In market-driven economies, infrastructure deployment determines how users access resources. Flows of electronic information and support for computational activities have been overlaid onto preexisting and vital infrastructure systems such as water, sewage, and electricity. Until wireless computing becomes ubiquitous and reliable, digital communications will continue to depend on combinations of physical and wireless networks. These systems can be analyzed along a spectrum in terms of capacity and dependence. At one end of the spectrum, individuals and communities function “off the grid” by choice or by necessity (in remote locations). At the other end, entrepreneurial, market-driven actors anticipate business needs by enhancing the capacity of existing city telecommunications and electricity grids.

Juxtaposing infrastructure choices at either extremes of the spectrum reveals how telecommunications networks imply design approaches and notions of economy. First, infrastructure directly reflects society’s attitude towards resource management. Second, incremental and wireless solutions generate a more complex context for connecting and disconnecting as spatial barriers dissolve. As we move towards increased wireless
telecommunications infrastructure, clarifying the choices systems and building designers make when delivering access become society-wide dilemmas.

Living “off the grid” is a voluntary situation or a result of being in a remote location. At this end of the spectrum, users must develop innovative ways to generate electricity for computation and connect telecommunications devices to send and receive information. At the opposing end, capacity and reliability are everything. High-capacity telecommunications infrastructure has been integrated in existing office buildings by entrepreneurial developers in Manhattan, one of world’s densest urban regions. In 1995, William Rudin redeveloped the former Drexel Burnham Lambert headquarters at 55 Broad Street in Lower Manhattan. The thirty-story tower was constructed in 1967 and is one of five office buildings owned by the Rudin Family in the financial district. After a prestigious line of tenants, the building fell vacant when Drexel went bankrupt in 1990. For six years, Rudin Management maintained the unoccupied building. Then in June 1995, 55 Broad Street was selected by a joint task force spearheaded by the Alliance for Downtown New York under Carl Weisbrod to become the New York Information Technology Center (NYITC). Twelve months and $45 million later, 55 Broad Street opened its doors to the first high-tech tenants.

By 1997, 80% of the 400,000 square foot building was reported occupied. A strategic leasing schedule was implemented to ensure a diverse mix of tenants including large firms such as IBM and Sun Microsystems and small to mid-size firms. Situated immediately adjacent to Wall Street, the building retained its locational value and gained a reputation as an information technology hot spot. In 1997, the building opened the Global Community Sandbox, an entire floor of leasable presentation space geared towards high-tech events hosted by in-house firms, local firms, and out-of-town firms.

The building survived the dot com bubble and space is still renting between $25 and $29 per square foot (as compared to $14-$20 when the building was first leased in 1995). IBM has moved out of the building but Sun Microsystems has remained. Some new, non-high-tech tenants have been allowed to enter the building to maintain high occupancy levels. According to Rudin leasing official, Gene Baumstein, neckties are back in vogue and social
events have died down. Nonetheless three components continue to drive how the Rudins market the building: technology, flexible office design, and community building.

John Gilbert, Executive Vice President of Rudin Management and 55 Broad’s Chief Technology Officer, praises the building’s high-capacity connections and wide range of service providers. Tenants can “just plug in” to high-speed Internet lines, satellite communications links, and video conferencing space with the telecom firm of their choice. Higher operating costs for office spaces result from these specialized systems but are offset by a tax and utilities relief package awarded under Mayor Giuliani.

Fox & Fowle architects were commissioned to redesign 55 Broad Street as a cross between the corporate Wall Street flavor and the informal camaraderie of Silicon Valley. In 1997, tenant build-outs cost the owners approximately $35 per square foot which is much higher than for generic office buildings. From the outset marketing strategies touted the community building aspect of 55 Broad. A strategic leasing plan was implemented to attract a distinct mix of large and small to medium high-tech firms. Sun Microsystems and IBM did much to attract medium-sized firms. The small and medium firms were also attractive for the large firms in need of more innovative products. IBM’s decision to move to the building was framed entirely as a strategic move on the firm’s part to locate its most creative professionals near the most important new-media start ups in New York City. A west-coast firm located at 55 Broad for its communal aspects, “They (IBM) described the places as a collaborative environment, designed to attract technology companies and create a community to share ideas and network. We’ve always enjoyed the free and easy collaborative spirit in Silicon Valley, and 55 Broad Street tries to recreate some of that spirit.”

High-capacity telecommunications infrastructure is contrasted with off-grid technology in this paper. Some individuals choose to disconnect or develop independent infrastructure. In other cases, remote locations cannot access infrastructure networks. Off-grid does not mean not communicating it simply means developing independent sources of electricity and wireless connections that constitute autonomous systems. These situations usually imply lower capacity computing and more voice communication than broadband transmittal of information.
For several years, a team of researchers headed by Lee Felsentstein and Mark Summer have been developing the Remote IT Village Project in Phon Kham, Laos with assistance from the San Francisco-based Jhai Foundation. The team developed Lao language open source software (called Laonux from Linux). They assembled the necessary hardware to connect a server and several workstations through radio local area network (LAN). Power is generated by pedaling on a bicycle to turn a small generator which charges a car battery. The project encompasses five villages whose LANs will eventually be connected via solar-powered wireless repeater stations.

The project is fraught with base-line problems that require ingenious solutions and very few resources. The villages do not have access to electricity or phones. Weather conditions could not be worse for electronic devices. Hot and humid seasons alternate with floods and dust storms. Back-up parts have to be imported from abroad. Two days before the planned trip to Phon Kham the main server and the backup server were destroyed by an electrical surge. These basic problems require innovative, low-tech solutions that do not depend on any outside source of energy or IT tech-support.

The Phon Kham project was first a community building project and second an IT development initiative. Many families had never communicated with their relatives abroad. One member of the community was dying and he wanted nothing more than to speak with his daughter in Canada before dying. The Jhai Foundation supplemented the Remote Village Program with high-school Internet Learning Centers which would act as support networks and community building centers. And when the computers collapsed, villagers hosted a party for the researchers instead of lamenting the set backs to reinforce how important the project was to them.

Both cases have very particular characteristics that make them useful placeholders for the extremes of on-grid/off-grid infrastructure networks. In the case of 55 Broad Street, the building may resemble a Silicon Valley office park on the inside but it is still located in a classic downtown business area. In fact, the central location was essential in achieving the level of connectivity required by the Rudins. Only urban centers have enough underground
guideways for deploying the amount of fiber optic cable necessary to provide such high
capacity service as Stephen Heyman Director of Commercial Real Estate for Trinity Real
Estate notes, “Any building of reasonable size can get this stuff (fiber-optic cables, robust
telecommunications), but you have to be in the city. If you are out in New Jersey it won’t be as
easy.”

The overlap of existing urban infrastructure such as roads and tunnels with high-speed fiber
optic connections make for more expensive and individually controlled systems that only high
value-added firms can afford. And the financial risks are considerable, which the ongoing
debate between telecommunications firms and real estate developers reconfirms. Telephone
providers are demanding building owners provide equal access to their interior
telecommunications networks. John Gilbert, Rudin Vice President, stressed his opposition to
equalizing the playing field: “We’ve been able to navigate by understanding the needs of
telemark providers and tenants. Why does government want to get between owners and carriers
if there’s no problem?”

The Rudin building attempts to respond and generate market
demand. The Wall Street Journal questioned the rationale for the building in 1996. Some
reports thought the Rudins were ahead of the market and others interpreted the strategy as
build-it-and-they-will-come. Free access to telecommunications infrastructure would
undermine the attempt to market a unique product.

The off-grid case in Laos has very different characteristics from 55 Broad Street. The situation
is clearly anti-urban and much of the discussion stresses independence, autonomy, and rights to
access information which global networks can provide. Technological barriers limit the project
to low-capacity and small-scale computing and communication. The incremental improvement
villagers experience is surely greater than the change companies and corporations located at 55
Broad Street seek.

Both cases rely on the availability of global communications links that make rapid
telecommunications important and connectivity from remote places possible. The Wall Street
location of 55 Broad Street connects the building to the global financial markets. The Jhai
Foundation’s development efforts depend on the ability to channel funds from migrants and
other donors back to Laos. International migration makes digital communication relevant and interesting for the Phon Kham villagers.

The ability to go beyond the normal office building and overcome adverse conditions give both cases a pioneer feeling. The cases also both incorporate elements of the other extreme. On the one hand, 55 Broad Street includes a so-called “hearth room” which is completely disconnected from telecommunications, especially e-mail. On the other hand, the Laotian government is attempting to connect Phon Kham to the national electricity grid as quickly as possible. It seems that hyper-connectivity makes disconnection more valuable and being disconnected heightens the attraction of full-time access.

The two projects also differ from one another in very significant ways. In the case of 55 Broad Street, one of the wealthiest New York developers is sponsoring the deal. Similarly, large firms and powerful corporations populate much of the building. The Remote Village Project relies on very limited funds and large amounts of volunteer input for materials and labor.

The spatial implications of each case also diverge. Enhancing telecommunications at the heart of one of the world’s densest urban centers reinforces existing urban patterns. Wall Street is already considered the core of the world financial markets and locating high-tech firms there confirms outwardly that financial power is wielded from this central location. Phon Kham is aptly placed at the opposite extreme. As a result of the Remote Village Project, Phon Kham is now known to readers of Wired magazine throughout the world.

The divergent spatial configurations are reinforced in crisis situations. After 9/11 direct Verizon customers lost their connections as did firms that depended on other providers who also used Verizon infrastructure. Firms had signed with several providers to ensure redundancy but the systems were vulnerable at several points. Gilbert’s adamant responses about how technology failures should never happen again: “You cannot separate real estate from technology. Property owners have to provide their customers with access to technology. We have to be able to keep in contact with the outside world, regardless of what happens.” Gilbert stressed in the interview with the reporter, “we can never let it happen again.” Lower Manhattan’s rich telecommunications infrastructure was too concentrated in certain zones.
Rudin is now trying to connect the LAN’s of its buildings throughout Manhattan wirelessly. According to the Alliance for Downtown New York, the 10,000 to 30,000 square foot tenants are the most difficult to serve.\textsuperscript{xix}

In the opposing case, remote location and necessity create a type of crisis situation. In this situation, crisis spawns invention and ingenuity rather than destroying a market for infrastructure. For developing countries like Laos, a minimal system represents a significant incremental gain without generating vulnerabilities. Some families choose to live the same way in the United States. In “off-grid” communities, individuals make an explicit choice to be self-reliant. Scott Mainwaring’s research at Intel revealed that many of these individuals had lived through personal crises that led them to develop a more appropriate lifestyle. It is impossible to tell whether everyone would be able to live in such a way. It may be the case that well-functioning collective grids are more sustainable than many individual systems. Without implying any specific recommendations, the cases highlight key design questions that cannot be taken for granted.

The Jhai Foundation initiative and 55 Broad Street are examples at opposing ends of the telecommunications infrastructure spectrum and still they share a significant number of characteristics. In both cases, moral prerogatives play an important role in the project’s agenda. John Gilbert of Rudin believes that the future for cities and real estate development lies in controlling and parsing out information infrastructure. While these superior systems are associated with financial gain an additional community building aspect can be traced through all his interviews. In the case of Laos, the entire project has development objects as programmer Anousak Soupavanh says, “I also passionately believe that the benefits of information technology must be widely and freely available to the Lao masses.”\textsuperscript{xx}

Understanding the spatial implications of telecommunications infrastructure begins to unravel the key difference between the two cases, namely the fundamentally different approach to deploying and accessing scarce resources. 55 Broad Street falls in the period when telecommunications firms were laying miles of fiber optic cables throughout the largest urban centers in the United States. Townsend describes how these “fiber barons” reinforced existing urban locations and misunderstood the implications of connectivity. He argues that “irrational
exuberance” led to a poor distribution of telecommunications infrastructure and “finds that poor planning and too much competition resulted in a highly uneven geographical distribution of digital network infrastructure that is likely to persist for many years.”xxi Following the dotcom crash, the ailing telecom industry will take a long time to fill in the gaps in the infrastructure.

In Laos, the deployment of infrastructure relies on what Ernst Schumacher termed “intermediate technology” in Small is Beautiful (1973). Instead of suggesting advanced, complicated systems, intermediate technologies provide enough capacity without displacing people and destroying communities. Schumacher suggests technology that is “vastly superior to the primitive technology of bygone ages but at the same time much simpler, cheaper, and freer than the super-technology of the rich. One can also call it self-help technology, or democratic or people’s technology – a technology to which everybody can gain admittance and which is not reserved to those already rich and powerful.”xxii

In the cases discussed here, wireless technology plays an essential role for the “off-grid” scenario while high-capacity telecommunications still depend on physical wires. Asked about Rudin’s future telecommunications strategy, leasing official Gene Baumstein discussed the importance of enabling wireless access throughout the firms’ buildings. As high-capacity connections and minimal capacity connections assimilate the same technology designers will make decisions as to how these technologies evolve. The line between off-grid and on-grid will become blurry and yet some citizens will continue to be disconnected or choose to be independent.

Making hard choices about open access, infrastructure design, and even-handed deployment will result from socio-cultural choices driven by markets for scarce resources. It is in designers’ and in society’s interest to understand these choices and ensure that robust systems are developed that can enhance a collective future of mutually in/dependent actors.

These actors become simultaneously dependent and independent when wireless connections slowly replace fiber-optic systems. In this world, each wireless device acts as a mini-relay station for short signals. Actors pass on the communications indiscriminately or choose to
This trend resembles a bottom-up form of infrastructure deployment that completely blurs the boundaries between off-grid and on-grid. Designers need to be aware of these trends and develop approaches to building design and infrastructure systems design that conserve resources and enhance overall infrastructure networks rather than giving preference to isolated nodes within these networks.

Endnotes

i Environmental planners continue to debate how telecommunications impact city infrastructure: “Competing ideas about the environmental role of telecommunications are largely based on differing conceptions of the type and direction of the linkages between “electronic” and “physical” flows and spaces within cities.” Marvin in Hack, Gary and Roger Simmonds, eds. Global City Regions: Their Emerging Forms (London: Spon Press, 2000), p.244.

ii In this paper, building designers and IT systems designers are often referred to interchangeably as designers meaning those individuals who determine the level and type of access provided.

iii William Rudin now runs the company of the legendary New York real estate dynasty. The company owns 22 apartment buildings and 16 office buildings (10 million square feet).


v The new tenants are of a different stroke than the Drexel executives. The new employees do not wear neckties but “flannel shirts” and sport “piercings of various types.” http://www.poly.edu/ite/55broad/begin.htm When the building first opened the type of tenant situation was described as: “Your company is a two-year-old electronic publishing firm, which builds and hosts Web sites for financial service organizations. You have been operating out of a 2000 square-foot loft on West 25th Street, in a space occupied by a sewing-machine repair service until you moved in a year ago. Now, the space isn’t big enough to house your staff of twelve and all your equipment, and you have had several problems recently with power fluctuations.”


viii Phone interview with Gene Baumstein of Rudin Management conducted 5 December 2003.

ix 55 Broad Street Technology Pages, http://www.55broadst.com/technology/

x Proposed in 1994 by Mayor and signed by Governor Pataki in October 1995.


Reporter from *Wall Street Journal*, 13 December 1996, “..how much of Rudin’s idea was just wire and fiber, and how much would it define a new market for building space with technology.”


David Reed’s research at the MIT Media Lab makes the case for these kinds of scenarios.

References

General


55 Broad Street


Remote IT Village Project


Jhai Foundation, http://www.jhai.org/