

SUSTAINABLE FOUNDATIONAL TECHNOLOGIES AND SERVICE PLATFORMS

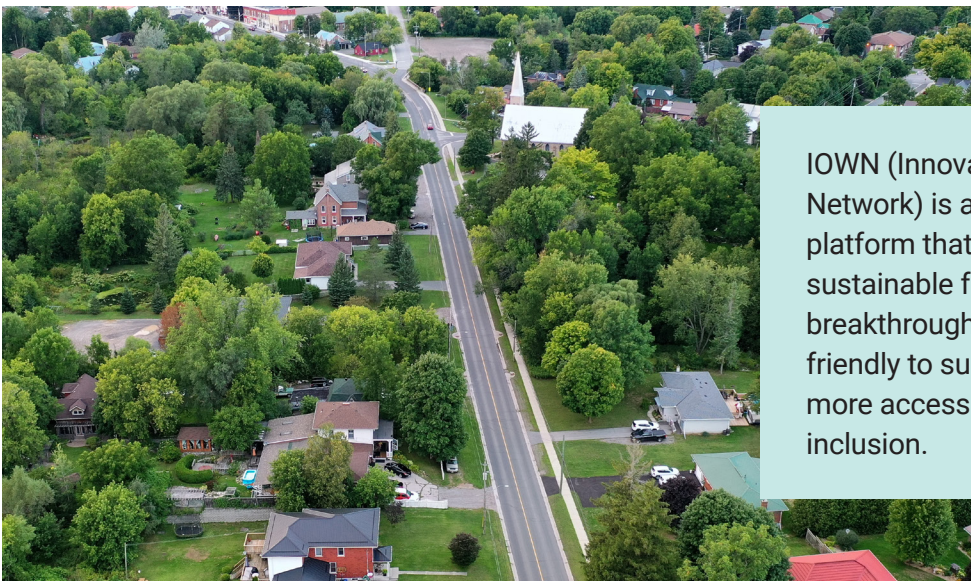


MORE SUSTAINABLE TECHNOLOGIES AND PLATFORMS



NTT and others have continuously enhanced information and communication technology's speed, versatility, scalability and efficiency to improve people's lives and business results.

This constant innovation has driven explosive growth in data traffic and volume and a never-ending need for greater bandwidth and speed on the internet. It will continue to rise, and the demand will exceed the current processing capacity limits. We know that a more robust and efficient information processing infrastructure is required to reduce pressure on the energy grids, networks, and computing platforms. We will need to continually advance innovation to break through current technology limitations to address these demands.



IOWN (Innovative Optical and Wireless Network) is a new communications platform that will pave the way to our more sustainable future while addressing these breakthrough needs. It's environmentally friendly to support sustainable growth and more accessible to promote diversity and inclusion.

[The IOWN vision](#) is about developing a new infrastructure featuring ultra-high capacity, ultra-low latency and ultra-low power consumption. It uses new technologies to utilize data and information beyond the limits of what's in place now.

IOWN will help boost processing power and the computations required for interactions between digital twins and long-term behavior forecasting. This capability leads to highly accurate future predictions and social improvements. A significant amount of research, development and testing is underway to finalize IOWN specifications by 2024 to implement by 2030.

FOUNDATIONAL TECHNOLOGIES FOR A BETTER FUTURE

ALL PHOTONICS NETWORK (APN) - LOW POWER, HIGH-QUALITY, HIGH-CAPACITY

APN incorporates photonics-based technology into everything from networks to devices. It plays a significant role in information transmission, enabling end-to-end communication from the device to the server based on photonics.

It has been impossible to leverage photonics for this purpose in the past. However, today, a photonic crystal structure is possible through a refractive index. Light can be effectively confined to small areas to improve the interaction between light and material.

[APN](#) extends beyond ground-based communications to terrestrial-satellite communications, undersea and space networks, replacing electricity-dependent components. Performance targets include lower power consumption, high quality and capacity, and fewer delays. Research and development teams expect a 100-fold enhancement of energy efficiency and transmission capacity and reduce the end-to-end delay by 1/200.



Electronics have been used in chips that perform calculations on computers. The recent trend toward higher integration means more wiring inside chips generates more heat, limiting performance and adversely affecting. Photonics technology replaces the electronics of microprocessor chips to reduce power consumption and incorporates high-speed arithmetic technology unique to optical technology. Chips can combine photonic and electronic technology.



COGNITIVE FOUNDATION (CF) - INTELLIGENT DATA AND INFORMATION RESPONSE PLATFORM

The CF acts as a multi-orchestrator that quickly provides an overlay solution that responds to needs by optimally controlling various resources such as cloud, networks, devices and applications. It creates an information processing platform capable of analysis and forecasting that is not constrained by each system or data format.

Information and data orchestrated by the CF will form the basis of IOWN. Based on collected data, systems will optimize the network autonomously to plan and execute measures against predictions.

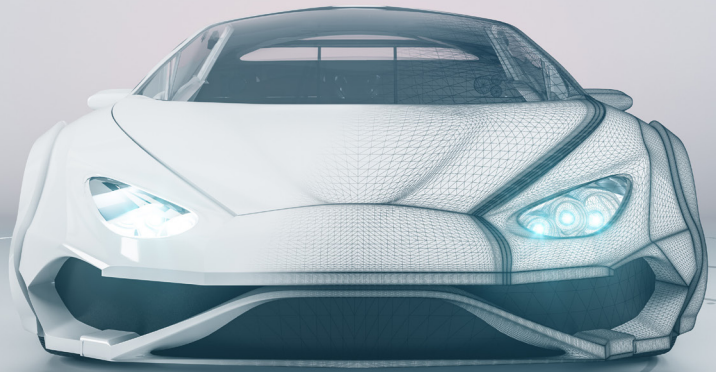
In applications such as the Las Vegas Smart City project, [the CF](#) is used to collect data from various sources and systems using different reactive response and proactive prediction formats. Looking ahead, CF will mature into a self-evolving lifecycle management system that will enable the consolidation of responses to drive action.



DIGITAL TWIN COMPUTING (DTC) - HIGH PRECISION DIGITAL REPRESENTATIONS OF THE REAL WORLD

DTC aims to create previously impossible real-world reproductions to simulate different environments by duplicating, combining and interchanging various digital twins. Digital twins are currently used in many industries to copy and simulate things, processes, and spaces from real to digital.

Until now, digital twin frameworks have entailed real-world mapping objects into cyberspace to perform analysis and predictions with the results used after reversing them back. This new computing paradigm will enable new, large-scale, high-precision reproductions.

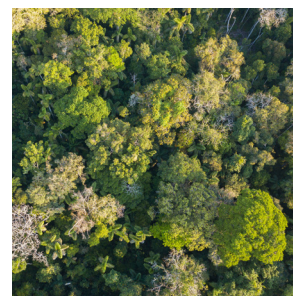


This virtual reality can be created by performing operations that enable simulations in cyberspace that will surpass real-world reproductions. Thinking, decision-making and behavior processes are unique models and contained in DTC to help with future predictions. [DTC](#) will also enable a better urban design that currently is not efficiently or thoroughly done. DTC can create a virtual society with local conditions, including climate built with complex data and information variables. This virtual world can allow a city's optimal infrastructure composition and urban area to be simulated in advance.

IOWN SERVICE PLATFORMS UNLOCK NEW VALUE

Beyond the IOWN foundational technologies, NTT envisions three common service platforms that unlock new and improved ways of learning from data and information. They are data-centric computing infrastructure, direct photonic communication and extreme Network-as-a-Service.

Development of photonics-electronics convergence devices is underway to support these services. Instead of setting up computing infrastructure at the server, this platform creates photonic disaggregated computing. It uses photonics to dynamically connect necessary resources such as CPUs, GPUs and memory in response to demand. These models support IOWN's entire information processing capabilities.



DATA-CENTRIC COMPUTING INFRASTRUCTURE SERVICE

Around the world, governments, organizations, and enterprises are exploring paths to a more human-centric society through the deep integration between the physical and cyber worlds. For example, systems are being developed where information is intertwined across smart cities, collecting and accumulating data for insightful purposes.

We see a future where data is being used for you and not just taken from you. [The data-centric platform](#) shifts the playing field by eliminating the need for massive private platforms that monetize data. It makes it easier to use data to benefit individuals and society without causing more significant harm.

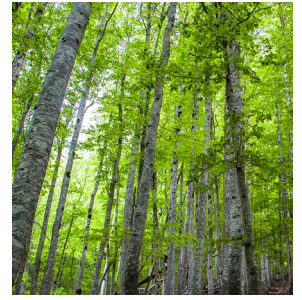


We believe in a fair and neutral infrastructure for all, and this platform will create new value at every level. Enterprises or individuals requiring robust data will have access to an environment that provides high-quality, easy-to-use, safe, and secure data. It gives the ability to conduct AI analysis on data in a standard format and utilize pre-analyzed data on a secure, collaborative and sustainable platform.

This data-centric platform will have three core functions. **1.** A data hub stores and distributes a wide variety of previously complex data to transmit confidentially **2.** An AI platform that makes it easy to analyze, learn, infer and predict. And **3.** Disaggregated computing reduces the power needed to scale up AI computing.



EXTREME NETWORK-AS-A-SERVICE (NAAS)



As the reach of 5G services expands, many companies are developing technologies for the 6G era and beyond, expected around 2030. It's no surprise that we need even faster networks to handle predicted, exponential increases in data volume, as well as the convergences of people, platforms, systems and machines.

Extreme NaaS is a network that improves real-time information exchange and usage, offering high-speed, high-capacity communications to support future services. Wireless networks are currently optimized for the environment, not the solution or user. Looking ahead, Extreme NaaS connects multiple wireless and fixed communications services effortlessly, both public and private, without awareness or interruption to the user or service.

Implementing [Extreme NaaS](#) requires innovation by service providers, controlling information and accessing networks. The concept of the network service provider will evolve to a 'network service environment' that combines and integrates networks by allocating wireless and fixed access according to what the user requires at that moment.



Extreme NaaS also effectively gathers information from surrounding environments such as cameras, sensors, devices, human behavior, and emotions for precise predictions and added value. Research is underway to explore organic coordination between optical and wireless networks to respond to demands and needs. The goal is to create transmission paths that use every material and physical space.

PHOTONIC DIRECT COMMUNICATIONS

The pandemic fueled rapid social adoption of remote activities, illustrating real-time content delivery gaps. Many organizations look to improve current user experiences and interactions.

These modifications are based on traditional IP networks, and 5G, which have limitations. Photonic Direct Communications is a real-time multipoint connection technology delivered across various bandwidths without user intervention and based on an all- photonics network (APN). It creates exact, multi-location casting enabled services with high reliability and scalable capacity on function-specific networks.

[Photonic Direct Communication](#) will be realized by fully utilizing the APN technology underlying IOWN. For example, the ability for people in different locations to communicate with each other as if they were in the same place will forever change the way sports and entertainment are conducted. It will also free us from constraints on where we live and the location and size of venues.

As people begin to communicate without awareness of technology or their distance from others, we will connect naturally with people worldwide.



INNOVATION FOR A SUSTAINABLE FUTURE

MOVING TOWARD A BETTER US

NTT believes in resolving social issues through our business operations by applying technology for good. We help clients accelerate growth and innovate for current and new business models.

Our services include digital business consulting, technology and managed services for cybersecurity, applications, workplace, cloud, data center and networks – all supported by our deep industry expertise and innovation.

As a top 5 global technology and business solutions provider, our diverse teams operate in 80+ countries and regions and deliver services to over 190 of them. We serve over 80% of Fortune Global 100 companies and thousands of other clients and communities around the world.

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