Performance Work Statement  
Public Health National Program Office

Patient Care Services

Department of Veterans Affairs

**Using Innovative Data Tools to Understand, Predict, and Prepare for the Impacts of Climate Change on Veteran Health**

**Section 1: General Information**

**1.1 General:**

The Public Health National Program Office (PHNPO) requires a multi-component solution to identify and create actionable interventions around climate-related health risks to U.S. Veterans. This will include a solution that provides comprehensive climate data, modeling, and forecasting of climate impacts that have been demonstrated to impact health conditions affecting Veterans, and seamlessly integrates this data, including capabilities to synthesize, analyze, and visualize, with Veteran medical record health data in PHNPO’s existing public health surveillance platform, Praedico. This solution will further PHNPO’s work toward achieving the goals outlined in the U.S. Department of Veterans Affairs (VA) Climate Action Plan (CAP).

**1.2 Background:**

1.2.1 Climate change increasingly affects every aspect of human life. Ongoing studies continue to report a close correlation between climate change and human health. It is estimated that global death rates will increase by 73 per 100,000 people by 2100 due to changes in temperature alone. Recent findings suggest that the health impacts of climate change are primarily related to underlying risk factors, such as chronic disease, lifestyle choices, and environmental exposure to other health stressors. Based on limited data, initial prediction scenarios suggest that many prevalent climate change impacts correlate with an increase in negative health outcomes.

Beyond the direct effects on human health, it is also now established that as climate change affects the physical environment, the distribution and prevalence of certain infectious diseases will increase, resulting in increasing healthcare demand. The subject is increasingly attracting the attention of health professionals and climate change scientists, particularly with respect to Lyme disease and other vector-borne human diseases. Latitudinal, altitudinal, seasonal, and interannual associations between climate change and disease, along with historical and experimental evidence, suggest that climate change can affect disease outbreaks and overall human health in nonlinear ways.

The increasing negative effects from climate change could have extraordinary implications for the VA in terms of Veteran health, care delivery, health equity, emergency preparedness and response, and overall VA facility and health care costs. Recent trends in U.S. climate data demonstrate that extreme temperature events (both hot and cold) are becoming more frequent. Environmental factors have the potential to significantly impact healthcare delivery: a 2023 study found that large portions of the U.S. could experience electric grid strains coinciding with periods of extreme heat, leading to large surges in emergency department visits with the potential to overwhelm hospitals’ resources. Extreme temperatures will likely worsen chronic health conditions, such as heart disease, respiratory disease, diabetes, influenza and pneumonia, kidney disease, and septicemia. This could especially harm the many Veterans that are predisposed to poor health outcomes to due to additional underlying risk factors such as chronic medical conditions, poverty, and homelessness.

To fully understand the implications of these changes, more data integration and analysis is needed to correlate climate change and health effects and to project future climate impacts on VHA healthcare delivery. Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*, established a comprehensive government approach to the climate crisis, requiring each government agency to develop a Climate Action Plan (CAP). The 2021 VA CAP outlined five specific climate vulnerabilities, with two directly addressing the public health impacts of climate change, related to a) the increased demand for emergency care and supplies during dangerous natural disasters related to climate change, and b) the adverse human health impacts to Veterans (and VA employees) of climate-related environmental changes, such as heat waves, floods, droughts and other extreme events, leading to direct health effects as well as food-, water- and vector-borne diseases, changes in the quality and safety of air, food, water and stresses to mental health. Fortunately, new tools and resources are now available to provide innovative insights into these issues that will allow for better strategic approaches and strategy development.

Recent advances in artificial intelligence (AI) and machine learning (ML) have accelerated the adoption of algorithmically-enhanced data platforms and services and present an opportunity to gain high-fidelity insights into community-specific risk factors, including social and demographic data at varying geographic scales (national, state, region, neighborhood, and individual), such as wealth, education, physical environment, infrastructure, food, connection, safety, health care access, housing, and various other lifestyle and preference data for most adults across the U.S. These datasets include risk indicators for various disease states and conditions (such as homelessness), and sophisticated predictive algorithms that can be deployed across the data sets to model risk.

New, high-resolution climate models are also available to allow for predictive capabilities at the community and individual levels that can be integrated with Veteran demographic data, creating a first-of-its-kind 360-degree assessment of climate impacts on Veteran populations. When combined with existing Veterans Health Administration (VHA) veteran health data sources, these new analytical approaches could provide the most high-resolution insights ever achieved to understand the complex relationships between climate change and Veteran health. These insights can then be used to inform better healthcare delivery, pandemic preparedness, and allocation of healthcare resources as well as project non-linear growth in VA healthcare costs. These analytics could also shape alerting programs that could notify VHA public health experts before or during impending or developing public health concerns.

**PURPOSE:**

1.2.2 VHA PHNPO’s intent is to leverage the resources described above to innovate an integrated public health surveillance platform and analytics tool combining Veteran medical record data, evidence-based climate data and forecasting, and Veteran demographic data, and conduct a pilot effort to evaluate climate and Veteran health forecast scenarios as follows:

1. Employ the novel data and algorithmic platform, JUPITER, to build on the recent work, *Analysis of Correlation between Climate Change and Human Health Based on a Machine Learning Approach*— to develop high-fidelity community-level climate and health risk profiles for three U.S. counties (at least one rural and one urban/large metropolitan city) using existing VA datasets.

Jupiter Intelligence™ is the global market, science, and technology leader in physical climate analytics for resiliency planning, risk management, and disclosure. Jupiter’s customers include five percent of the world’s largest enterprises, many companies within the Global 2000, the U.S. Department of Defense, and public sector authorities in jurisdictions around the world. Its analytics have been adopted by at least one of the world’s five largest entities in asset management, banking, chemicals, insurance, oil and gas, minerals and mining, electric utilities and construction. Disclosed private sector customers include AstraZeneca, BP, Entergy, Hawaiian Electric, JLL, Liberty Mutual, MS&AD, Nephila and Zurich Insurance. In addition to the DoD, Jupiter’s public-sector work includes FEMA, NASA, NOAA, New York City, the City of Miami, the U.S. Department of Housing and Urban Development, Broward County (Florida), and national security agencies. Jupiter’s partnerships include most of the world’s largest accounting, consulting, engineering and insurance firms, and defense contractors, including Aon, Bain, Boston Consulting Group, Guidehouse (formerly Navigant), MS&AD, and Zurich Insurance. The Jupiter Promise program partners with NGOs to provide climate analytics to improve resilience for the world’s most vulnerable, under-resourced populations. Jupiter’s enterprise-grade, best-in-science solutions—ClimateScore™ Global, and the ClimateScore Planning suite—together form the world’s only global-to-street resolution climate analytics offering. Their foundation, the Jupiter ClimateScore Intelligence Platform, is based on rigorous global climate, weather, ocean, hydrological, and data science, and transparent methodologies.

1. Use historical, longitudinal climate data and metrics derived from the integrated with Veteran medical record data to develop, implement, and evaluate a pilot to determine the empirical relationship between climate change and three highly impactful chronic health conditions (e.g., asthma/emphysema, heart disease, and kidney disease) that are prevalent among Veterans. The pilot will be constructed using the risk profiles developed in Phase 1 and will incorporate anonymized individual medical record-level Veteran health data from the VHA medical record database.
2. Utilizing the empirical relationships developed in Phase 2, use high-resolution climate forecasts based on modeling of three future climate scenarios (SSP1-2.6, SSP2-4.5, and SSP5-8.5) to project climate impacts on the chronic health conditions evaluated in Phase 2. This approach can quantify physical climate risk anywhere in the world down to a 90-m resolution. It employs dozens of the scientific community’s most respected climate models, coupled with machine learning, land use and elevation data, and models for hydrology, wildfire, severe weather, and more. The hazard output parameters include inland flooding, coastal flooding, heat, cold, wind, precipitation, drought, hail, and other severe weather, and wildfire. All climate hazards will incorporate similar components, which fall into two categories: those used to calculate future extreme hazards at a broad level, and those used to downscale those projections to the local level.
3. Use the projections developed in Phase 3 to identify correlations between climate change and specific health conditions affecting Veterans to inform policies and interventions and model potential interventions that VHA could deploy to mitigate the risks identified, including outlining the additional resources that VHA will require to meet the needs of Veterans as demand for healthcare services grow with worsening environmental conditions.

This four-pronged approach seeks to ensure the following: that VHA takes advantage of newly available climate and data technology resources to use longitudinal climate data below the zip code level to develop high-fidelity community risk profiles; that the pilots be conducted in >3 different locations (urban and rural) to ensure learning, cross-pollination, and evaluation of multiple potentially vulnerable Veteran populations; and that the “test and evaluate” approach facilitates an iterative transition to scale and ultimately impacts Veterans’ lives.

VA’s integration of an advanced analytics platform with existing VA and other supplemental data resources would allow for a real-time view of potential climate change-induced risk factors that may exacerbate or cause adverse health outcomes in Veterans.

We plan to develop, integrate, and leverage an advanced analytics platform to inform development, implementation, evaluation, and scaling of a pilot program. To assess the most relevant and high-resolution climate intelligence, we will utilize advanced climate projections that can quantify the risk to populations due to changing environmental conditions across the entire U.S., including noncontiguous states and territories. For example, new ML and AI tools can determine how changes in the climate cause future flooding, extreme heat and cold, high winds, drought, and wildfires at 90-meter resolutions. The model products are determined by employing data from dozens of well-vetted climate models, coupled with land use and elevation data, and models for hydrology, wildfire, and severe weather to analyze trends in future climate scenarios. These outputs can quantify risk due to environmental perils in 5-year increments from 2020 through 2100, for three potential carbon emissions scenarios (SSP1-2.6, SSP2-4.5, and SSP5-8.5).

Over the past few years, organizations have leveraged data-driven insights from advanced analytics to make more informed and effective decisions. As technology has advanced, AI and ML techniques have been used to gain a more comprehensive and nuanced view of community behavior, allowing organizations to predict future trends, tailor healthcare strategies, and measure the effectiveness of their engagement efforts while optimizing resource allocation. Similarly, by pursuing the example activities and developing the outputs described above, the VHA PHNPO can not only better serve Veterans most vulnerable to the impacts of increasingly severe chronic health conditions in the near-term, but can also realize the long-term benefits of yet-untapped AI and ML advances that can enhance understanding of community risks, develop predictive risk modeling, create tailored interventions, and measure engagement impacts. This will also help the PHNPO contribute to the broader community’s understanding of how climate change changes environmental conditions and affects health risk factors for all Americans.

1.2.3 The Climate Action Plan also specifies that, in addition to preparing and deploying enhanced biosurveillance systems and epidemiologic investigations to better understand and address climate-related impacts, another key action required to prepare for the impact of climate change on Veteran health is readiness of critical supply and pharmaceutical stockpiles. The All-Hazards Emergency Cache (AHEC), comprised of Emergency Pharmacy Services (EPS), Office of Emergency Management (OEM), and PHNPO (Lead), provides short-term coverage for the initial 48-72 hours of a large-scale emergency and complements the contents of the U.S. Strategic National Stockpile managed by the Department of Health and Human Services (HHS) Public Health Emergency Medical Countermeasures Enterprise. Increases in temperatures and precipitation extremes are projected to result in extreme weather events, and climate change is also likely to change the epidemiology of certain infectious diseases. Resulting natural disasters, large-scale emergencies, and pandemics will stress local supplies on hand and potentially interrupt supply chain activities. VA relies on these stockpiles to respond to the impact of surges in the demand for supplies and to mitigate impacts of high consequence infections. VA is also prepared to participate in regional disaster planning and response, as part of VA’s “Fourth Mission” activities under the Stafford Act (42 U.S.C. Ch. 68). PHNPO must be prepared to adapt and update AHEC, as needed, to respond to the effects of climate change on disease transmission, and to understand the potential impacts of climate change on the AHEC program itself.

1.3 Period of Performance: Date of award to one (1) year.

1.4 Place of Performance: TBD

1.5 Hours of Operation: TBD

1.6 Type of Contract: TBD

1.7 Invoicing: All invoices from the contractor shall be submitted electronically in accordance with VAAR Clause 852.232-72 Electronic Submission of Payment Requests.

VA’s Electronic Invoice Presentment and Payment System – The FSC uses a third-party contractor, Tungsten, to transition vendors from paper to electronic invoice submission. Please go to this website: <http://www.tungsten-network.com/US/en/veterans-affairs/> to begin submitting electronic invoices, free of charge.

More information on the VA Financial Services Center is available at <http://www.fsc.va.gov/einvoice.asp>.

Vendor e-Invoice Set-Up Information:

Please contact Tungsten at the phone number or email address listed below to begin submitting your electronic invoices to the VA Financial Services Center for payment processing, free of charge. If you have question about the e-invoicing program or Tungsten, please contact the FSC at the phone number or email address listed below:

* Tungsten e-Invoice Setup Information: 1-877-489-6135
* Tungsten e-Invoice email: [VA.Registration@Tungsten-Network.com](mailto:VA.Registration@Tungsten-Network.com)
* FSC e-Invoice Contact Information: 1-877-353-9791
* FSC e-invoice email: [vafsccshd@va.gov](mailto:vafsccshd@va.gov)

**Section 2: Definitions & Acronyms**

2.1 Definitions:

*Contractor*. A supplier or vendor awarded a contract to provide specific supplies or service to the government. The term used in this contract refers to the prime.

*Subcontractor*. One that enters into a contract with a prime contractor. The Government does not have privity of contract with the subcontractor.

*Work Day*. The number of hours per day the Contractor provides services in accordance with the contract.

*Work Week*. Monday through Friday, unless specified otherwise.

2.2 Acronyms:

AHEC All Hazards Emergency Cache

CAP Climate Action Plan

CDC Centers for Disease Control and Prevention

EPS Emergency Pharmacy Services

HHS U.S. Department of Health and Human Services

HIPAA Healthcare Insurance Portability and Accountability Act  
FISMA Federal Information Security Management Act  
NIST National Institute of Standards and Technology

OEM Office of Emergency Management  
OIG Office of the Inspector General

OMB Office of Management and Budget  
PHNPO Public Health National Program Office

SLEP shelf-life expiration program

VA U.S. Department of Veterans Affairs  
VAAR Veterans Affairs Acquisition Regulations

VHA Veterans Health Administration

**Section 3: Government Furnished Property, Equipment, and Services**

3.1 The contractor will be working with VA staff in the performance of the Climate related Public Health activities. The VA staff working on this project includes:

A) Three Physicians

B) Three Epidemiologists

C) Eight Laboratory Personnel

D) Four Program Support Specialists

3.2 GFE – Contract Staff Computers

VA will provide GFE laptops for each contract staff member participating in this project.

**Section 4: Contractor Furnished Items and Services**

4.1 PHNPO conducts disease surveillance and public health response activities within VHA focusing on public health. Public health surveillance includes activities such as detection and tracking progression of disease outbreaks, monitoring disease trends across VA, early warning of bioterrorist, climate-related, and other health-related events, and specialized laboratory testing. Composition of vendor team:

* Must be sufficiently representative of parties involved to ensure expert advice is available or able to be sought and efficient communication is achieved.
* Should be of a size that facilitates effective and appropriate action.

**Section 5: Tasks to be Performed**

The outputs detailed below would support the development and execution of the key activities described above.

The Public Health National Program Office (PHNPO) requires a multi-component solution to identify and create actionable interventions to reduce climate-related health risks to U.S. Veterans. This will include a solution that provides comprehensive climate data, climate modeling and forecasting; incorporates Veteran demogaphic data at the sub-zip code level which have been demonstrated to impact health conditions affecting Veterans and which have the potential to influence climate-related health risks; and seamlessly integrates this data, including capabilities to synthesize, analyze, and visualize, with Veteran medical record health data in PHNPO’s existing public health surveillance platform, Praedico. This solution will continue to further PHNPO work toward achieving the goals outlined in VA Climate Action Plan.

* 1. **. Task 1**
     1. Provide and implement comprehensive data integration management strategy for novel integrated climate and public health surveillance platform and analytics tool, including developing program goals, objectives, deliverables, policies and procedures, timelines, and work plans, as needed, to meet division mission and goals in established time frame. Program planning should also include resource requirements, evaluation plans, and risk management plans.
     2. Establish, track, and report on work plan progress to ensure adherence to schedules and milestones.
     3. Develop a program evaluation plan that assesses solution acceptability, feasibility, and scalability.
     4. Gather information from evaluation assessments, analyze, synthesize, and disseminate insights to PHNPO staff, and/or vendor/subcontractor as appropriate, to help inform decision-making, project improvements, and next steps.
     5. Conduct meetings/listening sessions between staff in PHNPO divisions to understand customer needs and expectations and client responsibilities. Regularly engage with PHNPO staff to ensure updates/improvements are made to data integration strategy, as needed.
     6. After deployment and kickoff, meet with customers to facilitate necessary training, learn from engagement feedback, synthesize on-the-ground information, and cycle back to vendors/subcontractors to assure updates/improvements are made prior to re-deployment.
     7. Coordinate between data integration, program management, and communications staff to ensure data analysis is integrated into the work of each PHNPO division and is communicated to stakeholders.
     8. **Task 1 Deliverables**
        1. Kickoff materials and strategy meeting
        2. Monthly progress reports
        3. Annual progress report
        4. Project plan(s) and design: Climate Change and Veteran Health pilot project
        5. Calendar of key milestones and events
        6. Data workflow report(s)
        7. Stakeholder briefings to review analytics capabilities, models, and potential intervention strategies
        8. Project evaluation plan(s)
        9. Final report(s): Climate Change and Veteran Health pilot project
  2. **Task 2**
     1. Provide access to Jupiter Climate Data Solution, a comprehensive climate database and solution, including Analytics, latest Global Climate Models (GCM), User Interface with Data Visualization.
     2. Climate Platform inputs include: Historical, longitudinal climate data with high-resolution data to evaluate impacts and risks down to the local (zip code) level geographically, from comprehensive, complete, accurate, and updated data sources.
     3. Climate Platform inputs include: Climate metrics to directly measure risk related to flooding, wind, heat/cold, drought and water stress, extreme weather and precipitation events, and wildfire.
     4. Evidence-based, current global climate models, integrated with machine learning, geological data, and weather, including but not limited to:
        1. Global climate models on sea-level rise, increasing temperatures, storm intensification, and altered rain patterns;
        2. Historical data, including re-analysis data, satellite observations, and in-situ observations;
        3. Additional models of hydrology, wildfire, evapotranspiration, tropical cyclones and hurricanes, and other severe weather events (hail, extreme precipitation, heat/drought events); and
        4. Local conditions including elevation, vegetation, and land use.
     5. Flexible time horizons customizable to various risks and intervention periods specified by VHA Public Health office, including projections of risk through at least 2100, in 5-year increments.
     6. Climate data and modeling that are evidence-based, vetted, and validated in the scientific community and supported by the expertise of scientific leaders in climate, earth, and ocean sciences.
     7. Predictive, dynamic climate modeling and forecasting capability using the most up-to-date and comprehensive climate data.
     8. Complex simulation and forecasting capability of future climate hazard risks including across various time horizons, across various geographic regions or localities, and across multiple carbon/climate scenarios (i.e., SSP1-2.6, SSP 2-4.5, and SSP 5-8.5).
     9. Mapping physical climate risk to healthcare delivery impact by climate hazard, region, time frame, or specific healthcare category/type.
     10. User interface/experience customized to VHA/PHNPO project needs including interactive applications or dashboards, on-demand queries or reports, data science tools, and/or APIs.
     11. **Task 2 Deliverables**
         1. Monthly progress reports
         2. Annual progress reports
         3. Release notes, when applicable. Technical documentation of the exemplar algorithm's construction and production. The design of the predictive forecasting model (of, for example, increased prevalence of severe asthma events in Connecticut) will include theory, methodology, feature selection, feature engineering, training parameters and results, validation results, and code employed to accomplish the build of the algorithm. The code for including production scores from this algorithm in the ETL (extraction-transformation-load) processes will also be provided.
  3. **Task 3**
     1. Integration of VA health and demographic data with climate data points; modeling and forecasting with Veteran medical records (health) data within existing PHNPO public health surveillance platform, Praedico.
     2. Collaboration with existing public health surveillance platform developers to support PHNPO in synthesizing and visualizing the combined data on an integrated data and algorithmic platform to gain insights on multiple aspects of climate-related Veteran health impacts. This includes design, development, and deployment of a novel and/or integrated database and algorithm platform, within or in collaboration with Praedico, with optimized user experience/dashboard(s) to:
        1. Visualize the integrative data scores/reports, insights and projections incorporating a) Veteran health data from the VHA database, b) comprehensive climate data elements, and 3) comprehensive social determinants of health data elements, and associated predictive modeling and analytics;
        2. Identify correlations between climate change and specific Veteran health conditions, health risks, and demographics to inform VHA and public health policies and interventions; and
        3. Adapt projections to model impacts of interventions, assess various time horizons, and understand the additional resources that may be required to meet Veterans’ needs due to the negative effects of climate change on Veteran health and healthcare services.
     3. Incorporate client (VHA PHNPO) feedback and program office needs, aligned with VA’s Climate Action Plan and other directives and executive orders, in final platform product.
     4. Ensure data is compatible with existing data exchange with the Centers for Disease Control and Prevention (CDC) and can be used to establish data exchanges with other federal agencies, as applicable.
        1. Update data exchange with CDC with new climate data, as needed.
     5. Ensure data analytics and visualization platforms are in formats that can be used to inform peer-reviewed publications on findings as well as education and training materials on climate and health for providers, Veterans, and other relevant stakeholders.
     6. Assure integration of data while maintaining continuous compliance with VHA data security, HIPAA, Privacy Act, and data sharing laws and best practices.
     7. **Task 3 Deliverables**
        1. Monthly progress reports
        2. Annual progress reports
        3. Technology reports/documentation, including technical/network architectural diagrams
        4. Release notes, when applicable. Technical documentation of the exemplar algorithm’s construction and production. The design of the predictive forecasting model (of, for example, increased prevalence of severe asthma events in Connecticut) will include theory, methodology, feature selection, feature engineering, training parameters and results, validation results, and code employed to accomplish the build of the algorithm. The code for including production scores from this algorithm in the ETL (extraction-transformation-load) processes will also be provided

**Section 6: Security Requirements**

6.1 The Contractor and their personnel shall be subject to the same Federal laws, regulations, standards and VA policies as VA personnel, regarding information and information system security. These include, but are not limited to Federal Information Security Management Act (FISMA), Appendix III of OMB Circular A-130 and guidance and standards, available from the Department of Commerce’s National Institute of Standards and Technology (NIST). This also includes the use of common security configurations available from NIST’s Web site at: <http://checklists.nist.gov>.

6.2 The Contractor shall comply with all applicable requirements as outlined in VA Handbook 6500.6 “Contract Security.” The Contractor and their personnel shall be subject to the Federal laws, regulations, standards, and VA Directives and Handbooks regarding information and information system security as delineated in this contract.

6.3 The Contractor is required to complete and submit the Contractor Security Control Assessment (CSCA), version 1.2, dated 05/15/2009, or the latest version available.

6.4 Privacy Act: The Contractor shall be responsible for safeguarding all confidential information. The Contractor shall keep all information confidential pursuant to, and comply with all provisions of, the Privacy Act of 1974, HIPAA, the Freedom of Information Act, M-1, Part 1, Chapter 9 and other VA regulations.

6.5 Violation of the Privacy Act of 1974 may involve the imposition of criminal penalties. The Contractor shall protect against loss or misuse of all dictated and transcribed documents. The documents described in this solicitation are irreplaceable medication information. The Contractor shall insure the confidentiality of all patient information, and shall be held liable in the event of breach of confidentiality.

6.6 The Contractor shall ensure the confidentiality of all patient and provider information. The Contractor shall not retain information longer than herein required for sensitive or patient identifying data and shall comply with all directives and regulations pertaining to the Privacy Act of 1974, Freedom of Information Act, and VHA Lookback Manual Program Operations Manual. Contractor and all contract employees shall be required to sign confidentiality statements.

6.7 The Contractor shall adhere to the following policies and laws applicable to all services to be provided under this contract. These policies and laws are retrievable via the worldwide web.

1. Healthcare Insurance Portability and Accountability Act of 1996 (HIPPA)
2. Fraud and Related Activity in Connection with Access Devices and Computers, 18 U.S.C. 1029-1030
3. Electronic Communications Privacy Act of 1986, PL 99-508
4. Title 38, U.S.C. 5701, VA Claims Confidentiality Statute
5. Title 38, U.S.C. 5705, Confidentiality of Healthcare Quality Assurance Records
6. Title 38, U.S.C. 7332, Confidentiality of Certain Medical Records

6.8 VHA Business Associate Agreement (BAA): The Contractor shall execute a BAA upon award of the contract.

6.9 The Contractor shall have and maintain a VA-approved site-to-site virtual private network (VPN) connection for remote service.