Executive Summary

> "For the third year in a row, Arizona State University tops the list of *most innovative schools* in the nation, recognizing the university's groundbreaking initiatives, partnerships, programs and research." [US News and World Report, 2018]

Innovation is at the heart of Arizona State University's plans to extend, expand and reinvent the information technologies services to faculty, researchers, students, and staff, as well as to the surrounding community. As a national leader and collaborator with Arizona's other public universities, ASU invites participation in this Integrated Technologies Collaborative (ITC) Request for Proposal (RFP) to design and build new academic initiatives, commercial partnerships, and regional collaborations. Our vision is to advance the adoption of innovative and experimental technologies that enhance the learning experience for students and faculty while enabling researchers to discover new knowledge on a national infrastructure platform at ASU.

ASU's ITC RFP solicits the vendor community to work with us to plan, collaborate, and deliver technology and services that enable and empower our "Smart Campus" and "Cloud First" initiatives. This advanced network will function at the scale of a city and operate as a regional platform intended to accelerate ASU's Universal Learning and fundamental research programs for the next 10 years. We have included ASU's 50 Big Innovations to help frame need and outcomes for this advanced network architecture. We encourage RFP responses that will help ASU establish and support collaborations with Arizona's higher education community, regional cities, science-driven initiatives, and national technology/service providers.

ASU has become one of the globally acknowledged thought leaders for Smart Campus efforts in America. We seek to extend our adoption of emerging, connected technologies at the heart of the Smart Campus as we build a Next Generation Network capable of enabling and supporting the growth of one of the top five smartest campuses in the United States. ASU's overall objective is to improve safety, visibility, sustainability, and the quality of life for our students, faculty, and staff, as well as for the surrounding municipalities, state agencies, tribal communities, and constituents throughout the state of Arizona and beyond.

This ITC RFP offers service providers an unprecedented opportunity to align with the nation's largest and most innovative university, its athletic programs, its local and regional commercial associates, global online leadership, and public sector constituents.

Key objectives of this ITC initiative are as follows:

- Upgrade and expand the ASU's connectivity infrastructure with the goal of creating a system designed for dynamic changes, exponential growth potential, environmental sustainability, visibility, improved public safety, and enhanced learning.
- Position ASU's public and private cloud infrastructure as a single pane of glass for the user community.
- Develop a technology framework that positions ASU to nimbly adopt, implement, and leverage new technologies as they become available.
- Improve campus operational and policy decision-making through data and analytics.

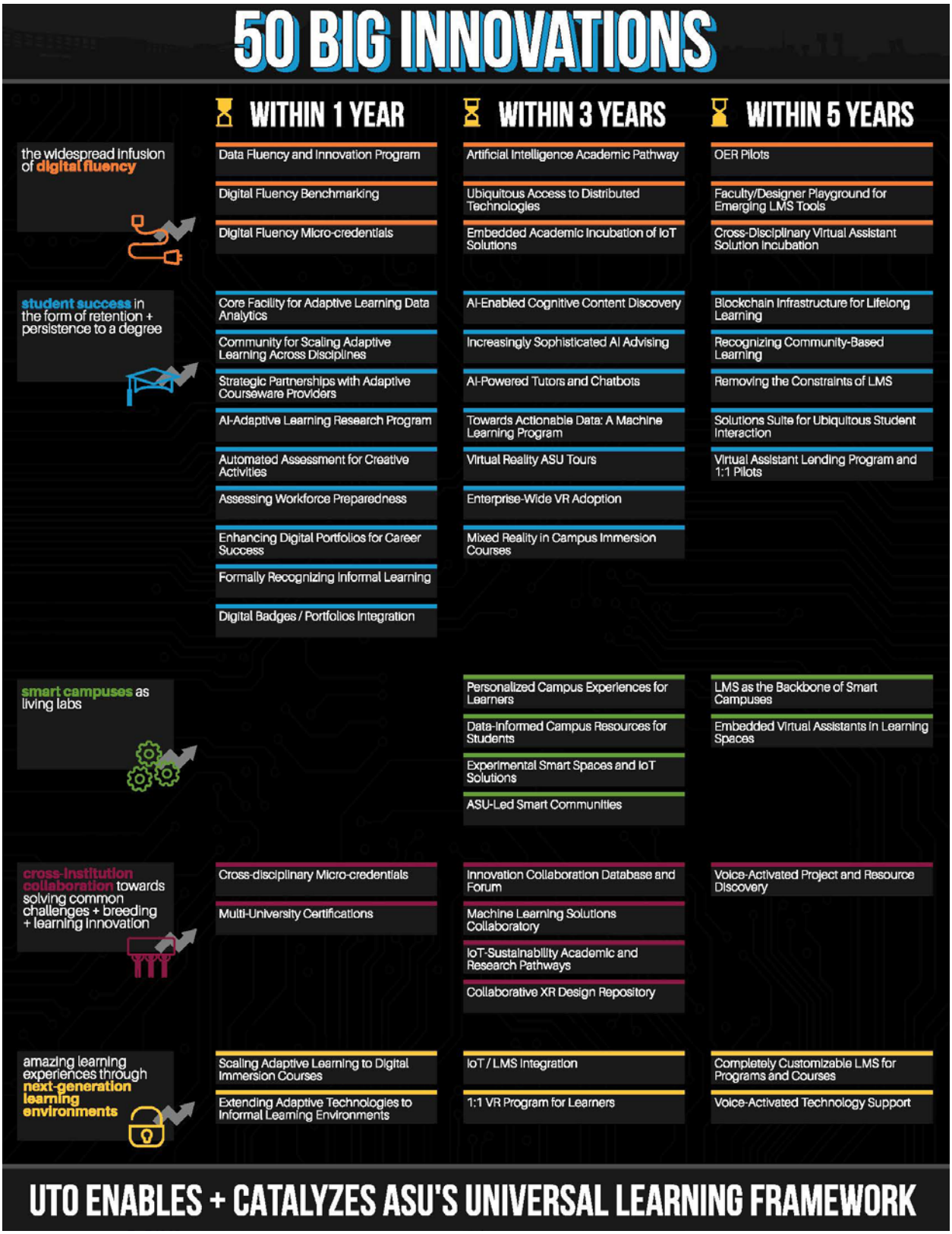
- Increase student, faculty, and staff engagement and access to ASU resources.
- Drive economic development.
- Improve the quality of services to faculty, staff, and students, and the ASU community.
- Improve network capacity for science- and research-driven programs.
- Develop and support new entrepreneurial and research centers to advance cloud computing and advanced mobility/wireless.
- Access new and innovative financial opportunities for ASU and its service providers.
- Advance corporate and social responsibility and sustainability goals

Call to Effect the Vision

This RFP serves as a catalyst for ASU to facilitate and support the next five years of exceptional research, teaching and learning at Arizona State University. Higher education technology offices have long served as integral forces for providing the infrastructure that connects students, faculty, staff, and the community at large. Oversight in providing this framework ensures that all digital interactions are secure and support the institutional mission through smart technology investments. We recognize that the future is uncertain; yet technology offices must cut through the noise to implement decisive strategies based on the needs of their communities, real-world trends, and their own core vision for shaping a more connected, efficient global society.

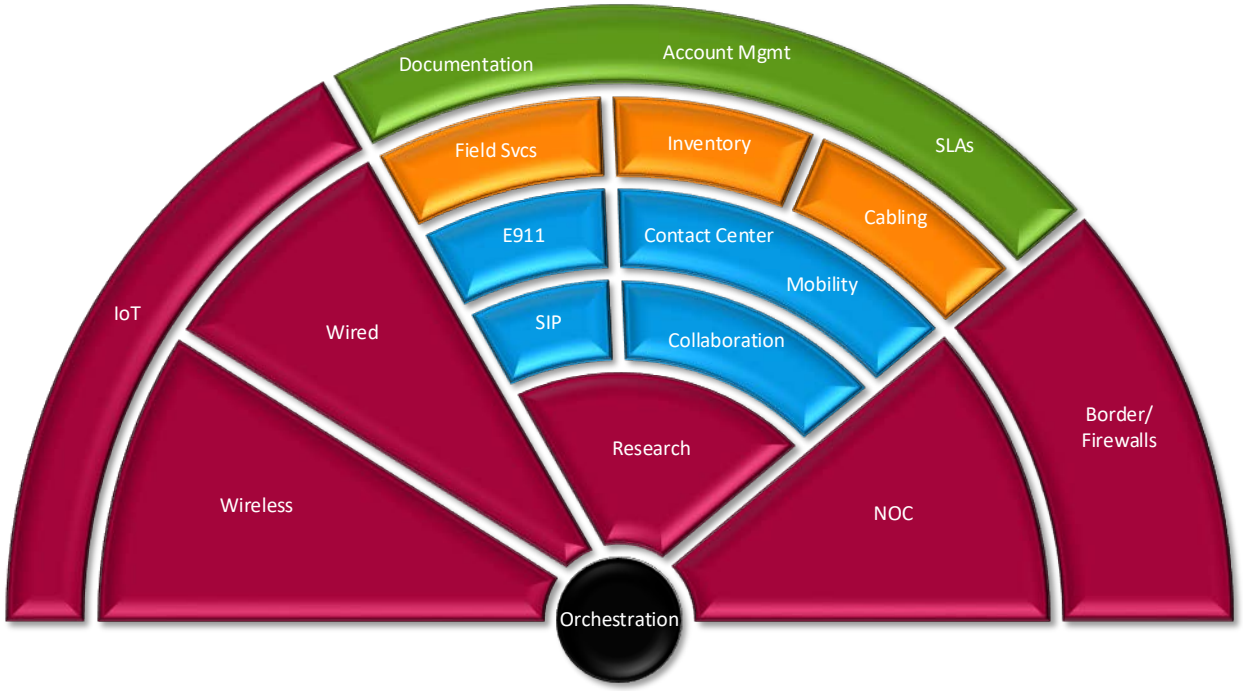
With that in mind, the University Technology Office (UTO) at ASU is on track to accelerate the vision of Universal Learning — an evolving model of higher education that is defined as “capable of being of service to all learners, at all stages of work and learning, from all socioeconomic backgrounds, through educational, training, and skill-building opportunities.” Our Next Generation Network should lay out the pathway to achieve a Universal Learning framework within the next few years.

The UTO is engaged to drive the future of technology services, projects, and collaborations at ASU, as characterized by our vision of 50 Big Innovations (see next page), approached through the lens of bolstering digital fluency, student success, smart campuses, next-generation learning environments, and cross-institution collaboration. These programmatic focus areas, coupled with emerging technologies that support their growth, can be viewed as the concrete entry point to the imminent concept of Universal Learning.


50 BIG INNOVATIONS
WITHIN 1 YEAR
WITHIN 3 YEARS
WITHIN 5 YEARS
the widespread infusion of digital fluency
Data Fluency and Innovation Program
Digital Fluency Benchmarking
Digital Fluency Micro-credentials
Artificial Intelligence Academic Pathway
Ubiquitous Access to Distributed Technologies
Embedded Academic Incubation of IoT Solutions
OER Pilots
Faculty/Designer Playground for Emerging LMS Tools
Cross-Disciplinary Virtual Assistant Solution Incubation
student success in the form of retention + persistence to a degree
Core Facility for Adaptive Learning Data Analytics
Community for Scaling Adaptive Learning Across Disciplines
Strategic Partnerships with Adaptive Courseware Providers
AI-Adaptive Learning Research Program
Automated Assessment for Creative Activities
Assessing Workforce Preparedness
Enhancing Digital Portfolios for Career Success
Formally Recognizing Informal Learning
Digital Badges / Portfolios Integration
AI-Enabled Cognitive Content Discovery
Increasingly Sophisticated AI Advising
AI-Powered Tutors and Chatbots
Towards Actionable Data: A Machine Learning Program
Virtual Reality ASU Tours
Enterprise-Wide VR Adoption
Mixed Reality in Campus Immersion Courses
Blockchain Infrastructure for Lifelong Learning
Recognizing Community-Based Learning
Removing the Constraints of LMS
Solutions Suite for Ubiquitous Student Interaction
Virtual Assistant Lending Program and 1:1 Pilots
smart campuses as living labs
Personalized Campus Experiences for Learners
Data-Informed Campus Resources for Students
Experimental Smart Spaces and IoT Solutions
ASU-Led Smart Communities
LMS as the Backbone of Smart Campuses
Embedded Virtual Assistants in Learning Spaces
cross-institution collaboration towards solving common challenges + breeding + learning innovation
Cross-disciplinary Micro-credentials
Multi-University Certifications
Innovation Collaboration Database and Forum
Machine Learning Solutions Collaboratory
IoT-Sustainability Academic and Research Pathways
Collaborative XR Design Repository
Voice-Activated Project and Resource Discovery
amazing learning experiences through next-generation learning environments
Scaling Adaptive Learning to Digital Immersion Courses
Extending Adaptive Technologies to Informal Learning Environments
IoT / LMS Integration
1:1 VR Program for Learners
Completely Customizable LMS for Programs and Courses
Voice-Activated Technology Support
UTO ENABLES + CATALYZES ASU'S UNIVERSAL LEARNING FRAMEWORK

Overview

The structure of this RFP can be conveyed through the concept of an orchestra. The many sections, services and providers that comprise the entirety of the network must be distinctly effective, best-in-class components and personnel, coordinated and focused on delivering the infrastructure and services that will both drive and enable ASU's mission and vision.



Service providers may respond to this RFP by addressing one or many of the sections of service described herein, and will be expected not only to deliver their own services but also to work in sustained coordination and harmony with other ASU service providers and internal ASU departments – the composition and nature of which will change from time to time – to provide agile and high quality services to ASU resource and program recipients.

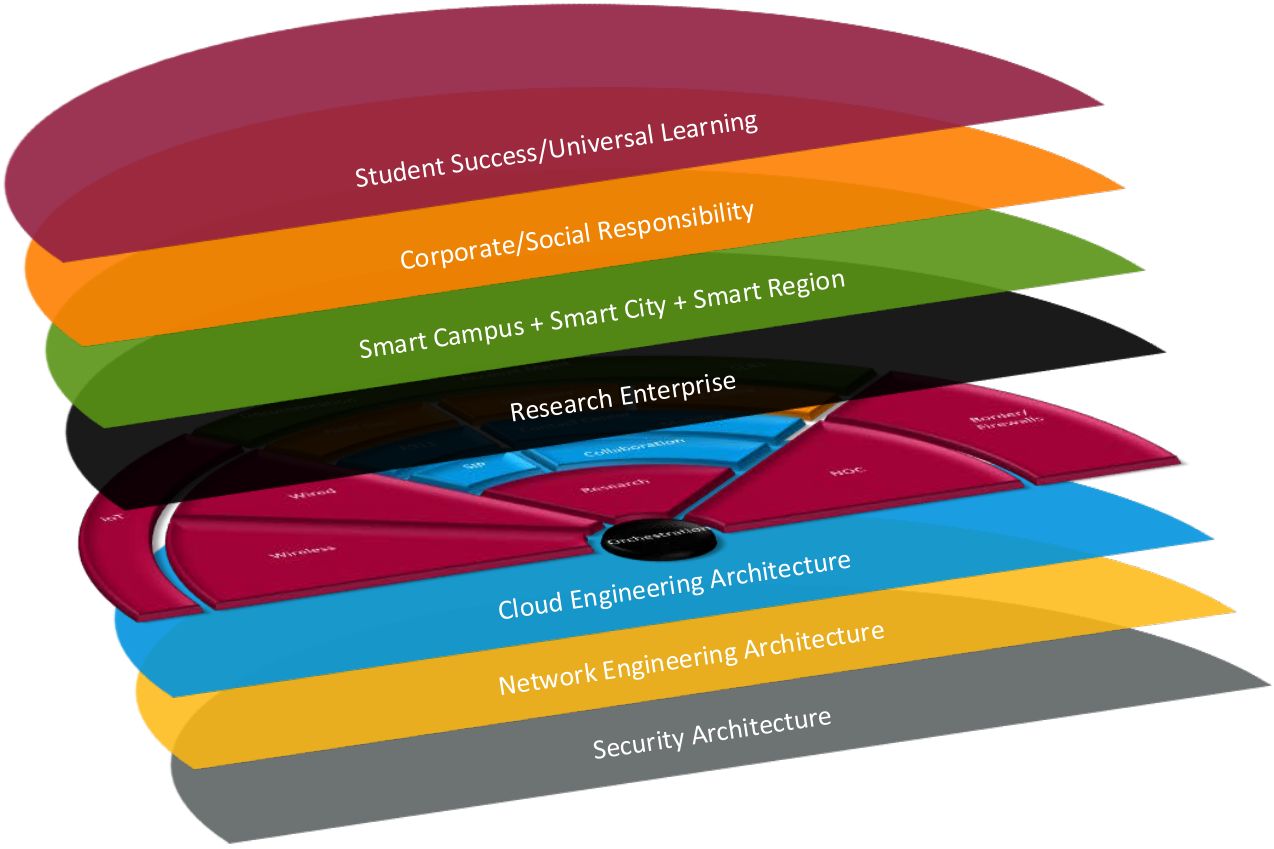
It is likely that no single supplier will be able to effectively provide best-in-class services in every category, so we expect respondents to describe their teaming strategy as well as their core area(s) of expertise as well as how they might align with other solution providers in synchronous delivery to ensure success at every level and across the ASU enterprise.

The provider(s) selected must align to ASU's culture, transact with ASU efficiently and pleasantly, demonstrate competent bench strength in the technologies and services proposed, offer flexibility for business change, show scalability to ASU's size, and readily share performance data and ideas for innovation with ASU to establish a practice of continuous improvement. ASU requires partner provider(s) with demonstrable office for managed partnership integration and capability. Providers

allied with ASU through this process will be advocates for innovation and become trusted advisors to ASU, providing thought leadership and planning activities in addition to providing core services.

Certain elements of design are expected to be incorporated throughout all services, architecture, design principals, strategy, and effort. These strategic elements relate to current and long-term sustainability, continuity, security, and innovation.

ASU will focus projects, services and initiatives across multiple strategic areas of engagement with the supplier and the University community. As we invest in new technologies, service models, and an expanded collaboration with the state and surrounding communities, ASU expects to re-invent its underlying network infrastructure. New and innovative uses of technology in classrooms, labs, research centers, and throughout the enterprise will require new planning and architectural approaches to mobility, cloud services, learning systems, and security for the ASU community. The following diagram illustrates our orientation to advancing the use of technology in areas of service to students and faculty as well as for our need to examine and lead in the adoption of emerging technologies.



Universal Learning Framework

ASU's vision for a Universal Learning Framework is an evolving model of higher education that is "capable of being of service to all learners, at all stages of work and learning, from all socioeconomic backgrounds, through educational, training, and skill-building opportunities."

Please review the attached Universal Learning Framework document to inform your proposals.

- Attachment 1 – Towards Universal Learning: Executive Summary

Corporate and Social Responsibility, and Value Added Services

ASU expects providers to be committed to corporate and social responsibility to effect real, positive change that considers ASU's inclusive, sustainable, and innovative commitments to community. Please provide a summary of any other value added services or programs which may contribute to the overall value of your proposal, including but not limited to:

- Training, internships, ambassador programs, and integration into the labor force
- Industry partnerships
- Support of ASU's charter and goals
- Support of sustainable development, veteran's affairs, initiatives in support of women, wellness, and our changing regional demographics
- Support and enhancement of ASU's reputation as an innovative, foundational model for the New American University
- Commitment to provide significant financial and non-financial support for the University and its signature programs.

Smart Campus + City + Region

ASU essentially functions as a city in itself, while aspiring to be a leader in utilizing technology to enhance the individual and societal well-being of the community it is embedded in. We expect the ITC to demonstrate how emerging technology can advance and enhance the daily work of a data-driven community of researchers, learners, and practitioners. As the epicenter for development of the solutions that comprise our Smart Campus, the ITC will design the strategy and the blueprints that galvanize the surrounding communities and cities to drive a Smart Region. ASU's Next Generation Network will be the backbone that enables this revolution and will encompass and support the emerging technology that allows the device communication, real-time campus infrastructure monitoring, data segregation, security, and network analysis that constitute a successful Smart Campus, City, and Region.

The UTO is already actively investigating, designing, and deploying solutions based on real-time sensor data, telemetry information, video analytics, and network information for the purposes of developing an increased number of actionable insights, improved processes, and increased efficiency. In order to meet our sustainability goals, we need much more real-time and longitudinal data monitoring of campus infrastructure, as well as controls, to include building water metering, leak detection, landscape irrigation, soil moisture monitoring, indoor air quality monitoring, "follow-me" lighting, daylight sensors, smart thermostats in residence halls, disaggregated energy monitoring, traffic monitoring, electric vehicle charging, etc. The advanced network infrastructure needs to provide easy integration of new metering devices and controls, while also providing tight security for the resulting data. Moving beyond

the concept of living laboratory, we seek to become a living example of how to operate a sustainable community. The ITC will continue these efforts to drive innovation across Smart Venues, Smart Resources, Autonomous Vehicles/Transportation Infrastructure, Smart Living/Health, and Smart Construction. We recognize the challenges associated with the collection, management, and distribution of these divergent data streams and are not expecting a *one-size fits all* network solution. Rather, responses should address the challenges facing the next generation network to be an enabler of real-time data solutions across a variety of platform options. These should address but are not limited to, low power wide access networks (LPWAN) for sensor data, wireless video backhaul technologies, location information, cellular networks, edge computing and how to view and manage them through a single pane of glass.

The ITC will not simply provide the support, explicit policy recommendations, and functional administrative requirements, but will also collaborate, architect, galvanize the community, and partner in designing the future of networks and smart solutions. Responses should contemplate scales for campus to city to region as well as migration and integration of legacy and green fields builds. Consideration should be given to research projects such as National Science Foundation (NSF) projects like the Platform for Advanced Wireless Research (PAWR).

Cloud Engineering Architecture

The UTO has adopted a "Cloud First" architectural strategy in the design of our offering of core services to the ASU community of academic researchers, learners, and faculty as well as for the surrounding municipalities, state agencies, tribal communities, and constituents. "Cloud First" is at the heart of our strategy to achieve our Smart Campus, Smart City and Smart Region aspirations.

However, in ASU's complex world, "Cloud First" does not mean "Cloud Only". Our teaming approach across our development and engineering groups as well as our Data Center and Network infrastructure extends to the Cloud, incorporating service offerings of market leading Cloud providers such as Amazon, Microsoft, Google and others. We expect to continue to explore and stage the development of enterprise applications to reinvent student success and Universal Learning at ASU across our existing Data and Network systems as well as those of our Cloud Service providers.

ASU's strategy is to establish the UTO within ASU as a provider of Cloud Services to our constituent community of students, faculty, researchers and staff. The ITC will bring the innovation, design expertise and ability to execute in order to truly deliver a full complement of valuable, stable, secure Cloud Services that leverages the benefits of a comprehensive hybrid Cloud infrastructure whether an individual component solution is deployed on ASU premises or within externally managed Cloud Data Centers. We will apply agile and lean principles in design and engineering solutions, and ensure that the implementation of solutions follow the quality, performance, scalability, and availability requirements of our users.

ASU expects the provider to engage cloud services organizations and companies to contribute significantly to the development and implementation of ASU's next generation reference architecture. ASU and its community use cloud-based services and solutions extensively to advance administrative, academic, and research programs and services. UTO functions as ASU's cloud platform provider in support of account management, systems monitoring, and service definition.

Cloud services and engineering providers are crucial collaborators to informing ASU's reference architecture as services shift and blend towards cloud-oriented solutions. We expect our "Cloud First" approach to discovery and innovation to be incorporated into all other aspects of the ITC. Specifically, we anticipate broader cloud services adoption within ASU and in our collaborations with municipalities, tribal organizations, and so on.

For example, on a case-by-case basis, traffic flows will be reviewed and assessed by the ITC to determine where in the hybrid cloud architecture tools such as firewalls, intrusion prevention, and anti-malware will be deployed. Similar evaluations and architectural decisions will be made based on user and system requirements and capabilities to support ASU's "Cloud First" strategy while ensuring the UTO's ability to deliver effective, secure, scalable, and stable infrastructure, platform, and software services. For the RFP, providers are asked to describe their expertise, capacity, and innovative strategy for the architecture, engineering, deployment and management of comprehensive Cloud Services to enable the ITC to deliver value to our constituents.

Network Engineering Architecture

ASU's advanced new network architecture will be strategically engineered not just to support but to attract and catalyze the adoption, proliferation, and innovation of next-generation technologies that will enable connectedness beyond traditional modeling. ASU is open to proposals for solution-driven designs not necessarily bound to any single manufacturer, brand, or platform. We invite providers to re-invent our campus networks by improving the design and functionality of our core systems while preparing the institution for a series of next generation upgrades such as:

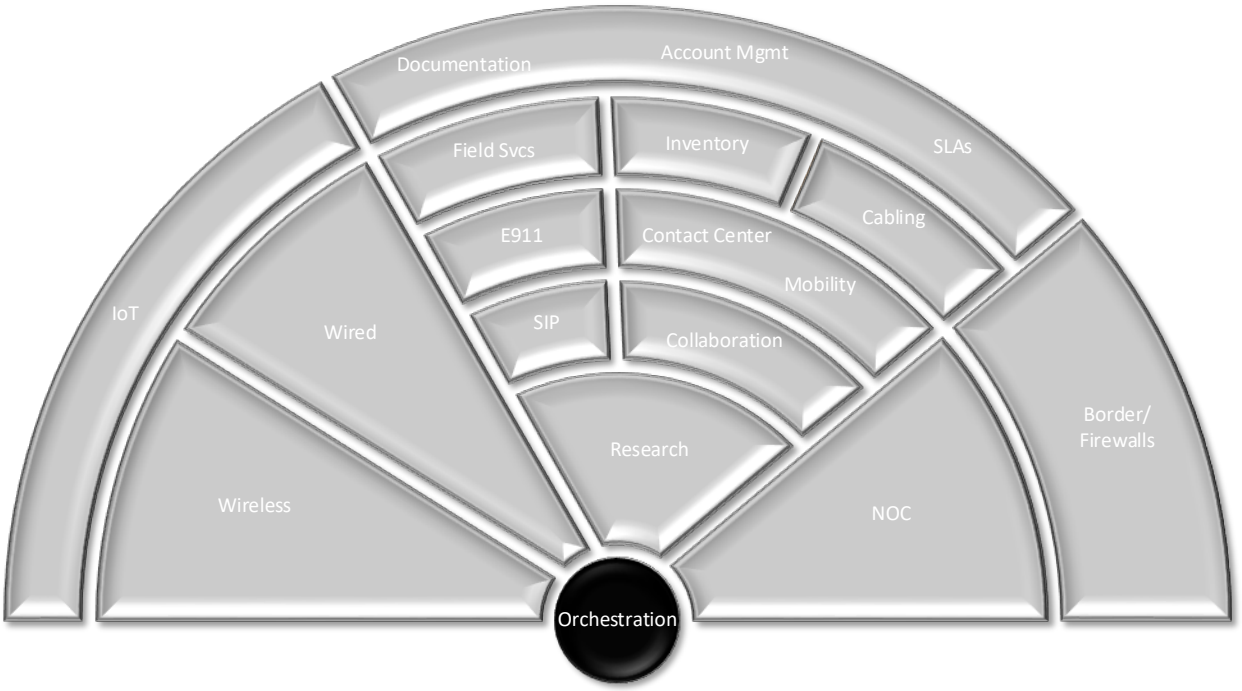
- Introduce new application driven network environments such as software defined networks (SDN) to advance our alignment with researchers and improve network agility in our data centers or clusters;
- Increase core and specialized capacities from 100GE to 400GE and architected to terabit requirements for advanced research activity;
- Increase research network capacities to support large file transfers and exchanges on an off campus.
- Enhance our ability to secure and analyze data en route and at rest;
- Improve network mobility for our students and faculty to learn and work independently across campus and in our community;
- Promote the use of advanced wired and wireless technologies to drive research capacity forward.
- Transition from IPv4 to IPv6;
- To design and engineer wired infrastructure to support a 5G-ready wireless solution;
- To design and engineer wired infrastructure to support hundreds of thousands of instrumented IoT devices.

Security Architecture

Security is of utmost concern to ASU, and must be integrated throughout every section, service, offering, and effort in delivering ITC services. Providers must possess expert level ability to architect complex, cyber secure networks and systems as well as the associated frameworks and methodologies to ensure security for all of ASU's constituents. Beyond minimum compliance, ASU demands proactive, predictive, and aggressive protection of data and environments for all aspects of ASU business.

Please see Section VII – Proposer Qualifications, item #10 and Section XIV of the RFP.

Orchestration



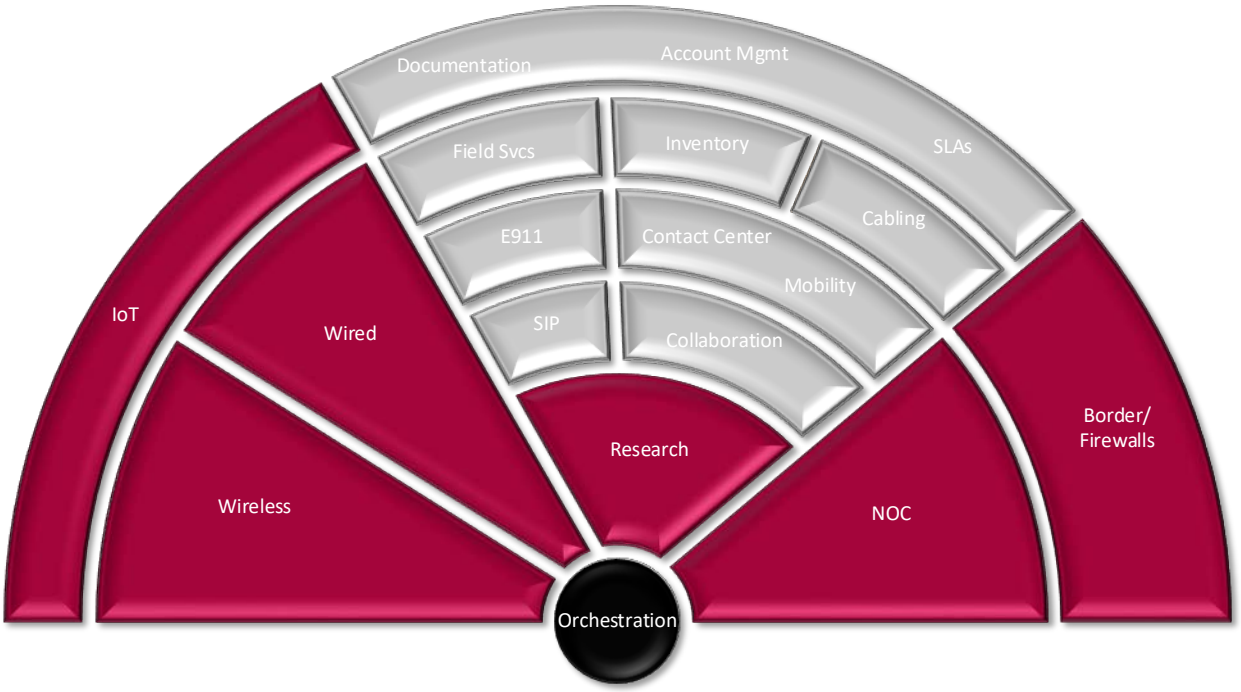
Paramount to the success of this complex endeavor is expert orchestration of all providers, services, efforts, systems, and processes. The entity serving in this role will work in lock step with ASU personnel to provide master synchronization, planning, coordination and communication across the enterprise and at every level. Orchestrator shall:

- Design an integrated solution to manage, operate, and resolve open issues through a defined partnership framework with ASU UTO
- Coordinate all teaming members, including vendors and service providers
- Work with ASU UTO and Procurement to coordinate vendor transactions under ASU policy and guidelines
- Provide a glide path to new architecture as appropriate
- Propose an innovation lab to advance next-generation opportunities associated with the full scope of the ITC, in collaboration with ASU UTO.

The net impact of this RFP will change how the University functions, beyond day-to-day information and data management. Organizational change management, skills transfer and training are key drivers to recognizing the full value of technology investments, as well as a critical piece to the civil service, and in turn to students, faculty and staff. Proposers should outline their strategy for workforce training and skills transfer, including details for each functional element of the program (e.g., data analytics platform, smart lighting, cloud engineering, etc.).

In addition, the ITC RFP, invites responses that demonstrate material interest in partnering to leverage the nation's largest and most innovative university, its athletic program, its local and regional commercial partners, global online leadership, and public sector partners.

Data Network



Data Network Management, Administration, Operations

The ASU network is a robust, traditional network, comprised of core and edge devices that are primarily Cisco systems. Its design is a standard dual core, multiple distribution, and access layer model using MPLS for segmentation. The target state is a redundant core with multiple 10GE connections to every building with the capability to upgrade to 100GE connections and beyond. The transition from IPv4 to IPv6 is a priority for ASU; we expect providers to outline their solid and proven approach to expediting this transition at ASU. Intensive research centers may require physically segmented or isolated network fiber connectivity to the Science DMZ. ASU plans to extend the research network to 75 or more additional buildings and locations.

Proposers must clearly articulate a solution and plan that not only supports the current network functionality, but also provides seamless transition to a next generation network over the next 1/3/5 years.

Current State

- Attachment 2 – Network Topology Diagrams (Core & Edge)
- Attachment 3 – Network Hardware Inventory
- Attachment 4 – Telecommunications Design Standard
- Attachment 5 – Typical Telecommunications Room

Network at a Glance

Switches	4,000
Firewalls	50
WAPs	11,000
Controllers	10

Routers 200
(see Unified Communications section for VoIP information)

ASU's enterprise MPLS environment is designed for multiple security segments, such as:

- Guest
- DMZ segments
- Student
- Staff
- Departments
- Research
- Compliance
- Management
- Building Controls
- Audio/Video
- Security (Cameras / badge reader)
- Datacenter and Collocated Datacenter

ASU is interested in providers' recommendations regarding stratification of the network as it may pertain to IoT expansion and deployment, including such technologies as:

- LoRAWAN - Sensor Data
- Wi-Fi - Individual Traffic
- mmWave - Backhaul Video Data
- Private LTE - Control of cellular data
- 5G-ready
- CBR - Citizen Broadband Radio
- Bluetooth Low-Energy (BLE)
- LiDAR

Network Protocols

In addition to typical network protocols, ASU utilizes the following:

- Open Shortest Path First (OSPF)
- BGP, mpBGP, and LDP
- Quality of Service (QoS)
- Virtual Switching System (VSS)
- VPC (Nexus)
- Dynamic Multipoint VPN (DMVPN)
- 802.1x authentication – Wired identity based networking
- IPSEC

Systems with Shared Responsibility

- Cisco ISE for Network Access Control (NAC) – managed by a third party
- Infoblox DNS system – system is administered internally by ASU; IPAM is within the scope of this section.

- Data Center Firewalls – currently managed internally to ASU; open to solutions that provide comprehensive management and coordination.

Wireless

ASU's intent and goal is to provide a convenient, ubiquitous, secure wireless experience for customers. SSID availability, access permissions, and security requirements are determined by users' credentials and affiliation with ASU.

In the current era of BYOD, ASU's guests, students, and employees have myriad personal devices, laptops, phones, etc. that need to be configured to access ASU's networks and other data resources. Our intention is that our guests are able to configure their devices rapidly and easily and to assist and support them when they encounter connectivity challenges. The ITC will need to strategize and propose proactive, creative solutions to assist users with device configuration, problem assessment, resolution, and education to resolve the issues of today and the unknown issues of tomorrow.

ASU's current Wi-Fi network leverages Radius and consists of 10 primary Cisco wireless controllers using mobility groups within campuses; broadcasting 3 standard SSIDs across 11,000 wireless access points (WAPs). Concurrent connections on any given business day may average 50,000+, with occasional peaks of 100,000+ connections during a semester. Busiest days may record 250,000 unique devices connected via wireless. It utilizes a Cisco Prime infrastructure and Cisco's ISE solution for NAC.

Use cases:

- Executive VIP Meeting Space
- University Classrooms
- Faculty/Staff Offices
- Departmental Meeting Areas
- High-Density Classrooms and Meeting Spaces
- Research Labs or Centers
- University-Managed Residential Rooms
- University-Managed Housing Lounges & Workspaces
- Libraries
- Sporting Events
- Concerts
- Speaking Engagements
- Theater
- Walking Malls
- Eating Areas
- Hallways
- Lobbies & Waiting Areas
- Parking Areas Adjacent to Buildings

ASU also uses various wireless bridge types for primary and backup connectivity solutions. Speeds range up to 1gig (10gig future). Full duplexing allows support for data and VoIP communications over wireless.

Cellular

ASU currently utilizes a distributed antenna system (DAS) with micro/macro cells across campus. ASU is interested in solutions that may include tying into the 5G-ready system and expanding it. While ASU's Tempe, West, and Polytechnic campuses are fairly well covered, the Downtown Phoenix Campus presents unique challenges in terms of interference and multi-carrier coordination.

Research Network/Cyberinfrastructure

ASU invites companies at all levels to collaborate in advancing innovation and competitiveness through high performance computing and advanced network research. ASU is interested in developing labs, innovation centers, and high-performance computing centers, to promote a mutually beneficial exchange between industry and academia in advanced computing techniques and technologies, and at the same time foster a framework for technology innovation and support economic development in the state of Arizona and beyond.

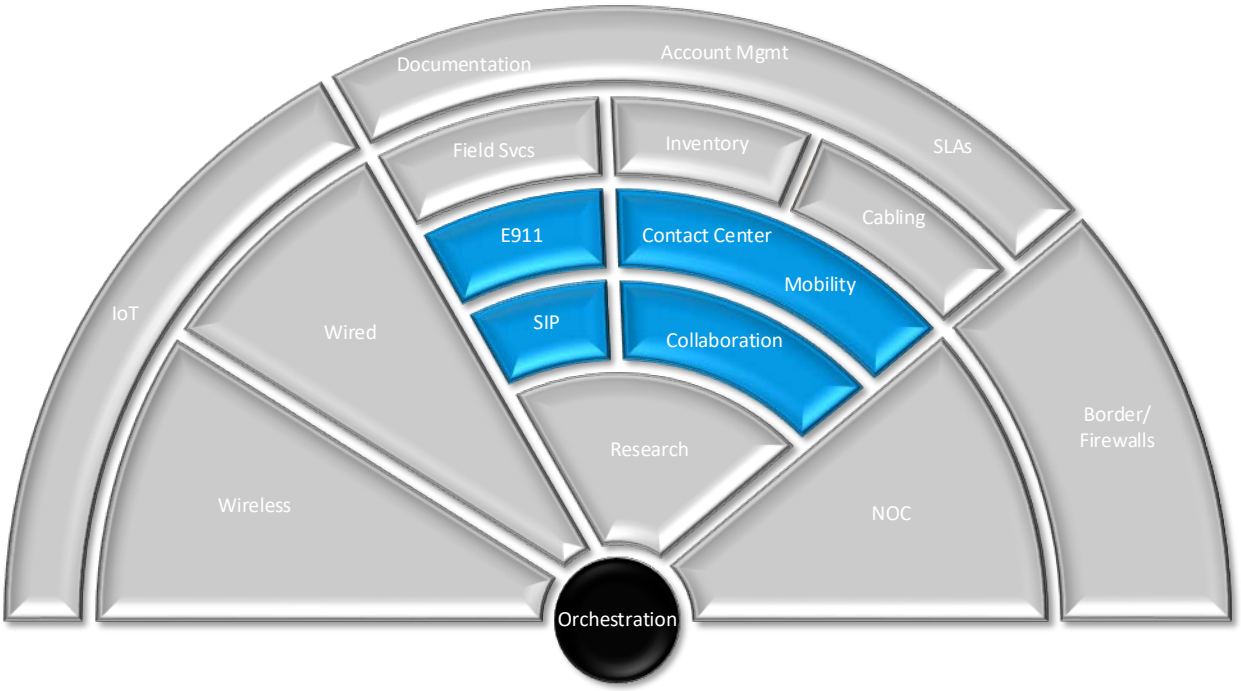
Research funders describe cyberinfrastructure as technology environments that support advanced data acquisition, storage, management, integration, mining, and visualization, along with other computing and information processing services that leverage compute and network resources beyond the scope of a single institution. It is a solution that addresses the challenges of bringing together researchers, laboratories, data, and systems with the goal of enabling the derivation and exploration of scientific theories and knowledge.

As federal research funding expands in support of academic research and high-performance computing, it will be important for the ITC to recognize and support ASU's goals in aligning our next-generation network with the growing cyberinfrastructure in order to help establish ASU as a leading research institution. Effective solutions will demonstrate cyberinfrastructure expertise to address the needs of ASU researchers in academic and cross-disciplinary contexts. The following elements encompass our areas of focus:

- Computing – advanced resources and services at all scales
- Data & Software – NSF's Data Building Blocks (DIBBS) program and infrastructure for sustained Innovation
- Networking & Cybersecurity – Campus cyberinfrastructure, International Research Network Connections, Cybersecurity Innovation for CI
- Learning & Workforce Development – Training-based workforce development for cyberinfrastructure

ASU seeks partners who understand and can co-design this advanced research network to conduct groundbreaking research in high performance computing, scientific visualization and data analysis, distributed and collaborative computing, and high bandwidth networking. This depth and breadth of experience provides the foundation for building strong research and development relationships that result in enhanced R&D programs for both ASU and the partner provider(s).

Unified Communications & Collaboration



Central to ASU's enterprise orchestration are the key elements of unified communications: telephony, conferencing, presence, messaging, contact center, collaboration, mobility, and life safety services. Provider(s) of unified communications services will be responsible for all aspects of these services, including installation, configuration, maintenance, support, documentation, and ongoing expansion and innovation. ASU expects to be a leader in Higher Education in the adoption and provision of telephony technologies.

Current ASU systems include both Cisco and Avaya platforms, edge devices, and applications. ASU is interested in providers' proposals that may involve replacement, upgrade, migration to cloud, or any combination of architecture that best positions ASU for innovation, flexibility, mobility, and global presence.

Current State

- Attachment 6 – Communications Network Topology
- Attachment 7 – Communications Hardware Inventory

Communications Systems at a Glance

The current voice systems are a hybrid, interconnected, model consisting of Cisco and Avaya platforms and adjuncts, serving 20,000 stations made up of VoIP (60%), TDM Digital (30%), and Analog (10%) endpoints. Currently, digital voice services are provided via the Avaya system; VoIP and analog services may be provided from either system, depending on infrastructure and life-safety determinants. However, ASU is interested in solutions that provide for platform agnostic services, utilizing VoIP and SIP services. Endpoints requiring analog service (e.g., life safety devices, fax machines, many of which are legacy devices) need to be accommodated with full functionality.

Private Branch Exchange and Unified Communications

The provider will install, configure, maintain, support, and document ASU telephony systems, including the existing Private Branch Exchange ("PBX") and Unified Communications ("UC") devices and applications, as needed in the provisioning of services. The provider will proactively research and recommend upgrades to the telephony systems in order to maintain efficiencies, service levels, and service integrity; to ensure ongoing vendor support of devices on the systems; and to keep ASU systems and applications technologically up-to-date. Engineering and network architecture decisions will be a collaborative effort between the provider and ASU, with ASU retaining final authority and discretion to direct providers in the provisioning of Services.

Circuits and Numbers

The provider will coordinate and manage incoming and outgoing circuits to provide the most efficient, reliable, and cost-effective solutions for ASU telecommunications. Providers will be required to work cooperatively with third parties that provide connectivity for ASU and will be responsible for ensuring compatibility, proper configuration, and successful testing of circuit terminations. The provider will manage the deployment and recovery of Direct Inward Dialing ("DID") numbers to ensure efficient use of this limited commodity and will accurately track and document all DID numbers owned by ASU.

System-wide Configuration

Voice Gateways. The successful proposer will provide termination points for voice lines that connect to the Public Switched Telephone Network ("PSTN").

Dial Plan. The service provider will manage dial plans to provide optimal call routing and dialing efficiency; will provide 5-digit dialing ability (dial plan permitting or based on the number of end users) so that ASU users may dial 5-digit extensions to connect on network and within the ASU telephony systems.

Caller ID. Provider will ensure the ASU telephony system is configured to provide caller identification information ("Caller ID") automatically, where technically possible, on incoming and outgoing calls.

Single Number Reach/Extension to Cellular. At the request of end users, Provider will enable end users' phone and cell phone to ring simultaneously or sequentially when an ASU number is dialed.

Features & Functionality

ASU telephony customers will receive, at a minimum, the following services:

Basic Calling Features. Provider will provide basic telephony features, including but not limited to:

- Transfer
- Conferencing up to 3 parties
- Speed Dial
- Hold
- Multi-Line (Bridged Appearances)
- Call Forwarding
- Call Logs
- System Directory

Additional Features. Provider will provide the following additional features as deemed appropriate by ASU to meet customer's functionality requirements:

- Attendant Soft Console
- Web Interface for device configuration
- Headset configuration and support

System Announcements. Provider will manage and maintain system announcements used in the voice platforms and will ensure quality of voice talent as well as consistency of voices within any given related set of announcements.

Voice Messaging System ("Voice Messaging" or "Voice Mail")

Provider will install, configure, maintain and support the ASU Voice Mail system. The ASU Voice Mail system will integrate with all enterprise telephony platforms at ASU, and will provide, at a minimum, the following services:

Voice Mail Subscription. Provider will provide users a system of receiving, storing, sending, forwarding, and otherwise managing voice messages.

Voice Mail Delivery. At the user's option, the system will deliver voice messages to the voice mailbox and/or to a user-defined e-mail address.

Automated Attendant. The system will provide automated attendant functionality.

Broadcast Messages. Subscribers will have the ability to create and send recorded messages to user-defined group lists maintained within the voice mail system.

Web Access. Provider will provide a web portal via which users may administer basic voice mail features such as greetings.

Message Notification. The system will provide notification of new voice mail received via an indicator on the associated desk phone. Additionally, at the user's option, the system will send a text message through a supported cellular provider to a user-designated phone number, and/or will call the users' designated phone number.

E-mail Integration. The system will provide the ability to integrate with current ASU e-mail messaging system.

Voice Mail Mobile Application. The system will provide the ability to access voicemail messages and features from commonly-used mobile phones and tablet devices, including at a minimum, iPhone and Android devices.

Telephone User Interface. The system will provide the option and ability (at a system level) to utilize an Octel Aria Telephone User Interface ("TUI").

Password Reset. The system will accommodate user self-service password resets.

Conferencing Service

Conference Bridges. Provider will provide in-system, 5-digit, and conference bridges as may be accommodated in existing telephony systems. Provider will also provide toll-free, 10-digit bridges, to be included at no additional charge.

International Conference Bridges. At the request of ASU departments, Provider will provide toll-free international conference bridge services to ASU departments and will invoice departments directly for such services.

Integrated Contact Center. Provider will architect, install, configure, maintain and support call center applications and platforms to provide Interactive Voice Response ("IVR") and Automatic Call Distribution ("ACD") services.

Reporting. Provider will provide call center reporting to ASU departments upon request. The system will provide the ability for self-service reporting. Provider will also provide custom reports at no additional charge.

Analog and Digital Voice Service

Provider will maintain and support all digital and analog end devices and gateways and will ensure maintenance and support of voice servers and architecture.

Analog Voice Service and Devices. Provider will install, maintain, support and configure analog extension services for ASU to support devices including: conference/speaker phones, fax machines, modems, special systems, point of sale machines, courtesy phones, and Blue Light Phones/Areas of Refuge, building controls, fire alarms and elevators.

Critical Emergency Services. Where services are deemed to be related to life safety, Provider will install ASU standard life-safety hardware and connectivity and will maintain this hardware and connectivity to ensure 99.999% availability.

Digital Voice Services. Provider will install, maintain, support and configure digital voice service and devices.

Voice over Internet Protocol ("VoIP"). Provider will provide ongoing maintenance and support on all ASU VoIP end points.

Third-Party Connections. Provider will support third-party Session Initiation Protocol ("SIP")-based or VoIP connections for ASU department applications.

Number Portability. Extension number portability will be accommodated to the extent the technology allows.

NextGen E911. Provider will deliver NextGen E911 services in coordination with other ASU contracted entities. Information for the ASU-owned DID numbers where Provider has Private Switch/Automatic Location Identification Service ("PS/ALI") access and authorization. For each instance of telephone move, add, change, or delete ("MACD") activity with E911 impact, Provider will provide timely, accurate and complete information necessary for E911 compliance, including but not limited to the Emergency Response Location ("ERL") information, ASU extension, ASU standard building name, and room/cubicle

number. Provider is responsible to proactively communicate with ASU Facilities Management on all infrastructure documentation changes to ensure accuracy of the database. Provider will work timely and in good faith to ensure efficiency in the PS/ALI update process. If Provider provides inaccurate E911 information, Provider will owe ASU a service level remedy as defined on Schedule D to the Master Agreement, Service Level Agreement, as the sole remedy for any inaccuracies in E911 information that Provider provides. Except for the service level remedy, Provider will have no liability for E911 information and disclaims all warranties regarding accuracy of the E911 information.

Where Provider does not have PS/ALI access and authorization, Provider will assist ASU so that ASU may provide information to the local provider that may grant PS/ALI access to ASU.

Documentation. Provider will document, store and make readily available to ASU information on all telephony systems and cabling.

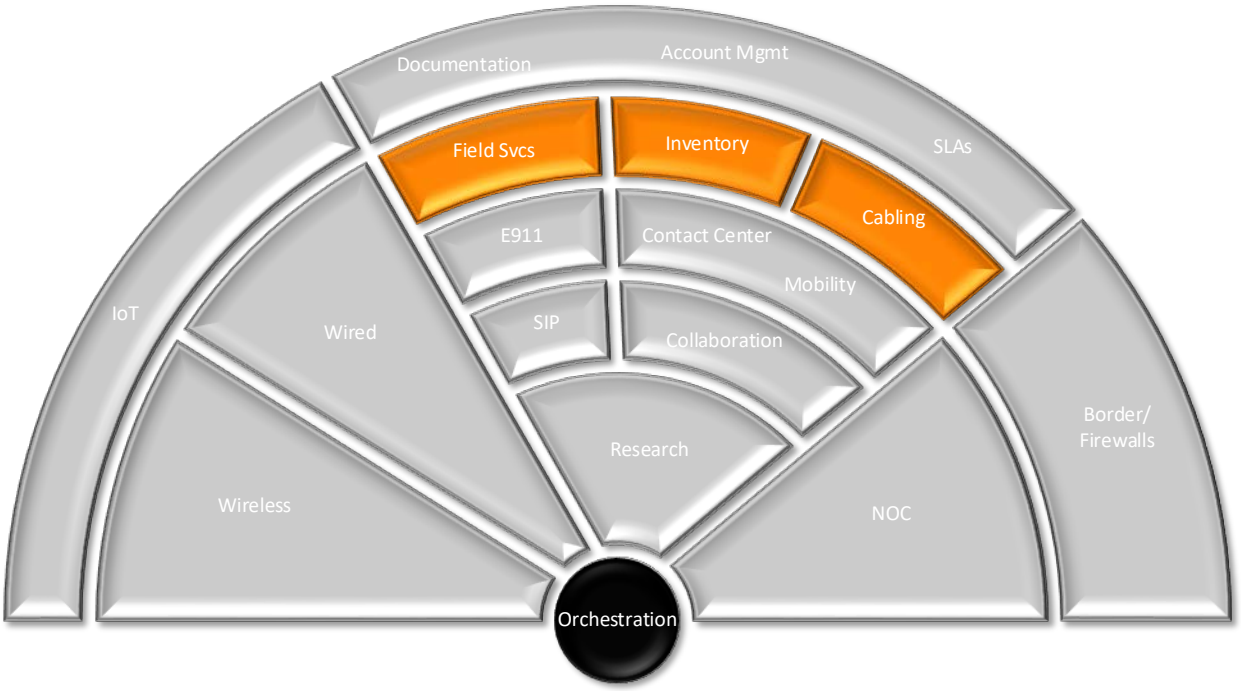
Remedial Audit and Documentation. Provider will conduct a thorough audit of all cable plant documentation, including telephony systems, to create a baseline set of accurate records.

Ongoing Documentation Information. Documentation will include, for each digital and analog device: building, room, jack number and associated extension information; for each VoIP device: building, room, jack number, switch port, port description, and associated MAC address.

Inventory. Provider will maintain an up-to-date inventory of all deployed and in-stock devices including for each device, model number, serial number, purchase date, purchase price, deployment status, and vendor support status (end-of-support, end-of-life).

Hardware Maintenance Agreements. Provider will assist ASU in managing and maintaining hardware maintenance contracts, with direction from ASU. Provider will ensure that there is no unwarranted lapse in coverage for all hardware in place.

Logistics



Field Services

Field services necessary for the provision and support of data and voice networking include:

- Fleet management
- Field Technicians/Operations
  - Edge switch administration
  - MACDs for voice and data
- Ticketing - integration into ASU's ServiceNow platform
- Troubleshooting
- Front-line customer interface, to include some training

Inventory Management

ASU seeks a provider to manage all aspects of both physical and logical inventory of network devices. This service is tightly integrated with field services, provisioning, capacity planning, and asset management. Therefore, the responsible provider is expected to work seamlessly and harmoniously with other providers within the orchestrated system of services, to ensure fluidity, ultimate customer service, and accountability, through finely-tuned workflows and processes, systems, and committed resources.

Responses should address elements such as (but not limited to):

- Physical space
- Loading dock, shipping/receiving/distribution operation in consideration of ASU's
  - Restricted driving on campus malls
  - Distributed facilities (multiple campuses)

- Asset tracking
- Salvage – familiarity with ASU's salvage rules and procedures
- RMA & Trade-in – end-to-end management of manufacturers' RMA and trade-in programs and procedures
- Inventory database

ASU is interested in innovative solutions that may simplify the operating expense model, such as vendor-managed inventory, or a solution that perhaps encompasses the entire system as a service, including ownership of assets/inventory.

Cabling/Infrastructure

The ASU cable plant includes all cabling (copper, fiber, coax, or other), for the LAN and backbone infrastructure. The provider will install, maintain, repair, support and document the ASU cable plant in the provisioning of services. Documentation of the infrastructure must include all active and inactive cable, to enable effective capacity planning, troubleshooting, expansion, and reporting. ASU's documented copper cabling infrastructure consists of about 75% CAT6, 20% CAT5, 5% CAT3. The current fiber backbone is comprised of about 60% single-mode fiber and 40% multi-mode.

- Fiber backbone, riser and station
    - 62.5, 50 micron and single mode
- CAT3, CAT5e, CAT6, CAT6A, CAT6A Shielded, etc.
- Copper multi-pair cable
    - OSP and riser
- Coaxial cabling
    - RG62, RG11 station
- Repair and maintenance
- Cabling/infrastructure database

Rethinking Building Infrastructure

Connected and Efficient Buildings

Connected and efficient buildings utilize a shared infrastructure that combines power and data on a universal connectivity grid (UCG) to support building automation systems, wireless access points, security cameras, access control systems, digital displays, networked sensors, LED lighting, and much more. ASU is interested in providers with expertise in building information modelling (BIM) to support ASU's smart city initiatives.

Automated Infrastructure Management (AIM)

ASU is interested in exploring AIM technologies that utilize integrated hardware and software systems that automatically detect the insertion or removal of cords, support documentation of the cabling infrastructure and connected equipment, and enable management of the infrastructure and data exchange with other systems. These technologies facilitate ASU's goals of:

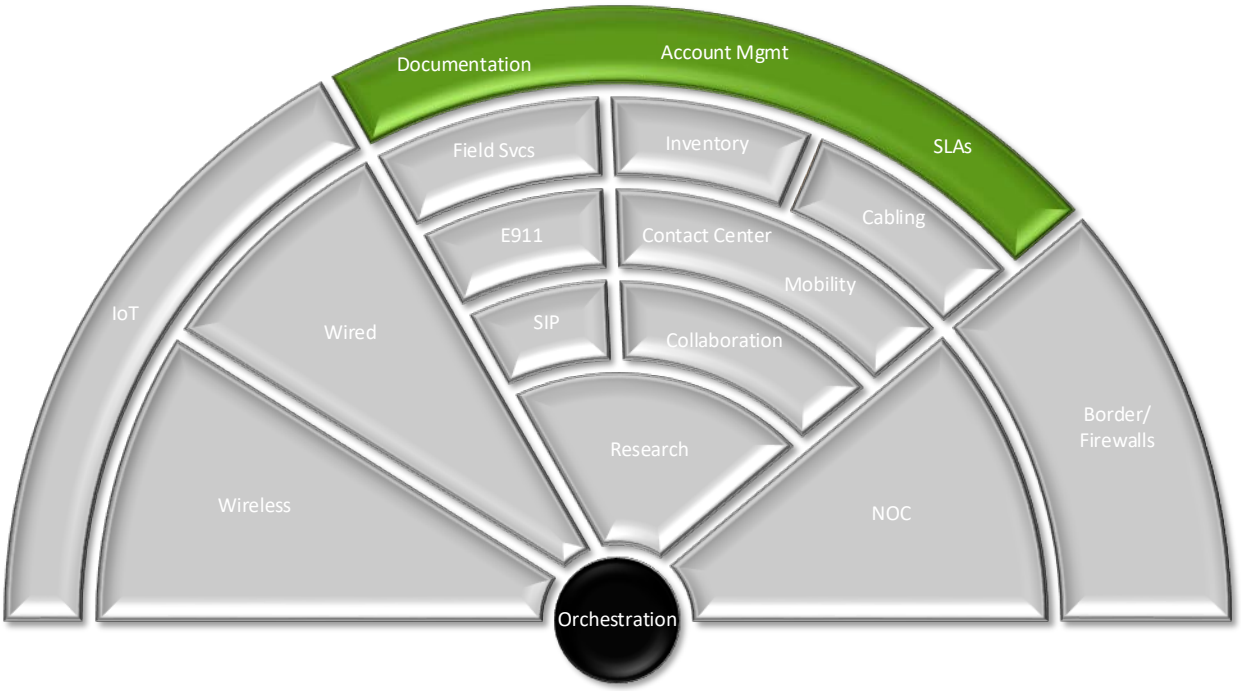
- Maximizing operational efficiency;
- Facilitating cabling infrastructure and connected device administration;
- Streamlining facilities, IT, intelligent building, and other management processes and systems;

- Supporting business information systems covering asset tracking and asset management;
- University commitment to climate-neutral energy goals (sustainability)

Responses should include proposed AIM solutions covering elements such as:

- Intelligent hardware that detects insertion and removal of cords;
- Software that
    - Collects and stores the resulting connection information,
    - Relates the connection information to cabling connectivity information,
    - Relates the cabling connectivity information to information from other sources, and
    - Makes the connection information accessible to either an authorized user or to other systems.

Account Management



Telecom Carrier Services

- Carrier services coordination & billing
- Account keeping/reconciliation
- Telecommunications Expense Management (TEM)

Capital Fund Management

ASU is interested in the use of a dedicated capital fund (e.g., escrow account, credit line, or other) for the purpose of purchasing equipment, software, licenses, maintenance, and services, for technology refresh, expansion, and ongoing operations. Providers may suggest models for cap-ex fund management that will provide flexibility to ASU for purchasing from any supplier and will protect ASU's investment strategy with regard to forecasted technology purchases.

Documentation

The provider of this service will own the entirety of documentation efforts with regard to network operations. Although other providers may own aspects of service that require documentation, this provider will own documentation and its place in the orchestrated model of this ITC. The provider must coordinate, drive, audit, and ensure availability of all documentation systems and data, for use by ASU and any of ASU's other providers, as permitted by ASU.

- Network documentation
  - Infrastructure
  - Topology drawings
  - Cabling database
  - Inventories
  - Interdependencies of systems, processes, and workflows

- Standards & Procedures – drafting, publishing, maintaining, communicating
- Knowledgebase – integration with ASU's ServiceNow knowledgebase
- Customer Communications
    - Polished and professional
    - Expertise in creating and distributing communications
        - Marketing
        - Training
        - Routine service announcements
        - Surveys

Service Level Agreements

Service Level Agreements that are negotiated with provider(s) should incent and reward continuous improvement and excellent performance, and not just be punitive in nature. This section of the orchestra provides the rhythm, guidelines, and punctuation to the overall performance of these enterprise services. ASU is interested in models that demonstrate expertise in specific network technologies through objective measurement of rigorous standards, delivered via dashboards, reports, mobile applications, notifications, workflows, etc., that are readily available, quantifiable, and universally understood.

SunRISE/Jagger e-Commerce System

The Proposer will use ASU's SunRISE e-commerce system for the purchase of catalog products and services provided by the vendor. Please refer to Attachment C SunRISE General Terms. Also, if you would like more information about SunRISE, please visit the SunRISE home page at https://cfo.asu.edu/purchasing-sunrise.

Ordering Procedures

Proposer must be able to accept purchase orders placed by the ASU customer via SunRISE (https://cfo.asu.edu/purchasing-sunrise), ASU's web-based application for ordering supplies and equipment. If proposer has on-line ordering capability, the successful proposer may be required to work with our e-Commerce Team on setting up the interface between SunRISE and Proposer's website. When an order is placed via SunRISE, an ASU generated purchase order will be sent to the supplier to process.

Invoicing

For SunRISE orders, the the vendor will send the invoice directly to ASU Accounts Payable via the eInvoicing process. Credit card (P-Card) receipts should be sent directly to the individual who placed the order. ALL invoices must list the department's name, ASU purchase order number, contract number, date ordered, item description including manufacturer name and model number, quantity ordered, unit price, and extended price.

LIST OF ATTACHMENTS

- Attachment 1 – Towards Universal Learning: Executive Summary
- Attachment 2 – Network Topology Diagram (Core & Edge)
- Attachment 3 – Network Hardware Inventory
- Attachment 4 – Telecommunications Design Standard
- Attachment 5 – Typical Telecommunications Room
- Attachment 6 – Communications Network Topology
- Attachment 7 – Communications Hardware Inventory