

Networking for Sustainability

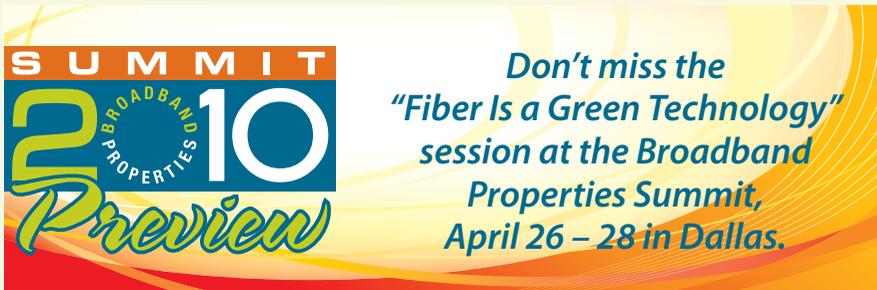
Telecommunications networks have a critical role to play in helping to meet the world's goals for controlling greenhouse gas emissions.

The following is an excerpt from "Networking for Sustainability: The Network Offset Effect," published by AT&T Business Solutions in December 2009. The full white paper, including detailed documentation, is available at www.att.com/Common/about_us/files/pdf/AT&T_SustainabilityWhitePaper.pdf

As the world transitions to a low-carbon economy, the search for viable solutions to control greenhouse gas (GHG) emissions and reduce the carbon footprint of industries, businesses and individual consumers has risen to the top of the global public policy and business agenda.

Rapid advances in information and communications technology (ICT) hold enormous potential for the future by enabling smart networks that can deliver environmental savings both quickly and cost effectively. Some of the best examples come from the simple fact that the energy required for communication (moving photons) is much less than the energy required to physically move people and things (moving atoms).

To lower carbon dioxide equivalent (CO₂e) emissions, it is necessary to change how we produce and consume energy. Changing production is a slow route, but changing consumption can be faster and is often less expensive. For business, some of the lowest-hanging fruit is paying attention to what is moved around the planet. Moving in-



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formation through fiber, wires and air-waves is much less energy-intensive than moving people to permit the exchange of information. For example, moving work to people, as is the case for telecommuting and videoconferencing, can be much more efficient than moving people to work, particularly when long distances are involved or when groups are brought together from multiple locations to attend meetings.

Equally important is the role of smart networks in providing faster access to better information, which enables smarter decisions to be made regarding the use of resources in general and energy more specifically. Remote sensors that support smart-grid solutions, for example, will be critical in enabling more efficient electricity distribution and consumption. Likewise, products that once consumed significant amounts of energy for manufacturing, packaging, transport and storage are being dematerialized for distribution and consumption over smart networks, avoiding the need to create physical product entirely, rang-

ing from music downloads to e-books, magazines, newspapers and movies.

According to Global eSustainability Initiative (GeSI) estimates, ICT has the potential to enable CO₂e emission reductions five times larger than the CO₂e emissions generated by ICT use. And while the ICT industry has long recognized the value of its products and services in delivering increased energy efficiency and productivity gains, it has only just begun to develop the tools and methodologies needed to track and verify those gains in terms of CO₂e emission reduction to help customers make smarter sustainability choices and investments and better prepare them for any future carbon offset, cap and trade or regulatory scenarios.

HOW COLLABORATIVE NETWORKS AND SUSTAINABILITY CREATE VALUE

In 1993, network pioneer Robert Metcalfe described the "network effect" to explain how the addition of each new user or device on a communications network resulted in an exponential increase in its value. Widely referred to as "Metcalfe's Law," the network effect has evolved through subsequent iterations and interpretations to demonstrate how various measures of value on a communications network can grow at a rate faster than the linear growth in the number of users or devices connected.

Because changing consumption can be faster and less expensive than changing production, businesses can reduce their carbon footprints by moving information rather than people.

This white paper introduces the network offset effect for carbon mitigation to describe a similar positive outcome in sustainability value creation that can be both additive and cumulative from collaborative networks that have the ability to eliminate, reduce or simply make more efficient high-carbon activities, processes, connections or transactions that can be automated, virtualized or replaced with low-carbon alternatives that use the networks of ICT providers.

THE NETWORK EFFECT IN SMART WORKPLACES

According to GeSI, by allowing employees to work from the most optimal location and meet virtually, rather than in person, businesses could reduce total U.S. CO₂e emissions attributed to air and road travel by an estimated 5–9 percent. In addition, travel substitution could save

U.S. business \$20 billion to \$40 billion in reduced fuel consumption.

In fact, a recent independent study of telecommuting found that while 40 percent of U.S. workers have jobs that would allow them to telecommute, less than 4 percent actually work from home. The study further noted that 40 percent of the workforce, representing 33 million Americans, could collectively reduce GHG emissions by up to 107 million tons a year and save almost \$43 billion of gasoline each year.

The Economist Intelligence Unit survey on workplace sustainability initiatives around the world found that 43 percent of respondents surveyed cited increased use of virtual meetings as their biggest contribution thus far in reducing their carbon footprint. According to a recent American Consumer Institute study, if videoconferencing were to be substituted

for just 10 percent of business air travel in the U.S., carbon emissions would be reduced by some 35 million tons annually, which is the equivalent annual energy savings required to provide electricity to more than 4.1 million homes. And globally, the World Wildlife Fund (WWF) estimates that telecommuting and virtual meetings could eliminate 1 billion tons of workplace emissions annually by the year 2030.

While many organizations have partially established the infrastructure needed to support telecommuting, including migrating enterprise applications and administrative functions to remotely accessible interfaces, a more thorough approach would take into consideration the full complement of enterprise and home office resource, application and access requirements along with the necessary data, voice and tech-

THE CASE FOR TELEPRESENCE IN ADVERTISING

The last thing DDB advertising agency CEO Tim Rodgers wanted to worry about when preparing a new “Stretch” creative campaign to support AT&T’s business-to-business marketing was having to sell his agency on presenting its new creative concepts over a video teleconference call.

Finding it difficult to clear everyone’s calendar to schedule an in-person meeting, Bill Archer, AT&T Business Solutions’ chief marketing officer, suggested the DDB creative team, based out of Chicago and St. Louis, forgo a February visit to Bedminster, N.J., and instead conduct the meeting via the AT&T Telepresence Solution.

“Initially, I was dead set against it,” said Rodgers. “In our business, we feel that it is a sign of respect to go visit someone and show them the work in person. And this being a creative business, we feel that if we can charm our clients with our mystical magic, it will make all the difference in whether they become true believers in the advertising.”

Reacting to that first telepresence meeting, Rodgers remarked, “Telepresence worked great and the meeting went way better than we could have possibly hoped. The amount of extra time we gained to work on the campaign, not to mention the good night’s sleep we enjoyed by not traveling, clearly resulted in a better meeting all around.”

However, making matters more difficult for DDB, the “Stretch” campaign also needed to be segmented to specifically address the needs of multiple divisions within AT&T’s business marketing organization that had previously used their own, separate campaigns. This meant DDB also had to sell its advertising creative to and receive the buy-in and approval of a much broader group of marketers.

“Different parts of the organization also needed to believe in the campaign, so the challenge was to convince everyone

to agree from the start that this was the right way to go,” said Rodgers. “It was critical to get in front of these different clients and have them feel like they were part of the idea instead of ‘Here it is, hope you like it.’ And, since they’re in different locations, we would’ve had to take our show on the road, which simply wouldn’t have been feasible given budget, calendar and time constraints.”

The initial telepresence meeting, which linked together the DDB account team in Chicago with its AT&T counterparts in Bedminster and Dallas, was followed by two successive telepresence meetings as the campaign was further developed and presented to a broader number of AT&T marketing clients. All told, the DDB team conducted eight telepresence meetings with its AT&T Business Solutions clients as the marketing program progressed through the summer months. Those eight meetings replaced 52 round-trip airline flights, saving more than \$32,000 in travel costs and reducing CO₂e emissions by an estimated 26.2 metric tons. In the meantime, Rodgers now considers himself a telepresence tele-evangelist who believes the many benefits offered by the technology clearly outweigh the value of face-to-face meetings in many situations.

“Though it’s somewhat counterintuitive, you come to realize that you actually get people more focused using telepresence than in a normal meeting because the technology makes you more self-aware than an in-person meeting,” said Rodgers. “And you can read the room as well as or better than in a live meeting: You become more aware of a fidget, a furrowed brow or even the sneak peek at the BlackBerry. Once we got past the guilt feeling, like we should have been on a plane going to see the client, we couldn’t imagine having had to do it any other way.”

Telecommuting is potentially the most promising opportunity for businesses to capture significant carbon reduction benefits in the near term with relatively minor investments in equipment and infrastructure.

nical services needed to deliver a robust remote access experience. In the meantime, many organizations are examining extending the benefits of telework to their entire organization to support business continuity in the event of a widespread pandemic or other natural or man-made disaster, as well as realizing enhanced productivity gains from extending the work environment.

AT&T TELEPRESENCE SOLUTION

The AT&T Telepresence Solution combines innovative video, audio and interactive elements to create a unique, virtual presence over the network giving users an “in-person experience.” Using telepresence equipment from various vendors, the AT&T Business Exchange, AT&T’s Multi-Protocol Label Switching-enabled global IP Network and virtual private network (VPN) capabilities, and specialized management software, telepresence creates new ways for companies to collaborate and conduct global business internally, across supply chains and across industries. It delivers actual-size images via full, high-definition (HD) video and spatial audio within a specially designed environment, creating the experience of being in the same room with remote participants, whether they are down the street or around the world, while retaining the high level of network security provided by a VPN network.

AT&T uses telepresence in its own business to conduct meetings and to improve the ability of employees to work anywhere, anytime. In fact, AT&T conservatively estimates that its own use of AT&T Telepresence Solution, in addition to improving productivity, will allow AT&T to reduce CO₂e emissions by approximately 31,000 metric tons over

the next six years – an amount that is roughly equal to the emissions generated by 5,732 passenger vehicles for a year.

THE ENVIRONMENTAL BENEFITS OF TELECOMMUTING

Given that transportation represents approximately 26 percent of CO₂e emissions worldwide, telecommuting is potentially the most promising opportunity for businesses to capture significant CO₂e reduction benefits in the near term, with a relatively minor investment in technology equipment and infrastructure that is either already in place or is readily accessible for immediate deployment. In addition, the calculations for capturing the initial carbon benefits of eliminating commuting travel miles are relatively straightforward and verifiable. Beyond these technology requirements, of course, successful telecommuting programs also depend on investments in optimizing business processes and harmonizing workplace behavior to overcome potential cultural and managerial barriers.

An AT&T telecommuting survey, based on responses from more than 9,000 full- and part-time employees and their supervisors participating in the company’s telecommuting program, concluded that productivity increases, often dramatically, by enabling employees to perform work away from their central work location. Completed in August 2009, the survey indicated that among telecommuting supervisors, more than 98 percent indicated that telecommuting has had either a positive or a neutral impact on employee productivity. This view was shared by employees themselves, with more than 96 percent indicating that they agree or strongly agree that they are more productive on the days when they telecommute.

The increase in productivity, accord-

ing to survey respondents, is attributed to fewer office interruptions and distractions, less socializing, and less time spent in nonwork-related activities such as commuting to the job or traveling from building to building for meetings. In addition, more than 85 percent of respondents rated telecommuting as either important or very important to their overall job satisfaction.

The AT&T telecommuting program is also delivering significant reductions in CO₂e emissions. The AT&T telecommuter population surveyed avoided 142 million commute miles per year, with annual fuel savings of approximately 7 million gallons and a net reduction in CO₂e emissions of 61,637 metric tons per year. With an average round-trip commute time per employee of 113 minutes, respondents cited “work-life balance” as the number one reason they telecommute. The time that employees would have spent commuting to and from work can be used instead as personal or family time and, as indicated by 96 percent of respondents, also represented time that was given back to the company as additional productive time.

In addition to a telecommuter population that, at this writing, totaled approximately 10,000 employees, the company has enabled 130,000 employees with mobile and remote access technologies that allow them to telework from a variety of locations. AT&T defines telecommuting as a formal work arrangement in which people work from home at least one day each week.

TELECOMMUTING QUALITY OF LIFE BENEFITS

In addition to the body of research attesting to the productivity gains afforded by the many variants of telework and telecommuting, there is also growing recognition for the positive impact on personal productivity and quality-of-life issues that are enhanced by eliminating wasted travel time for comparable types of work and increasing access to work.

What’s more, numerous studies over the years, including a recently released Cisco report based on 2,000 company employees who telecommute, have helped build a strong case for the ancil-

lary benefits of telecommuting, including improvements in job satisfaction, reductions in employee turnover and the intangible benefits of improved work-family balance.

AT&T REMOTE ACCESS SERVICES

Reducing GHG emissions associated with unnecessary workplace travel is aided by remote access solutions that extend the boundaries of fixed workplace environments. To achieve location independence, workers need secure broadband access.

AT&T Remote Access Services provide workers with the flexibility to access corporate information applications on the fly, whether telecommuting, working from home, traveling or perhaps even as extended members of corporate work groups. Providing an experience and performance similar to what they would achieve directly on the corporate network, AT&T Remote Access Services provide users with access to their corporate applications through a single, simple, reliable logon while working remotely from locations throughout most of the world.

AT&T remote access solutions include services such as these:

- AT&T Global Network Client, a VPN client, provides seamless, reliable remote access to enterprise infrastructure and Internet resources.
- AT&T VPN Tunneling Service (AVTS) enables customers to extend reliable remote access and site-to-site capabilities to branch offices and remote workers through dedicated connections to the AT&T Global Network or Internet.
- Laptop Connect provides reliable, easy to use, one-click mobile access via broadband cards to AT&T enterprise infrastructure and Internet applications via the AT&T Global Network Client.
- AT&T Network-Based IP VPN Remote Access Service (ANIRA) provides business customers with a single solution for connecting their personal computers or local area networks remotely to secure corporate resources as well as the public Internet.

THE NETWORK EFFECT WITH SMART DATA CENTERS AND SMART GRIDS

According to a recent data center study released by the U.S. Environmental Protection Agency, by 2020, data centers could surpass the airline industry as a top GHG polluter. The GeSI report estimates that the number of data center servers will grow at a 9 percent annual rate worldwide to reach 122 million in 2020, up from 18 million in 2002, helping grow IT sector emissions at a 5.7 percent compound annual rate, while driving the sector's overall contribution to global CO₂e emissions from 1.3 percent of the world's total today to 2.8 percent by 2020.

Current utilization rates for data center servers, storage and other assets are as low as 6 percent, and facilities utilization rates average less than 60 percent, according to the GeSI report. The key to realizing increased IT and data center efficiency potentially resides with current trends toward the adoption of hosted

services (outsourcing and cloud computing), server and storage virtualization and low-energy cooling as a means to replace less-efficient data centers and application services, deliver business continuity and address demand elasticity.

Virtualization optimizes the use of physical computing and networking hardware through software that improves utilization, reduces cost and saves energy. According to a recent Forrester Research survey, nearly half of U.S. enterprises have implemented some form of server virtualization to address utilization rates and drive efficiencies from a more consolidated server population.

The basic idea behind virtualization is to transfer and consolidate processes into a centralized server or hosted server environment that consists of physical infrastructure that is shared through secure virtual partitioning and that can be run more efficiently than the customer's existing data center. What's more, hosted service environments are often much more likely to incorporate upgraded

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Cloud computing enables businesses to move their processing to data centers that produce lower greenhouse gas emissions.

technology faster than would be the case with a customer-provisioned data center, thereby yielding even greater efficiencies.

While increased efficiencies can be shown to exist in many cases, the critical point in determining environmental impact is the net reduction in carbon emissions rather than energy savings. Depending on the location of the server, carbon dioxide emissions can range from a low of 0.03 pounds CO₂e/kilowatt-hour (kWh) in Idaho to a high of 2.15 pounds CO₂e/kWh in Wyoming with a U.S. average of about 1.34 pounds CO₂e/kWh. Understanding the locations of the servers being taken offline and the hosting servers is critical in determining the carbon emission savings that result.

AT&T SOLUTIONS FOR SMART DATA CENTERS

AT&T helps businesses build and operate their IT infrastructure more efficiently by employing virtualization technology both in AT&T data centers and at customer locations. The AT&T Global Network, which incorporates layered network-based protection, allows customers to bridge these environments together, providing flexibility in where and how to deploy IT capacity to meet evolving business demands.

Hosted solutions let customers tap into AT&T's multitenant service platforms, which provide each customer with a logically partitioned slice of the underlying shared physical assets. Leveraging virtualization and multitenancy, customers can rightsize their consumption of network, processing and storage resources, often with less cost and waste than the previously underutilized, dedicated infrastructure.

In addition to dedicated hosting services, AT&T provides a range of utility- and cloud-based solutions that give businesses greater flexibility, speed and control over their IT infrastructure and allow them to better match capacity

with application demand. These services include the following:

- AT&T Synaptic Hosting is a fully managed, utility-based solution that provides configurable capacity as well as near-real-time bursting to accommodate variable demand or peaks in user traffic.
- AT&T Compute as a Service is a virtualized computing environment that lets customers directly control their IT resources and pay for consumption on an hourly basis.
- AT&T Storage as a Service is an elastic, virtualized data storage that automatically scales up or down to whatever size the customer may need and that is billed based on the amount of storage used.

MANAGED HOSTING SERVICES

AT&T's comprehensive suite of Managed Hosting Services allows customers to tailor their IT configuration and scale across AT&T support teams, operational tool sets, service platforms and data centers.

- Server Management: Many of AT&T's hosted solutions include the latest energy-efficient servers that typically deliver more processing power per watt.
- Server Virtualization allows customers to consolidate physical servers with the potential to reduce their associated power, cooling and space requirements.
- Integrated Client Networking is a utility-based networking solution that includes a full set of advanced network features packaged on a per-port basis.
- Managed Storage provides hosted servers that can connect to partitioned disk resources provisioned on multitenant storage area network and network attached storage platforms.
- Data Backup Services efficiently back up data residing on hosted servers to

common tape and disk platforms as an alternative to using dedicated backup infrastructure.

CO-LOCATION SERVICES

Even customers who deploy and manage their own IT infrastructure within AT&T data centers can realize energy savings when compared with running that same equipment in their own data center. These savings result from the reduced overhead associated with running cooling systems as well as core power infrastructure such as transformers, switch gear, uninterruptible power supplies, power distribution units and other components.

AT&T Internet Data Centers are 28 percent more efficient than the industry average, made possible by best practices in cooling system design, advanced airflow, high-efficiency lighting, data center automation and more. Additionally, AT&T is a contributing member in the Green Grid, a global consortium dedicated to advancing energy efficiency in data centers and business computing ecosystems.

SMART ELECTRIC GRIDS AND SMART BUILDINGS

Bringing two-way smart-grid communications and monitoring capabilities that enable electric utilities to route power in more efficient ways, including remote energy management and control of appliances and other networked devices, support for bidirectional power sharing for new alternative energy sources and, through smart metering, more efficient energy use in residential and commercial buildings.

Second only to deforestation, emissions from power generation globally account for 24 percent of total man-made CO₂e emissions. Losses from transmission and distribution are estimated to account for 8–15 percent of all power generation.

Smart-grid technology, which consists of software and hardware that enable more efficient power transmission, distribution and management, reduces the need for excess capacity, supports real-time, two-way communication and information exchange between suppliers and customers and optimizes supply and

demand through better monitoring and data capture.

The introduction of advanced home meters will allow customers to monitor real-time usage to take advantage of off-peak savings, while suppliers can better manage usage during power spikes and avoid costly service interruptions. Smart grid can also support the integration of renewable power sources. According to the GeSI report, smart-grid technology has the potential to reduce carbon emission by up to 2.03 gigatons by 2020 and cut U.S. electrical power generation sector emissions by as much as 14 percent by 2020, saving \$15 billion to \$35 billion in energy and fuel costs.

AT&T SOLUTIONS FOR SMART ELECTRIC GRIDS AND SMART BUILDINGS

AT&T offers a wide range of smart-grid and strategic mobility products and services to the utility industry, including wireless solutions for field service workers, and a two-way wireless, real-time communications network for monitors, sensors and controllers on the electric grid to improve reliability. A key component in smart grid development is smart metering, which connects residential meters directly with the utility, enabling two-way, machine-to-machine communication. AT&T, utilizing SmartSynch's smart-grid technology, has developed a smart metering solution that connects residential meters over the AT&T wireless network. In addition, smart metering mitigates the need for building or maintaining a separate utility-based communications network.

AT&T helps enable smart grids by providing the same broadband and wireless communication technology used to connect people with their world every day. Smart grids depend on two-way communications between virtually all devices producing, distributing and consuming electricity. AT&T has teamed up with other companies to provide this two-way connectivity:

- Itron OpenWay Solution allows utilities to read electric meters remotely, helping ensure more accurate billing and efficient use of energy.
- SmartSynch Solution, relying on AT&T's wireless network, uses point-

to-point configuration – AT&T provides a direct link from smart meter to utility using a SIM card in every smart meter, just like a cell phone.

- Cooper Power Systems offers fault detectors and capacitor bank monitors certified on the AT&T wireless network to provide near real-time performance measurements and trouble notification to utilities, thus improving the reliability of the electricity distribution grid.

CONCLUSIONS FOR PROMOTING ICT SOLUTIONS

AT&T also identified other emerging opportunities where AT&T's products and solutions can harness the network offset effect for CO₂e reduction aligned with the GeSI findings in the areas of smart data centers and smart electric grids. In both areas, while it was possible to identify substantial energy savings when examining a specific usage case, AT&T concluded more work needs to be done in developing measurement models that take into account differences between facility, application and equipment usage for a given activity or business process that could be applied more uniformly in calculating CO₂e reduction benefits.

Equally important, AT&T realized that any measurement of CO₂e reduction must first be accompanied by accurate baseline data to develop clear and verifiable before-and-after documentation.

To further explore the network offset effect potential for the most strategic products and services that enable travel reduction, AT&T worked with an independent research firm to develop a model for calculating expected CO₂e reductions based on a hypothetical scenario. This included both internal and external usage associated with AT&T Telepresence Solution, AT&T Connect and VPN remote access solutions. While other product areas were initially examined, AT&T determined to conduct a more detailed analysis of teleconferencing and telecommuting applications, which represented the "low-hanging fruit" for early widespread corporate CO₂e reduction and provided the most immediately accessible data for quantification.

Further development of verifiable data across other application areas is planned for the future. However, this area was deemed a critical initial target for demonstrating the potential for environmental impact and significant CO₂e reductions made possible by network-enabled applications and services that limit travel and the movement of people.

While AT&T has also begun to implement baseline data collection for some of its own business processes, including for Internet data centers and hosting facilities, clearly more work needs to be done – at the product, company and industry levels – to create baseline data from real-world customer usage scenarios that can be aggregated, analyzed and applied to document these additional promising areas for CO₂e reduction.

The result would be a set of standard benchmarks that could be applied with confidence along with the tools and methodologies needed to provide the rigorous documentation to deliver verifiable outcomes that customers and their stakeholders demand.

AT&T's commitment to help establish these industry benchmarks starts now. From this point forward, AT&T will endeavor to harness the power of its ICT products and solutions not only to help customers achieve the business efficiencies and velocity they have come to expect from AT&T Business Solutions but also to help them realize their full CO₂e reduction potential as well. As such, AT&T is undertaking efforts to provide customers with tools that will demonstrate the environmental impact of AT&T's products and services – beginning with those that enable travel reduction – and AT&T will be working with others to identify usage scenarios and to better aggregate customer data for further quantification of the CO₂e emission savings enabled by AT&T ICT products and services. **BBP**

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