custom electronics products and services. The company also provides security and monitoring for home and businesses with custom alarm systems.

VCS Security Systems

Location: Victoria

Contact: Chris Vasquez

Contact E-mail: vcs@viccomm.com

Company URL: <http://www.viccomm.com/>

Description: VCS Security Systems offers design and installation services in the security and home theater industry. Other products include access control systems, audio systems, home cinema/theater systems and phone/intercom systems.

Video General, Inc. Custom Electronics Division

Location: Arlington

Contact: Matt Hannah

Contact E-mail: sales@videogeneral.com

Company URL: <http://www.videogeneral.com/electronics/about.htm>

Description: Video General provides structured wiring and home theater solutions for new homes. The company's other products include central vacuum, security systems and distributed audio/video systems.

Waypoint 29, Inc.

Location: Houston

Contact: Human Resources

Contact E-mail: corporate@waypoint29.com

Company URL: <http://www.waypoint29.com/>

Description: Waypoint delivers custom home theater, home automation and lighting control systems to its customers.





TSTC Emerging Technologies

Texas State Technical College Emerging Technologies identifies emerging technology trends, evaluates potential workforce implications and recommends new courses and programs for two-year colleges in Texas. The purpose of this program is to ensure Texas employers continue to have the highly skilled workforce necessary to compete in an increasingly global and technologically complex marketplace.

This program fulfills a legislative mandate enacted by the 76th Congress, which charges Texas State Technical College with developing and administering a program to identify, evaluate, and forecast potential emerging technology programs which are likely to have a positive impact on the State's economy (SB1819). This program was originally funded by Carl D. Perkins through the Texas Higher Education Coordinating Board.

More information about TSTC Emerging Technologies may be found at www.forecasting.tstc.edu.





TSTC Publishing

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Home Technology Integration

Implications for Community and Technical Colleges in the State of Texas

A growing number of homeowners and homebuilders are integrating digital technology into residences because the cost of these systems is decreasing. System integrators (employers) indicate a lack of available expertise in the home technology integration (HTI) sector capable of designing, installing and supporting these home subsystems. HTI includes audio, video, networking, control systems, air conditioning, security and computer technology. As the entry cost of HTI solutions and services decreases, the market is expanding beyond large, custom-built homes and into the broader mass housing market.

The analysis and information resources provided in this report will aid colleges in developing HTI programs and certificates. This publication includes an overview of HTI technology, analysis of existing HTI curriculum, descriptions of relevant industry certifications, the nature of HTI jobs and skills, a directory of over 100 Texas HTI companies, and market drivers and constraints impacting the HTI industry and employment.

TSTC Emerging Technologies

Texas State Technical College Emerging Technology identifies emerging technology trends, evaluates potential workforce implications and recommends new courses and programs for two-year colleges in Texas. This program helps to ensure Texas employers continue to have the highly skilled workforce necessary to compete in an increasingly global and technologically complex marketplace.

Visit www.forecasting.tstc.edu for more information about this program and additional TSTC Emerging Technologies publications.

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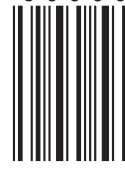
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