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Convergence, Divergence, or Fragmentation: How are Digitalization, Service Competition, and Corporate Consolidation Reshaping Employment Systems in U.S. Telecommunications?

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Convergence, Divergence, or Fragmentation: How Are Digitalization, Service Competition, and Corporate Consolidation Reshaping Employment Systems in US Telecommunications?

Telecommunications networks are undergoing a fundamental digital transformation. Network digitalization has decoupled service offerings from the underlying network technologies and architecture. This process is basically complete for network backbones and large institutional customers. Remaining are the residential and small business markets where specialized analog networks designed for voice service or television broadcasts are being upgraded and replaced. The typical American household or small business is gaining access to a growing set of telecommunications service options for voice, Internet, data, and video, as the network providers, resellers, and consortiums bundle together service packages. The research presented in this paper examines four major local networks and network services, fixed wire line, wireless, cable television, and the Internet to investigate how this digital transformation is reshaping technician employment systems across these formerly specialized telecommunications networks and services. To examine this change we utilize two unique establishment surveys of telecommunications technicians, one undertaken in 1998 and the other in 2003, a period of substantial change in the telecommunications industry.

This research seeks to explore what Dunlop called the "industrial relations system" and what will be referred to as the employment system. An employment system requires that actors and rules reflect a considerable degree of cohesiveness and interdependence. The concept is "deliberately variable in scope; it may be used to characterize an immediate work place, an enterprise, a sector, or a country as a whole (Dunlop, 1993, p.285)." This research investigates the influence of telecommunications network digitalization, service competition, and corporate consolidations as forces shaping the levels of the telecommunications employment systems. This paper considers three rival employment system hypotheses, each suggesting a different level of institutional cohesion and operation. First is the competitive convergence hypothesis. As different digital networks compete

for customers, each will imitate and adopt the most successful practices converging around a similar set of human resource rules and work practices. Convergence should be evidenced by a trend toward an emerging unified industry employment system. Second is the institutional divergence hypothesis. Since each of these different networks have their distinctive histories, demonstrated effectiveness, established routines, and distinguished competencies, each network will pursue its own unique cost effective path in adapting to digital technology by incorporating these new technologies into their respective established institutional employment system, consequently multiple systems should co-exist and compete (Katz and Darbishire 2000). Third is the fragmentation hypothesis. As the deployment of new technology and service competition increases, it encourages flexibility and adaptability provided by microelectronic technologies in such a way where competitive advantage shifts to those who maximize local solutions (Katz 2005). One potential consequence of local decentralization is that there so much fragmentation that no coherent industry or network systems emerge, instead the industry employment systems are replaced by an overall set of inchoate practices, procedures, and rules from the network perspective, developed at the workplace level. Fragmentation, nonetheless, may be a transitory outcome, since network digitalization, corporate consolidation, and service competition is an ongoing process, this may be a period of noisy transition, where a mixture of old and emergent forms of employment practices co-exist, so evolutionary convergent archetypes might be difficult to detect by a single cross-section. By using two cross sections, we hope to eliminate some of the transitional noise by allowing us to identify trends toward or away from various employment practices.

Part I of the paper provides an overview of the changes underway in the local access networks and markets with a focus on residential service competition. Part II discusses the evolution of technician employment systems in traditional wire line and cable television distribution networks. Part III identifies the elements of each network's technician employment practices and their

respective changes and stability over time. Part IV analyzes the establishment level survey data. In Part V the findings are discussed and some tentative conclusions are reached about the stability and change of network technician employment systems.

Part I. Changing Telecommunications Networks and Service Competition

Since the passage of the 1996 Telecommunications Act, the number of telecommunications access lines has steadily grown in both residential and business markets, as market structures have become more competitive, moving toward national oligopolies with various local and regional competitors. All facilities-based networks are evolving away from either a broadcast or circuit switched network architectures to packet data networks capable of running TCP-IP (Transmission Control Protocol/Internet Protocol), which has become the essence of the digital convergence.

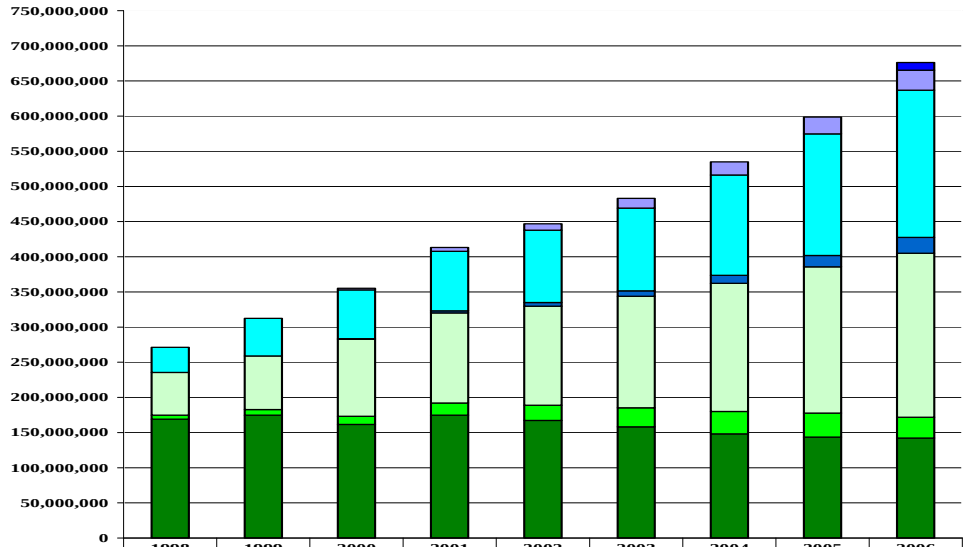
Figure 1 provides an overview of US telecommunications access line growth between 1998 and 2006, which has profoundly reshaped the industry's employment and technical work. Access lines grew by 2.5 times during this period from 271 million in 1998 to 676 million lines in 2006. Traditional voice grade wire lines peaked in 2001 with 192 million lines declining to 172 million in 2006. As a result of the Telecommunication Act and FCC's implementation of wholesale competition policy, Competitive Local Exchange Carriers (CLECS) market share of these traditional lines grew from 3% in 1998 to 17% in 2006, although in 2006 the CLECs did experience their first decline in voice grade access lines. CLECs for the most part resell Incumbent Local Exchange Carriers (ILEC) unbundled lines. Less than one-third of CLEC services are provided over their own facilities, mostly to business customers. In contrast to the decline of wire line voice grade service, wireless voice grade service expanded by 3.8 times between 1998 and 2006. In 2006, wireless had 233 million subscribers with a 71% penetration rate; one consequence of this wireless diffusion is that approximately, 11 million households by 2005 had fully substituted cell service for wire line

voice service. In 2006, the US had 405 million voice grade lines (wire line and wireless) in operation representing 72% more lines than the 235 million voice grade lines in use in 1998.

While wireless voice grade service growth has been substantial, the more important long-term development has been the rapid deployment of data lines capable of carrying high speed TCP-IP traffic. Data lines grew by 7.5 times between 1998 and 2006, from 36 million to 272 million in 2006. Data access lines accounted for 40% of the local telecommunications access services in 2006, up from 13% in 1998.

Figure 1:

US Telecommunications Acccess 1998-2006
Voice Grade - ILEC, CLEC, and Wireless and
Data - ADSL, Special Access Circuits, Cable Modem, and Broadband Wireless



	1998	1999	2000	2001	2002	2003	2004	2005	2006
Mobile Broadband									11,015,968
Cable Modem			2,284,491	5,184,141	9,172,895	13,684,225	18,592,636	23,936,536	28,513,500
Special Access Circuits	35,943,026	53,234,528	69,359,197	84,875,315	102,944,68	117,717,78	142,851,38	172,850,17	209,148,71
ADSL			951,583	2,693,834	5,101,493	7,675,114	11,398,199	16,316,309	22,575,010
Wireless Voice	60,831,431	76,284,753	109,478,03	128,374,51	140,766,84	158,721,98	182,140,36	207,896,19	233,040,78
CLEC Voice	5,384,264	8,194,243	11,557,381	17,274,727	21,644,928	26,985,345	32,033,915	33,975,336	29,782,241
ILEC Voice	169,282,04	174,712,49	161,656,11	174,752,27	167,330,00	158,274,53	147,993,21	143,757,70	142,249,66

Sources: Federal Communications Commission, Industry Analysis and Technology Division Wireline Competition Bureau.January 2007. *High-Speed Services for Internet Access: Status as of June 30, 2006*. Federal Communications Commission 2006. *Statistics of Communications Common Carriers 2004/2005 edition*. Washington, DC. *CTIA-The Wireless, Association, Annualized Wireless Industry Survey Results - December 1985 to December 2006*

For the most part large businesses and other institutions lease special access circuits from the local exchange carriers to meet their data and Internet access needs. The number of these circuits was estimated to be over 209 million in 2006. On the other hand, the deployment high speed data lines in the residential and small business data markets in the United State have been more challenging. According to the OECD in 2006, the US ranked 15th in the world in residential broadband penetration. The OECD reports that the world leaders Denmark and the Netherlands had 34 broadband subscribers per 100 inhabitants, while the United States had 22. Barriers to broadband deployment in the US include the lack of a national broadband policy; the FCC's competition policy, which encourages facilities duplication; the highly dispersed suburban housing patterns; which makes deployment more costly, the federal requirement that after 1968 in all new neighborhoods residential cable be buried, which greatly increases replacement costs, and the highly unequal distribution of household income, which skews broadband demand to the upper income groups that are more likely to be located in newer dispersed suburban communities.

In contrast to most of the world, the cable modem is the preeminent residential broadband technology in the US with 28.5 million subscribers in 2006, followed by DSL with 22.5 million subscribers used by the ILECs. Neither technology as deployed in the US offers residential customers significant bandwidth (speed), when compared internationally. Verizon, however, recently initiated the deployment of the much faster fiber to the home (FTTH), but they had less than a million subscribers in 2006. Both Verizon and AT&T plan to challenge cable television's video, Internet, and voice packages by rapidly deploying fiber over the next five years.

In 2005, the major wireless companies introduced wireless broadband services that operate at much slower speeds than its wire line counterparts. Nonetheless, by 2006 the FCC reported 11 million wireless broadband subscribers, over 90% percent of whom were business customers. Although championed as potential alternative broadband technologies, neither satellites nor electric

power lines have demonstrated themselves to be cost effective competitors with the wire line or cable networks.

Network ownership has steadily consolidated through mergers among the major corporate network operators, suggesting that there remain substantial economies of scale and scope in network operations; nonetheless the exercise of market power remains a persistent threat to customers and the government's liberalization policies. Underlying this process of consolidation is the question of "how many firms can these network service markets support?" As discussed above, the fixed wire line market is divided into competitive local exchange carriers (CLEC) that have 17% of the retail market, and incumbent local exchange carriers (ILEC) that are now dominated by two companies, the AT&T and Verizon that have regained end to end control over a substantial portion of the telecommunications backbone, wholesale, residential and business wire line markets. Their two wireless subsidiaries, AT&T Wireless and Verizon Wireless, in conjunction with Sprint Nextel constitute the wireless big three with almost 80 percent of US wireless service.

Cable television, on the other hand, is lead by Comcast (21.5 million subs.), Time-Warner Cable (15.1 million subs.), Charter (5.9 million subs), and Cox (5.1 million subs). Cable's big four account for 74% of the cable subscribers in the US. Since 1994 cable television distribution has competed with direct broadcast satellite. The two major satellite television providers are Directv and Echostar, which have together claimed 31% of the multi-channel pay television market.

The cable distribution industry is restructuring with the major companies clustering ownership in metropolitan areas to market cable's triple play of video, voice and high speed Internet, distinguishing itself from direct broadcast satellite, which is only capable of delivering video. Cable television basic subscriptions have been flat between 1998 and 2006 with approximately 65 million subscribers. Nonetheless, during this period cable television undertook a significant cable investment

program to upgrade its network, making them formidable competitors with the wire line companies for residential and small business customers.

Internet Service Providers still number in excess of several thousand but are lead by Time Warner (AOL and Roadrunner), Comcast, Microsoft's MSN, and United Online (Netzero and Juno). AT&T and Verizon control their own captive ISPs, as well. As voice grade and broadcast cable networks are increasingly converted into data networks, the future value of independent ISPs as the gateway to the Internet becomes more uncertain as they appear to be more and more as another artifact of regulatory policy.

The enormous growth of the telecommunications services market and wider basis for competition enabled by digital technologies has substantially changed employment patterns and practices. These changing conditions may permit local solutions to workplace and employment problems, potentially propelling diversity, differentiation, decentralization and even fragmentation of network employment systems. On the other hand, the corporate consolidation processes in each network increases the potential for centralized control over standardized employment systems within each network, possibly countering the decentralizing tendencies of market competition and digital technologies. History may also matter, as long-lived private employment institutions exert a stabilizing force in this industry. Two networks, traditional wire line and cable television distribution, each have well established, relatively successful, and distinct employment systems. They are the subject of Part II.

Part II. Legacy Employment Systems in Telecommunications

The Bell Telephone System

Throughout most of the 20th century, the Bell System was the telecommunications industry, a public utility, organized as a unified natural monopoly that provided both local and long distance

telephone services for most Americans. The 1984, AT&T divestiture fundamentally restructured the American telecommunications industry, but not its employment system for local services.

As an employer, the Bell System provided employment security for its workers and managers through comprehensive human resource planning. The employment system was profoundly reshaped by the AT&T-EEO Consent Decree of 1973 that sought to eliminate occupational gender segregation. Technician occupations had been exclusively a male domain, except for the position of frame attendant in the state of Michigan, which was exclusively a female occupation but only in that state. As a remedy to occupational gender segregation, AT&T introduced an upgrade and transfer plan that relied on paper and pencil testing, which stimulated the creation of broad-banded job titles, that replaced detailed job ladders, seniority, and trainability standards in regulating mobility in AT&T's massive internal labor market (Keefe and Boroff 1994).

Almost two-thirds of AT&T's 1.1 million employees in 1982 were union represented either by the dominant union, the Communications Workers of America (CWA), or the International Brotherhood of Electrical Workers (IBEW). Collective bargaining was conducted in a two tier national-local framework. The bottom local tier of the two-tier collective bargaining structure was often a state or a region that was relatively removed from the shop floor. To address work place job pressures, AT&T and CWA negotiated in 1980 a Quality of Work Life (QWL) Program, and by 1983, over 1200 QWL groups were in place that eventually involved over 100,000 employees in QWL committees (Keefe and Batt 1997).

The AT&T divestiture changed the structure of the industry and consequently changed the structure and procedure of collective bargaining. Pattern bargaining replaced centralized national bargaining. The pattern bargaining agenda, however after divestiture, would focus on union concessions. In 1986 bargaining largely eliminated the COLA clauses from the contracts. In 1989, bargaining centered on shifting from indemnity health insurance to managed care. In 1989,

however, disputes over health insurance produced four major strikes involving over 200,000 workers (Keefe and Batt 2002). At NYNEX a four-month pattern breaking strike by the CWA and the IBEW defeated the company's health insurance proposal with workers retaining indemnity health insurance, while managed care was accepted in all other agreements. In 1992, negotiations returned to pattern bargaining, which has persisted through the most recent round of negotiations in 2003 (Katz, Batt, and Keefe 2003).

The hallmarks of the Bell employment system included a highly articulated internal labor market that provides employment security with opportunities for promotions and transfers regulated by testing and seniority. Considerable amounts of formal and on-the-job training for a workforce comprised mainly of high school graduates that has allowed them to acquire firm specific skills and adapt to new technologies. Workers have company based careers with low turnover and high levels of retirement. This framework enabled the telephone industry to compile the best productivity growth record in the post-World War II era, exceeding five percent annually. The union contracts have provided employees with rising real earnings, employer funded pensions and health insurance, just cause for discipline and dismissals, and paid time off for vacations, holidays, sick leave, disability and personal days (Keefe and Batt 1999).

Cable Television

Starting in the late 1970's, cable television built a low cost employment system that deliberately shunned most of the Bell System's practices. The cable television distribution system was a local monopoly, regulated by municipal franchises and intermittent federal oversight. The first cable television systems were established in 1948. These early ventures retransmitted network television into rural communities unable to receive broadcast signals. By 1970, cable television had 4.5 million subscribers. When Time launched HBO using a communications satellite in 1975 to distribute its signal to cable system operators throughout the country, a new cable distribution

industry was created. By 1980, there were 28 national satellite channels available to local cable operators for distribution (Parsons and Frieden, 1997).

Once cable developed unique content, the lucrative urban and suburban markets opened to cable distribution after a series of judicial and regulatory rulings permitted competition between cable and broadcast television. Cable entered a decade of rapid growth. In 1975, cable systems served less than 10 million subscribers; by 1985 they served nearly 40 million subscribers. Employment in the industry nearly tripled (Toto 2000), and it is during this decade that a distinct cable distribution employment system emerged largely shaped by one company, TCI, (Tele-Communications Inc).

TCI became the largest cable operator in the United States through debt financing, aggressive accelerated depreciation methods, complex financial transactions, and corporate governance practices which vested control in two minority shareholders. TCI expanded by acquiring systems that had financially over-extended themselves. TCI's model for metropolitan cable system acquisitions involved renegotiating franchise agreements, reducing the number of channels offered in basic service, removing any innovative features from the network, cutting payroll in half, and eliminating incumbent unions through asset acquisitions (Robichaux. 2002 p 76). "Buying cable was like buying real estate," according to John Malone, CEO of TCI (Quoted in Robichaux, 2002, p.45). As the value of TCI's franchises rose, so did the value of its stock. Asset appreciation, not net earnings growth, was TCI's financial objective. Its high leverage, aggressive depreciation, and sizeable interest payments, tax-sheltered TCI's cash flow and served as the basis to qualify for more loans for additional acquisitions to generate more tax-sheltered cash flow.

TCI spent as little money as possible on employees, service, or upgrading its cable systems. The focus was on growing the company. TCI became known "for the poor quality of its service and the unresponsiveness of its employees (Davis 1998, p.49)." "Rude installers, no-show repairmen,

and busy signals were the norm. It was like getting the Hell's Angels sent to your home (Robichaux 2002, p.94)."

As a consequence of its financial strategy, TCI built a distinctive anti-Bell System set of employment practices, which became a model for success in this highly leveraged industry of mostly family run corporations (Eisenmann, et al. 2000).

TCI's workforce was a mix of both employees and contractors, often working side-by-side. Turnover was high; educational requirements and training were minimal; and security and retirements were non-existent. Wages and benefits were meager. Staffing levels were inadequate. The patchwork of cable systems throughout the country inhibited the development of a professional management or modern information systems. In 1993, when Bell Atlantic considered a merger with TCI, its per-worker benefits costs were estimated at nearly four times the level at TCI (Lohr, 1994). While cable television had, undisputedly, established the least cost employment system, it also had, undeniably, the poorest productivity growth, quality, and customer service record in the communications industry.

When TCI merged with AT&T in 1998, it served nearly one-in-four cable subscribers in the United States. Four years later, AT&T Broadband sold its cable acquisitions to Comcast for less than half of what AT&T had paid for them. The former TCI cable systems became part of Comcast. In the interim period, CWA had successfully organized numerous former TCI systems under a neutrality-expedited election agreement with AT&T. After the AT&T Broadband sale, Comcast aggressively undertook a successful decertification campaign at most of the newly unionized locations, reaffirming the perseverance of the TCI employment system in the cable industry.

Until the advent of digital cable, telephone and cable companies were not competitors. Analog cable offered a unidirectional broadcast signal to its customers; meaningful two way telecommunications were impossible. Telephone systems were the primary source of

telecommunications. With digitalization, however, cable can offer a triple play of video, Internet, and voice, which threatens the survival of the wire line providers who lag behind cable in upgrading their networks. As the cable and telephone companies rush into residential fiber broadband competition, a number of observers and Wall Street analysts question how many residential broadband networks can be profitably deployed (Cheng 2006)? Do we really need two residential fiber or mixed-fiber networks, where one high quality network might suffice (Hundt 2003)? The more skeptical analysts predict an inevitable price war that will leave both residential networks in financial ruin, if not bankruptcy. As a consequence of these concerns about residential network competition, the value of cable stocks plummeted in 2007, with Comcast's stock falling by 35% and Charter's decreasing by 62% (Cryan and Silva 2008). To allay some of the skeptics fears about the wire line broadband investments, Ivan Seidenberg, CEO of Verizon, tied part of his compensation to the financial performance of FIOS, Verizon's residential fiber network (Silver 2006).

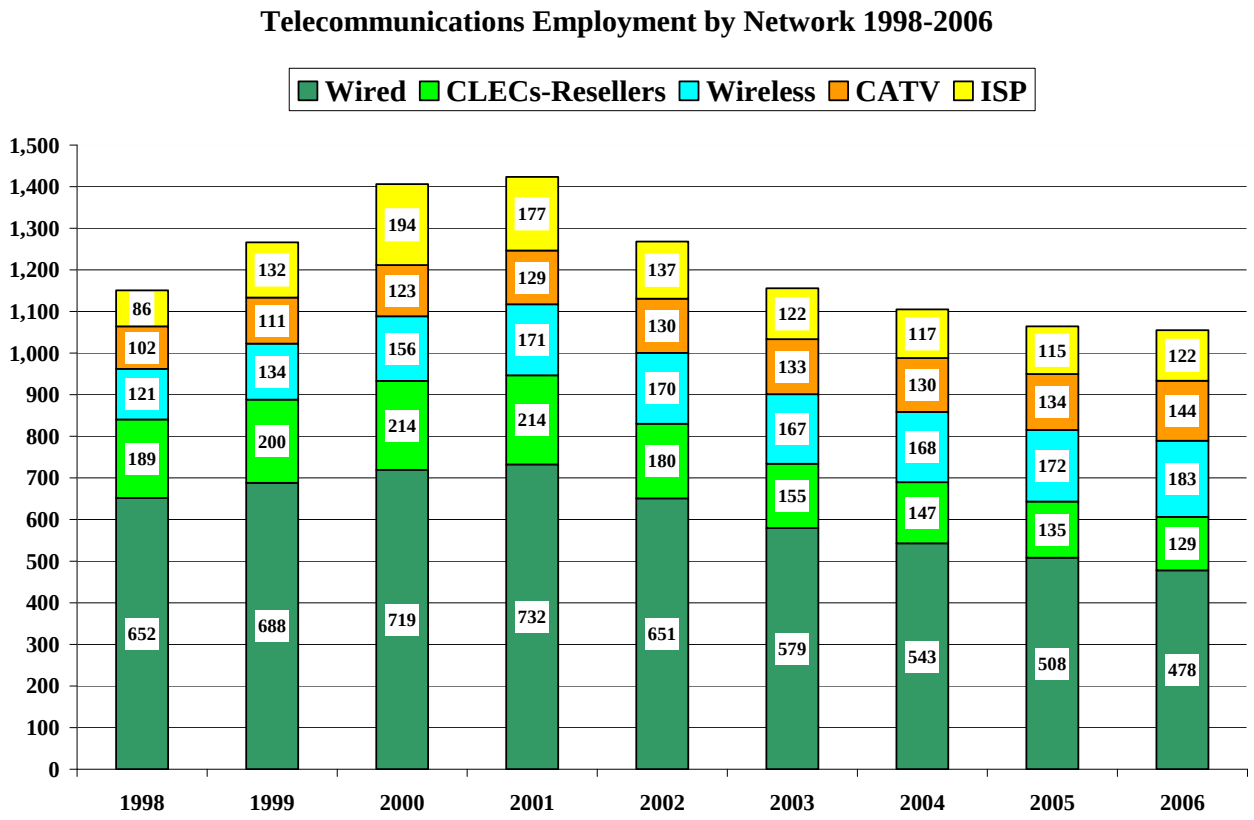
Several employment system questions are also raised by wire line facilities based competition as the distribution networks go head to head in residential markets: Will cable's low-cost employment system provide an advantage in this new competitive environment, or will cable need to adopt new employment practices to improve its productivity, quality, and customer service? On the other hand, can the unionized Bell employment system with its relatively high wages, health benefits, and pensions persevere as AT&T and Verizon compete with the substantially lower employment cost cable television systems? Next, we examine how market changes and digital technologies, and corporate consolidations have impacted the industry's employment, labor earnings, and the demand for different occupations.

Part III. Industry Employment, Labor Earnings, and Occupational Trends

Overall, employment grew more slowly than service as productivity accelerated in wireless, fixed wire line and ISPs, but stagnated in cable television. Peak total network employment occurred

in 2001, with 1.42 million workers, which declined by one-quarter to 1.05 million by 2006, marked by a steady shift away from fixed wire line employment. In 1998, local exchange carriers (ILECs) and competitive local exchange carriers (CLECs) accounted 57% and 16% of network employment, respectively, for a total of 73% of the industry's jobs. By 2006, their combined proportion had declined to 57%, representing a loss of 234,000 jobs during the eight year period. From peak employment in 2001, the wire line network lost 340,000 jobs or 36% of its workforce. Declining wire line employment is tied to increased productivity arising from digitalization, lower margins for competitive services, the changing mix of network service products, particularly the decline in traditional voice grade service, but not a reduction in overall services demand.

Figure 2:



Source: US BLS CES: Employment, Hours, and Earnings from the Current Employment Statistics survey (National) http://data.bls.gov/cgi-bin/dsrv

In contrast, to the wire line experience between 1998 and 2006, there has been a 39% employment growth for the other networks, wireless (51%), cable television (41%), and the ISPs (41%). Both wireless and Internet service providers experienced explosive growth in service demand in this period. Wireless employment remained flat between 2001 and 2005, as it posted the extremely high productivity growth. The ISPs were recovering from the excesses of 1990s as they consolidated their operations, and as many ISPs went out of business; not until 2006 did they gain employment. On the other hand, while cable television distribution has not been adding subscribers as it vigorously competes with satellite television, cable has been adding employees and contractors, as CATV operators have focused on offering new digital services bundles to fend off the challenge of direct broadcast satellite in its traditional video markets and gain first mover advantages in it competition for service bundles with the wire line providers.

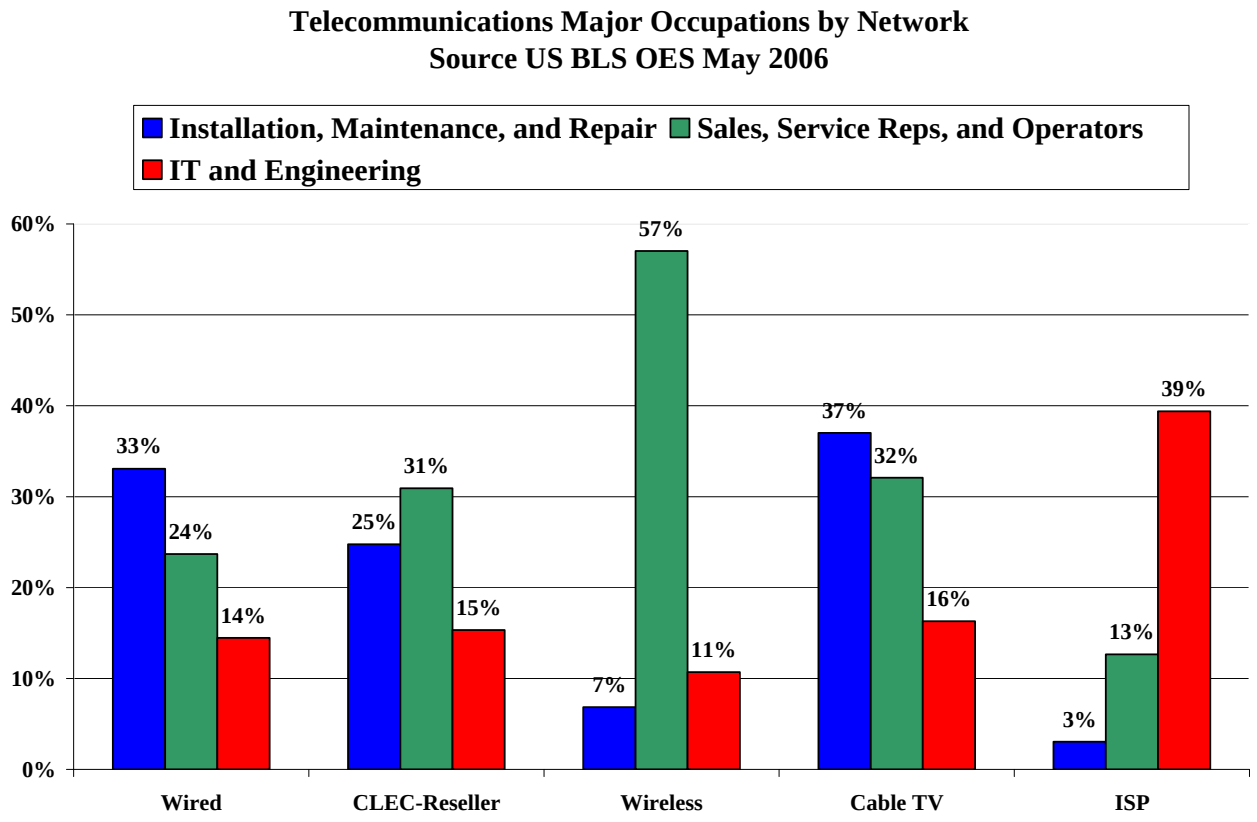
How Do Network Service Providers Organize Themselves to Provide Services?

Each network has a distinctive approach to organizing telecommunications work partly arising from their respective network technologies, but also as a result of managerial determinations about whether activities should be performed by employees or contracted to vendors or both.

Large incumbent wire line companies perform virtually all essential tasks internally. Employees are hired and trained to do the work of providing network services. The primary technical work is to construct and maintain the network and provide installation and repair services to the subscribers, which accounted for 33% of wire line employment in 2006 (source: BLS: Occupational Employment Statistics, May 2006; see Figure 3). Customer service represents the next largest group, 24% of wire line employees. Customer services is organized primarily into three subgroups: customer service representatives who address customer orders, billing, and changes in services, telemarketers, who sell services, and telephone operators, who provide information or call completion, a steadily shrinking group. The other major wire line occupational group includes

engineering and IT occupations, which accounts for 14% of the employment. These jobs are often classified as managerial specialist positions, placing them outside the scope of union representation. The other wire line network provider has similar occupation structure. Since competitive local exchange carriers, largely use the network elements of the local exchange carriers, they require relatively fewer installation, maintenance, and repair technicians (25%). Instead, they devote more resources to customer acquisition (31%). Cable television is notable since it employs, directly or as contractors, the largest proportion of installation, maintenance and repair technicians (37%) of any network. As with local exchange carriers the second largest employee group is customer service and sales (32%).

Figure 3



Source: Bureau of Labor Statistics, *Occupational Employment Statistics*, May 2006.

Wireless and the Internet, the two newest networks, have highly distinctive occupational structures. Wireless is not really a network. Wireless providers offer cellular network access. Once a call is

received by a cell tower receiver, it is routed into the wire line network to its destination. Wireless service providers employ relatively few technicians for installation, maintenance, and repair. Cell towers are mostly constructed and owned by American Tower. The major wireless companies have ownership positions and hold long term contracts with American Tower, which leases tower access for their transmitters and receivers. At cell sites the wireless electronics, receivers, transmitters, and antennas are usually installed by the manufacturers, not the wireless provider. Wireless technicians oversee network operations, perform network maintenance, and repair customer's cell phones in retail establishments. This allows the wireless companies to focus upon sales and service of their phones and services. Increasingly, this is being accomplished through retail stores owned and operated by the major carriers and relying less on third party vendors. Wireless employs 57% of the workforce in sales and service, making that occupational group the largest relative to any other networks. Wireless sales workers are employed in retail stores or as customer service representatives in call centers.

In contrast, the Internet Service Providers' (ISPs) largest occupational group is engineers and IT specialists (39%), who service the Internet and Internet access. ISPs, technically, are not network providers. They supply a network service, using TCP-IP that rides upon the physical network, most often owned by wire line and cable companies. By current federal regulations, the ISP (an enhanced service provider) must be a distinct business entity from the physical network provider. The ISPs' second largest occupational group is sales and service workers (13%), who market and service Internet access for business and residential customers. The ISP's are the only network service providers in the scope of this research, who outsource offshore significant parts of their technical and sales functions.

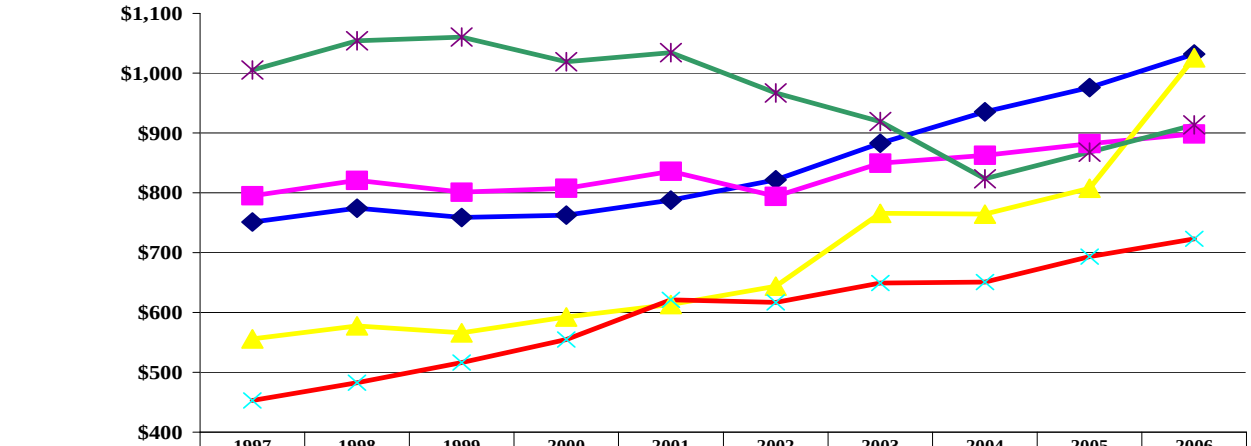
Given that commercial ISP's were relatively new and proximate to the dot com boom, they paid the highest weekly wages throughout the 1990's and into 2003 (Source BLS - Current

Employment Survey; see Figure 4). As the nature of Internet access, however, changed from dial-up to broadband and as competitive cost pressure mounted, ISP wages have declined as standardized work routines replace idiosyncratic processes.

Competitive local exchange carriers up until 2001, on average paid more than the traditional local exchange carriers, as they provided strong incentives for their commission paid sales representatives. Since their main business model depends on selling or reselling voice grade services, that has come under competitive pressure as access lines are lost to wireless and cable, their wage growth has slowed. Cable television has retained its position as the poorest paying network provider. In the last three years, the traditional local exchange carriers have gained the lead in wages paid, as their union contracts continue to provide modest wage growth. As AT&T Wireless unionized and Verizon Wireless responds to the union threat effect, wireless wages have also grown as the number wireless access subscribers, employment, and profits continue to rise.

Figure 4:

Average Weekly Wages of Telecommunications Workers by Network
1998-2006 Source: US BLS CES Employment, Hours, and Earnings from the Current Employment Statistics survey (National)



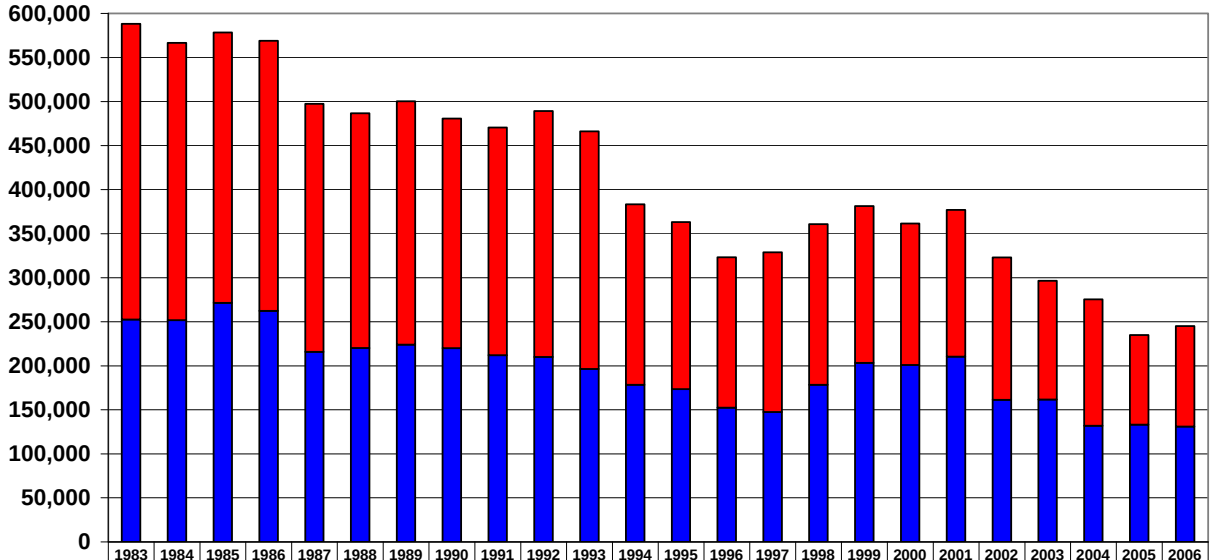
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Wire Line	$751	$774	$759	$763	$788	$822	$883	$935	$976	$1,032
CLECs-Resellers	$795	$821	$801	$808	$836	$794	$849	$863	$882	$899
Wireless	$556	$578	$566	$593	$613	$644	$766	$765	$808	$1,026
Cable TV	$453	$482	$516	$555	$621	$617	$649	$651	$694	$723
ISPs	$1,005	$1,054	$1,061	$1,019	$1,034	$967	$919	$824	$868	$914

US Bureau of Labor Statistics *CES: Employment, Hours, and Earnings from the Current Employment Statistics survey* (National)

During the last decade, the telecommunications technician labor markets became somewhat more competitive; employers, however, still exercised considerable monopsony market power through their control of firm specific training that historically was the only source of technical training in the industry. During the Internet boom of the late 1990's, a number of proprietary technical colleges, community colleges, vendors, and IBEW locals began offering programs of study and apprenticeships in telecommunications technology, focused primarily on data network routers and soft-switches used by the Internet Service Providers and local area networks (LANs). For a brief period of time after the boom ended, these programs created an over-supply of workers with these skills.

Figure 5

Union Members: Technical and Other Workers in Telecommunications 1983-2006 Source CPS
Decline from 588,128 to 245,146 Members
Technician Members Decline from 271,469 (1985) to 131,029 (2006)



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Sales and Other	335,4	314,7	307,0	306,5	281,6	266,6	276,1	260,8	258,5	279,2	269,8	204,8	189,5	170,9	181,4	182,6	178,1	160,6	166,5	161,7	134,6	143,7	101,9	114,1
Technicians	252,6	251,9	271,4	262,3	215,9	220,1	224,1	219,8	211,8	209,9	196,2	178,4	173,4	152,2	147,5	178,2	203,2	200,8	210,4	161,2	161,7	131,8	132,9	131,0

Source: NBER-Current Populations Surveys and Hirsch and MacPherson, Unionstats.com.

Since the divestiture of AT&T in 1984, union membership in the telecommunications industry has declined by more than half. Union density dropped from 56% in 1983 to 21% in 2006, as membership fell from 588,128 to 245,146 in 2006, a loss of 342,982 members in the post-AT&T divestiture period. Technician union density declined less severely from 67% to 42%, while technician membership dropped from its peak in 1985 of 271,468 to 131, 029 in 2006, a decrease of 140,440 technician members.

Membership decline can be attributed to three factors. First, labor-saving, productivity enhancing technological change has reduced labor demand per access line in traditional telecommunications networks. Second, the employment effects of declining demand for the wire line network's voice grade access lines have not been offset by the growth of special access data lines. Only with the deployment with residential broadband has there been a recent increase in union represented employees in wire line.

Third and most importantly, unions have encountered a wall of opposition from employers at the newer networks, successfully isolating the unions at the successors of the traditional Bell wire line employers. Only where the unions have established positive relationships have they had sustainable organizing success. For example, the Communications Workers of America gained recognition and the representation rights for 38,000 bargaining unit members at AT&T Wireless, by leveraging its political influence to gain a series of neutrality and card check agreements.

In contrast, Verizon Wireless covered by a similar card check agreement starting in 2000, but no longer needing the union's political influence, vigorously and successfully resisted organizing under that agreement. Also, MCI, now Verizon Business Service, continues its energetic opposition to unionization. In cable television, as discussed above, the CWA had gained recognition and contracts at AT&T Broadband under a neutrality and expedited election agreement. However, once

the AT&T Broadband merger with Comcast was completed, Comcast undertook an aggressive and largely successful nationwide decertification campaign.

While diminished in both members and density, unionization still remains a potent economic and political force within the industry. Nonetheless, the decline of unionization is the major institutional change in this industry's employment system. Except for AT&T Wireless, there is a relative lack of union coverage in the newer high growth sectors of the industry. Since unionization reinforces institutional employment stability and standardization, its decreasing coverage may become a factor permitting, convergence or fragmentation across the network employment systems. Also, given their relatively recent origins has wireless carriers and Internet Service Providers, it is unclear whether they have been to construct and institutionalize their own unique network employment systems. These and other empirical questions about stability and change are the subject of the remainder of this paper.

Part IV: Network Technician Employment Practices and Systems 1998 and 2003

The remainder of the paper focuses on the stability and change in technician employment practices at the four networks, wire line, cable television, wireless, and ISPs, using two stratified random samples drawn from the Dun and Bradstreet listing of establishments in 1998 and 2003. Establishments were stratified by location and size. Almost all establishments with more than 100 employees were sampled so that the survey would cover a larger percentage of the industry's workforce. Sampling of the remaining smaller establishments was done so that the total sample reflects the relative proportion of establishments in each segment of the respective Dun and Bradstreet industry listing. In the fall of 1998 and the summer of 2003, a university-based survey team administered telephone survey covering questions related to basic industry characteristics, management strategies, and work and human resource practices. There were 223 usable surveys

produced by the 1998 survey, and 237 usable surveys yielded by the 2003 survey covering telecommunications technicians.

The research examines the telecommunications technician employment practices using five sets of rules governing employment: compensation, work practices, unionization, education and training, and staffing. Technology measures are included since technology might be propelling change, and the average group size serves as a control. Table 1 provides the overall and four network means by category and item for both 1998 and 2003. The items and the significant changes between 1998 and 2003 are reviewed below.

During this period, network digitalization advanced significantly from 34% to 51% of all network elements, with the largest growth occurring in cable television, where 83% of cable technicians were working on digital networks in 2003. Wire line carriers also significantly increased the number of services they provided customers. Computer use, which has figured prominently in the debates about skill-biased technological change, is measured by desktop and laptop computer by technicians. Between 1998 and 2003, laptop use increased from 34% to 39%, but overall technician computer use remained constant during this period at 60%. The range of computer does vary greatly with a low of 18% for cable television technicians to a high of 78% for ISP technicians in 2003. Computer use by wire line technicians significantly grew from 57% in 1998 to 70% to 2003. Company provided cell phone use also grew during this period from 34% to 51% of technicians with the greatest increase occurring in among cable technicians rising from 42% to 83% with company supplied cell phones.

TABLE 1 NETWORK MEANS for Technicians Employment Practices

Means by Sample Year	Wireless	Wireless		Cable Television			LEC	LEC		ISP	ISP		Total Local Access		
Weighted by Coresize	**1998**	**2003**		**1998**	**2003**		**1998**	**2003**		**1998**	**2003**		**1998**	**2003**	
Hoteling T-Test *.05 **.01															
Technology & Services															
Company Laptop	57%	28%		5%	12%		38%	48%		10%	6%		34%	39%	
Computer Use on Job	89%	87%		8%	18%		57%	70%	*	99%	78%	*	60%	60%	
Company Cell Phone	62%	40%		42%	83%	**	22%	49%	**	1%	23%	**	23%	55%	**
Network Percent Digital	38%	54%		34%	83%	**	34%	41%		34%	58%		34%	51%	**
Number of Services	4.6	6.2		3.2	3.1		4.7	5.6	**	4.3	4.6		4.6	5.1	*
Compensation															
Ln Average Annual Wage	10.594	10.441		10.327	10.554	*	10.625	10.728	**	10.608	10.700		10.607	10.678	**
Benefits as Percent of Wage	21%	27%	**	25%	33%		37%	37%		21%	28%		35%	37%	
Percent Pay Variable	4%	9%		3%	6%		2%	8%	**	13%	4%	*	3%	8%	**
Work Practices															
Electonic Monitoring	32%	55%		7%	13%		22%	48%	**	52%	49%		24%	40%	**
Participation in Task Forces	40%	19%	*	17%	14%		16%	28%	**	74%	59%		20%	25%	
Self Directed Teams	16%	23%		14%	10%		5%	5%		30%	40%		8%	8%	
Unionization	8%	20%		10%	6%		97%	91%		10%	0%		82%	67%	**
Education & Training															
High School Only	4%	1%		60%	74%		37%	66%	**	3%	12%		35%	63%	**
Some College	43%	48%		27%	22%		63%	34%	**	51%	52%		59%	33%	**
Education Level	14.8	14.9		12.9	12.5		12.8	12.6		14.8	14.3		13.0	12.7	**
Weeks of Qualifying Training	22	12		28	32		61	91	**	28	38		55	73	**
Staffing															
Full-Time Permanent Employees	100%	97%	**	100%	77%	**	100%	96%	**	99%	91%	**	100%	92%	**
Employees with Less 1 year	16%	14%		12%	22%	**	13%	3%	**	21%	19%		14%	8%	**
Employees with Less 10 years	79%	65%		73%	62%	*	34%	35%		63%	77%		40%	43%	
Percent Retire in Last 5 years	2%	1%		1%	0%	**	29%	7%	**	3%	0%		32%	5%	**
Percent to Retire next 5 years	4%	11%		5%	4%		35%	35%		9%	1%		29%	27%	
Layoff Percent	0%	21%		2%	3%		2%	2%		4%	24%	**	2%	3%	
Annual Turnover (quits+ fired)	4%	7%		11%	25%	**	3%	3%		7%	23%	**	4%	8%	**
Temporary Employees	0%	1%	*	0%	22%	**	0%	3%	**	0%	2%	**	0%	7%	**
Contract Employees	0%	1%		1%	29%	**	1%	8%	**	1%	20%	**	1%	12%	**
Average Weekly Hours	49.7	46.4	*	44.0	45.9		47.8	42.0	**	47.8	46.7		47.6	43.2	**
Office Technicians	32%	60%		2%	6%		19%	22%		90%	72%		25%	22%	
Exempt Employees	29%	2%	*	1%	4%		5%	14%	*	20%	35%		7%	12%	

Annual wage compensation advanced slowly during the period 1998 and 2003, not keeping pace with increases in the cost of living, except at cable television. Wire line technicians received significant wage increases, however, below the rate of inflation. Benefit costs, as measured as a percent of wages, grew modestly during this period. Nonetheless, wireless carriers increased their benefits contribution from 21% to 27% of wages and cable television distribution increased their contributions from 25% to 31% percent of wages. Performance incentives grew as a percent of pay from 3% to 8% across the industry. Wire line carriers increased performance pay significantly from 3% to 8% of pay, while the ISPs retreated from performance based pay declining from 13% to 4% during this period. The most surprising compensation change was that cable television operators provided the highest percentage pay and benefit increases during this period. Nevertheless, that did not change their ranking as the worst paying network in the industry.

Technicians involved in task force or problem solving participation increased from 20% to 25%. The net change reflected a significant growth of these practices at the wire line carriers from 16% to 28%, while there were declines at the ISPs and wireless carriers. On the other hand, electronic monitoring of work performance continued to grow from 24% to 40% of technicians in 2003, the most significant growth occurred at the wire line carriers more than doubling the proportion of technicians electronically monitored from 22% in 1998 to 48% in 2003.

As discussed in the previous section, technician union coverage significantly declined during this period, dropping from 82% to 67% in these surveys. Wireless, however, did experience a growth of unionization from 8% to 20% with unionization of AT&T Wireless.

There are some unexpected results for education and training. Although there has been substantial technological change underway, there was a significant reduction in the education level of the technician workforce. Only the wireless carriers (51%) and ISPs (36%) rely on significant proportions of college graduate technicians. Most employers are increasing their reliance high school educated technicians. Wire line carriers increased the proportion of their technicians with high school only education from 37% in 1998 to 66% in 2003. This reduction in formal education levels has been coupled with a significant expansion in the weeks of qualifying training. This pattern most strongly emerges at the wire line carriers, which has increased qualifying training by half from 61 to 91 weeks. Their firm specific training exceeds other networks by 3 to 7 times.

At the same time, the industry has shifted toward more flexible contingent employment relations with significant increases in temporary workers (0% to 7%) and contract employment (1% to 12%) as the annual turnover rate doubled from 4% in 1998 to 8% in 2003. Full-time permanent employment significantly declined with the largest decline occurring in cable television distribution falling to 77% in 2003. Temporary employment significantly increased at wireless (0 to 1%), cable television (0 to 22%), wire line carriers (0% to 3%), and ISPs (0 to 2%). Contract technicians also

increased significantly between 1998 and 2003 at cable television rising from 1% to 29%, at the wire line carriers growing from 1% to 8%, and at the ISPs expanding from 1% to 20% of the workforce. Employees with less than one-year tenure declined in the industry (14% to 8%); however, increased in cable television from 12% to 22% as cable television significantly increased its rate of annual turnover to 25%. While the use of layoffs grew at wireless carriers from 0% to 21%, there was not a significant overall increase in the use of layoffs to adjust the workforce.

Only the former Bells had a significant number of technician retirements, and also they had more than one-third of their technicians becoming retirement eligible in the next five years. They remain participants in some of the last defined benefit pension plans in the industry. Most wireless (60% in 2003) and ISPs (72% in 2003) technicians work in offices, while most wire line (78% in 2003) and cable television technicians (94% in 2003) work in the field. The exempt employees working as technicians only constitute 7% to 12% of the technical workforce with the highest percentages at the ISPs (35% in 2003).

In summary, there were significant changes in the industry's employment practices for technicians during the period 1998 to 2003. There was a shift to performance based pay, increased electronic monitoring and , increased reliance on technicians with a high school education and expanded qualifying training. The most significant shift came in staffing arrangements as the labor market softened after 2000. Employers increased flexible and contingent working arrangements including a significant expansion in the proportion of contract workers and temporary employees, a reduction in full-time permanent employees, and higher turnover rates. Nonetheless, these general trends do obscure considerable variations at the network and workplace levels of the employment system.

Network Employment Practices and Systems

Next, in order to more systematically investigate the variations and the patterns of practices and rules across the different networks, a multinomial logit is estimated on the combined 1998 and 2003 samples. To operationalize this model detailed employment practices are used to predict network identity. The omitted category in the multinomial model is the wire line carriers, which contains the largest number of observations, and is also the original telecommunications employment system. Each employer entering the telecommunications business could have chosen all or some variant of the wire line carriers' employment practices.

The multinomial logit estimates provide significant results by each network. All else equal, cable television distribution networks technicians are more likely to use a company cell phone, work for a company that offers fewer service options, earn significantly less pay, are more likely to be electronically monitored, are less likely to participate in employee groups, are significantly less likely to retire in the next five years, experience greater turnover, and work with contractors. In contrast, wireless technicians work for employers who offer significantly fewer service options, provide less training, and pay lower wages. Wireless does not rely on employee participation forums, but makes the greatest use of self-directed teams, which seems appropriate given that many technicians work in small groups in retail stores. Wireless technicians are also less likely to be union represented, more highly educated, work longer hours, have less tenure, and are less likely to work with contract workers. The ISP employers also provide fewer service options. ISP technicians are significantly more educated, nonunion, less tenured, and have higher turnover.

Table 2

Multinomial logit (1-4)								**Logit (0-1)**	
Number of obs	270							Number of obs	270
LR Chi2sq (69)	445.84							LR Chi2sq (23)	246.31
Prob> Chi2sq	0							Prob> Chi2sq	0
Psuedo R2	0.7794							Psuedo R2	0.688
Log likelihood	-63.10505							Log likelihood	-55.85
Omitted Local	----------		**Multinomial**		----------	-----		**Logit**	
*>.1 **>.05 ***>.01	**Wireless**		**Cable TV**		**ISP**			**Local**	
Company Laptop	7.3532	***	-0.9246		-2.9824			1.1541	
Computer Use on Job	-4.1392	**	-4.0127	*	0.8199			0.3867	
Company Cellphone	-0.0278		5.8023	***	0.6527			-1.5742	*
Percent Network Digital	-2.7553	*	3.0116		-2.5576			0.7446	
Number of Services	-0.2121		-1.8355	***	-0.4820	**		0.7115	***
Ln(Average Annual Pay)	-4.5040	*	-5.6465	**	-3.5390			3.5800	**
Percent Pay Variable	2.7948		2.3185		2.0858			-1.3466	
Electronic Monitoring	1.1821		5.0386	**	2.6101	*		-1.5717	**
Employee Particpation	-8.8570	***	-6.1703	***	-0.3550			2.1468	***
Self Directed Teams	4.3904	***	-0.2606		1.2243			-0.9805	
Weeks Qualifying Training	-0.0490	***	-0.0029		-0.0176	*		0.0067	
Education	1.8509	***	0.2461		1.2108	***		-1.0403	***
Unionization	-5.6654	***	-1.2714		-50.1684	***		1.7889	**
Employee with less 1 year	-1.9092		-10.2340	**	-0.7465			0.8418	
Employees with less 10 years	6.3252	**	3.6435		3.0404	**		-2.4799	***
Employees to retire in 5 years	-4.4375		-37.9658	***	-14.0368			7.0456	**
Week Work Hours	0.4090	***	-0.1490		0.1263			-0.1340	**
Layoff Percent	2.3204	*	-5.4129		1.2333			0.2834	
Annual Turnover	-7.2421		14.2439	***	5.9985	**		-4.1639	**
Temporary Employees	-12.6021		20.1193		-24.9585			-5.0344	
Contract Workers	-25.5608	**	1.9088		-0.5488			0.0669	
Core Size	-0.0001		-0.0036		-0.0109			0.0037	
Year 2003	0.5030		2.6950	*	1.7873			-1.6095	**
Constant	5.0372		65.5701	**	15.2995			-20.4388	*

Significant at * .5 ** .01 *** .001

A simple logit is used to display the wire line estimates. The wire line network offered more service options. The technicians earn higher pay. They experience significantly greater electronic monitoring and more formal opportunities to participate in workplace task forces. All else equal, they have less formal education and have the greatest proportion of workers approaching retirement in the next five years; they also have the lowest turnover, and the highest rate of unionization.

Before reaching any conclusions about network employment systems, we will examine how much of the dispersion in employment practices is explained at the network level to investigate whether the patterns of network employment practices are sufficiently cohesive and interdependent to

be called an employment system and whether the variation in employment practices has been increasing or decreasing. The period between 1998 and 2003 was an episode of considerable turbulence in telecommunications, a time of considerable restructuring of firms, networks, and workplaces, where we might expect to see significant changes in practices.

Table 3 Gini Coefficients of Establishment Employment Practices by Network 1998 and 2003

Network Gini Coefficients	1998	2003	Difference	1998	2003	Diff 03-98	1998	2003	Diff 03-98	1998	2003	Diff 03-98	1998	2003	Diff 03-98
	Overall	Overall	Gini 03-98	Wireless	Wireless	Wireless	Cable TV	Cable TV	Cable TV	Local	Local	Local	ISP	ISP	ISP
Technology & Services															
Network Percent Digital	0.465	0.385	**(0.080)**	0.4195	0.2569	(0.1626)	0.4236	0.1512	(0.2724)	0.4578	0.4283	(0.0296)	0.5403	0.2330	(0.3073)
Number of Services	0.261	0.272	**0.011**	0.1879	0.2288	0.0409	0.3847	0.3956	0.0109	0.2521	0.2120	(0.0401)	0.2109	0.2667	0.0558
Company Laptop	0.580	0.580	**(0.000)**	0.4280	0.6767	0.2487	0.6231	0.6474	0.0243	0.5260	0.4943	(0.0317)	0.9008	0.9070	0.0061
Computer Use on Job	0.357	0.374	**0.017**	0.1116	0.1117	0.0001	0.6270	0.6628	0.0358	0.3618	0.2782	(0.0836)	0.0055	0.2223	0.2168
Company Cell Phone	0.665	0.433	**(0.233)**	0.3748	0.6038	0.2290	0.5555	0.1702	(0.3853)	0.6316	0.4816	(0.1500)	0.9462	0.7326	(0.2135)
Compensation			**0.000**												
Ln Average Annual Wage	0.008	0.012	**0.004**	0.0098	0.0179	0.0082	0.0159	0.0151	(0.0008)	0.0062	0.0084	0.0022	0.0116	0.0237	0.0120
Benefits as Percent of Wage	0.357	0.404	**0.047**	0.2283	0.3425	0.1143	0.1787	0.2943	0.1156	0.3601	0.4220	0.0619	0.2540	0.5237	0.2697
Percent Pay Variable	0.780	0.806	**0.026**	0.4661	0.5390	0.0728	0.5902	0.5893	(0.0009)	0.7901	0.8370	0.0469	0.4813	0.7338	0.2526
Work Practices															
Participation in Task Forces	0.569	0.688	**0.119**	0.4322	0.5581	0.1259	0.5594	0.7017	0.1423	0.5097	0.6769	0.1672	0.2571	0.3622	0.1051
Self Directed Teams	0.905	0.895	**(0.010)**	0.8361	0.7384	(0.0976)	0.8204	0.8976	0.0772	0.9393	0.8932	(0.0461)	0.6111	0.5278	(0.0833)
Education & Training															
Education Level	0.042	0.040	**(0.002)**	0.0462	0.0425	(0.0037)	0.0509	0.0322	(0.0187)	0.0292	0.0329	0.0037	0.0527	0.0556	0.0029
Weeks of Qualifying Training	0.464	0.468	**0.004**	0.5729	0.4274	(0.1455)	0.5929	0.4118	(0.1810)	0.4132	0.3873	(0.0259)	0.6023	0.7181	0.1159
Staffing															
Full-Time Permanent Employees	0.001	0.065	**0.064**	0.0000	0.0117	0.0117	0.0026	0.1333	0.1308	0.0003	0.0324	0.0321	0.0056	0.0579	0.0522
Employees with Less 1 year	0.459	0.722	**0.263**	0.4196	0.4143	(0.0053)	0.5230	0.3497	(0.1733)	0.4443	0.7778	0.3335	0.4489	0.5916	0.1428
Employees with Less 10 years	0.398	0.327	**(0.070)**	0.1269	0.1335	0.0066	0.1064	0.1316	0.0252	0.3883	0.3414	(0.0468)	0.3218	0.1621	(0.1598)
Percent Retire in Last 5 years	0.711	0.589	**(0.122)**	0.5496	0.3051	(0.2445)	0.7442	0.9472	0.2030	0.6500	0.4460	(0.2040)	0.8862	0.9158	0.0295
Percent to Retire next 5 years	0.474	0.497	**0.023**	0.4114	0.7261	0.3147	0.5421	0.7202	0.1781	0.3738	0.3750	0.0011	0.8972	0.8208	(0.0764)
Annual Turnover (quits+ fired)	0.591	0.692	**0.100**	0.4679	0.3931	(0.0748)	0.4206	0.4106	(0.0101)	0.5516	0.6010	0.0493	0.6617	0.5958	(0.0659)
Temporary Employees	0.860	0.781	**(0.079)**	0.9677	0.7147	(0.2529)	0.8918	0.4625	(0.4294)	0.8280	0.8354	0.0074	0.8714	0.7895	(0.0819)
Contract Employees	0.867	0.736	**(0.131)**	0.9575	0.7147	(0.2428)	0.8793	0.4807	(0.3986)	0.8535	0.7748	(0.0787)	0.9048	0.7786	(0.1262)
Average Weekly Hours	0.052	0.057	**0.005**	0.0516	0.0236	(0.0280)	0.0330	0.0544	0.0214	0.0519	0.0492	(0.0027)	0.0376	0.0826	0.0449
Layoff Percent	0.840	0.960	**0.119**	1.0000	0.8665	(0.1335)	0.8764	0.9423	0.0659	0.8151	0.9557	0.1406	0.8739	0.7988	(0.0751)
Electonic Monitoring	0.709	0.558	**(0.152)**	0.4915	0.3276	(0.1638)	0.8352	0.7734	(0.0618)	0.7111	0.4875	(0.2236)	0.4768	0.4225	(0.0542)
Office Technicians	0.752	0.782	**0.030**	0.6826	0.4038	(0.2788)	0.9776	0.9418	(0.0357)	0.8063	0.7758	(0.0305)	0.1049	0.2804	0.1754
Exempt Employees	0.935	0.884	**(0.051)**	0.7066	0.9768	0.2702	0.9937	0.9589	(0.0348)	0.9540	0.8632	(0.0908)	0.7983	0.6490	(0.1493)
Unionization	0.180	0.326	**0.146**	0.9213	0.7954	(0.1259)	0.9011	0.9400	0.0389	0.0328	0.0921	0.0594	0.9030	1.0000	0.0970
Average (ABS(.5-Gini)	**0.5109**	**0.5127**	**0.002**	**0.4564**	**0.4366**	(0.0199)	**0.5442**	**0.5083**	(0.0359)	**0.4899**	**0.4831**	(0.0069)	**0.5025**	**0.5097**	0.0071
			0.4%			**-4%**			**-7%**			**-1%**			**1%**

To examine changes in the dispersion of technician employment practices in the overall telecommunications and within each network, Gini coefficients are estimated to standardize the measurement of dispersion for each employment practice. The estimates are reported in Table 3. The average Gini coefficient, which measures employment practice dispersion, grew by 0.4% between 1998 and 2003 within the overall telecommunications industry; a finding that is clearly inconsistent with either the convergence or fragmentation hypotheses. The network average Gini coefficients reveal that employment practice dispersion was growing in the ISP network by 1%, while decreasing in cable TV by 7%, the local exchange network by 1%, and wireless by 4% between 1998 and 2003.

The ISP sector results strongly suggest that the patterns of network employment practices are insufficiently cohesive and interdependent to be called a network employment system in part,

because the variations in employment practices have increased, and the growingly incoherent pattern of practices in 2003. In contrast, both the local exchange carriers and cable TV sectors demonstrate considerable stability and interdependence, while the newer wireless network exhibits less stability as it undergoes a process of consolidation through mergers. Nevertheless, even in the more stable sectors network the majority of employment practice variation is occurring at the operating and workplace levels of these sectors.

Part V: Pulling It Together: Stability within Change or Change within Stability?

The two legacy employment systems, cable television distribution and wire line carriers have retained their essential characteristics and may have strengthened their traditional employment systems through corporate consolidations during and since the survey period. Wire line companies retain the Bell System's employment practices and internal labor market structure for technicians. These carriers remain highly unionized, pay higher wages, experience low turnover, employ mostly full-time permanent employees through retirement, and provide substantial firm specific training to high school graduates; they also encourage employee participation in task forces, while electronically monitoring employees who are making greater use of computers on the job. The system continues to grow productivity at close to 6% per year. Nonetheless, wire line companies have sought to increase staffing flexibility by increasing their utilization of temporary employees and contractors, and have shifted to greater use of performance based pay at the organizational not individual level.

Table 4 Network Employment Systems Summary

Technician Employment Conditions	**Wireless**	**Cable Television**	**Wire line Carriers**	**ISP**
Compensation	Lowest Pay and Benefits	Low Pay	High Wages	Declining Variable Pay
Turnover	Modest Turnover	High Turnover	Low Turnover	High Turnover

Work Organization	Self Directed Teams	Electronic Monitoring	Employee Task Force Participation, Electronic Monitoring	Electronic Monitoring
Education and Training	College or Some College, Little Training	High School	High School, Firm Based Training	Some College
Tenure	Less than 10 Years	Less than 10 Years	More than 10 Years, Retirement	Less than 10 Years
Staffing Practices	Full-Time Permanent Employees, Layoffs	Contractors, Temporary Employees	Full-Time Permanent Employees	Layoffs, Temporary Employees, Contractors
Union	Nonunion	Nonunion	Union	Nonunion
Network		Digital	Most Service Options	
Computers	Laptops, Little Computer Use	Little Computer Use	Computer Use Increasing	Computer Use Declining

Nevertheless, the basic features of the Bell System internal labor market persist. Wire line technicians continue to have employer based career jobs. What has changed is the scope of these internal labor market practices, which as recently as 25 years ago dominated the industry. Career jobs are shrinking, not because of a transformation of the former Bell System's employment practices but as a consequence of wire line's shrinking employment in the telecommunications industry. The newer growing networks have rejected career internal labor markets for technicians without much fear of unionization or technician shortages.

Cable television's low cost high churn technician employment system remains stable. It persists with lower pay, high turnover, high school educated technicians who work side by side with contractors and temporary employees. The companies remain vigilantly anti-union; nevertheless, cable technicians did experience significant improvements in pay and benefits during the survey period. Cable technicians make little use of computers, but work on cable television networks has

undergone the greatest digital conversion. As cable competes directly with wire line in residential markets for voice, high speed Internet, and video, the key question remains whether cable's low current cost or wire line's higher cost and high productivity growth system will prevail.

As the wireless industry consolidates into an oligopoly, lead by Sprint, Verizon, and unionized AT&T, each with a market share over 25%, an employment system for technicians has emerged. All else equal, the surveyed wireless establishments in 2003 offered their technicians the lowest pay and benefits in the telecommunications industry. Nonetheless, they experience modest turnover and rely more heavily on self directed teams than any other network. They also have the most educated technicians, who receive little training and not unsurprisingly, have relatively brief tenure. The companies rely mainly on full-time permanent employees who are mostly nonunion. During the survey period, these companies consolidated their operations and resorted to layoffs. While wireless technicians make little use of computers, some do rely on laptops to perform their jobs. Since the survey was completed, AT&T Wireless was unionized and as the Current Employment Statistics' data reported in Figure 4 reveals, wages have significantly improved in the wireless industry and rival those in wire line.

As our data indicate, the Internet Service Providers' employment practices became increasingly incoherent and unstable in 2003, as they responded to cost pressures and increasingly obsolescent service offerings. They have resorted to substantial layoffs, high turnover, and increasingly reliance on contractors to perform their technical operations in the United States. As access networks deploy digital technology and are capable of providing TCP-IP services to residential and business customer, the role of the Internet Service Provider is becoming an artifact of legacy regulations rather than a unique network service competence. As Internet users become increasingly sophisticated, they are also less dependant on their gateway provider. While still providing the critical gateway to the Internet, ISP's face enormous cost pressures, which has

translated into cutting employment costs through outsourcing offshore, hiring contractors, and resorting to employee layoffs. Even though ISP technicians share common practices, such as being significantly more educated, nonunion, low tenure, and high turnover, it would be hard to characterize an ISP network employment system. Instead, employment conditions are fragmenting as cost pressures rise and a business model with a low cost solution for the US based ISPs has not yet arrived.

The facilities based telecommunications networks, wire line, cable television, and wireless, each have distinct and divergent network level employment systems. Corporate consolidations have reinforced a pattern of institutional divergence, where each network is able to adapt its employment system to the current competitive and technological environment, where multiple systems co-exist and compete (Katz and Darbishire 2000). Nevertheless, while there is overall divergence, there are some convergent employment practice trends as all networks shift to performance based pay, increased electronic monitoring and increased reliance on technicians with a high school education and expanded qualifying training. Network employers also increased flexible and contingent working arrangements including a significant expansion in the proportion of contract workers and temporary employees, meaning a reduction in full-time permanent employees, and higher turnover rates.

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