MID-ATLANTIC CROSSROADS

2019-2024

Strategic Plan

Applied Cyber Innovation for Higher Education and Research

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MAX offers unique services for the research and education community. These services support research labs, federal agencies, higher education institutions, and other affiliate members.

EXECUTIVE SUMMARY

Research and Education (R&E) networks have a unique place in Internet history as early adopters of networking technologies in connecting universities and research institutions. In 2019, R&E and purpose-built networks continue to hold a prominent role in this landscape. Their function has expanded to include advanced networking and innovative cyberinfrastructure services.

The Mid-Atlantic Crossroads (MAX) is celebrating its 20th year of providing advanced networking and cyberinfrastructure services. This strategic plan shares the history and future of MAX—where MAX came from and where MAX is headed. It sets the pace for MAX's next five years of cyber innovation and advanced services. The plan takes into account trends in higher education and research, future needs of MAX customers, innovations in commercial cloud and Internet services, and the prevailing evolution in national and international R&E networking.

Six strategic goals define the next generation of growth of MAX's cyberinfrastructure platform and services:

1. Advanced Networking, Operational Excellence, and the MAX Network Footprint
2. Flexible Transport, Security, and Intelligent Edge Services
3. Customer Engagement and Partnerships
4. Research and Development
5. Financial Planning and Competitive Value
6. Marketing, Sales, and Communications

Through these strategic goals, MAX will strengthen its network and cyberinfrastructure platform to meet the needs of customers in the Mid-Atlantic region and advance the capabilities of its innovative and intelligent edge resource, MAXedge. MAX will continue to be a thought leader by engaging in novel research and development (R&D) through sponsored research activities and strategic collaborations with private sector corporations. Moreover, MAX commits to engaging customers directly, while employing best financial practices, and adding value to all provided services to enrich the customer experience. Finally, MAX will take a more focused approach to communicating, marketing, and further positioning its brand.

Letter from the Executive Director of the MID-ATLANTIC CROSSROADS (MAX)

MAXimizing the opportunities of the next 5 years

To MAXimize our future and realize our vision and mission, MAX has surveyed the Internet and cyberinfrastructure (CI) service landscape to prepare a five year plan to support the research and education community.

In 2019, the national and international networking and CI service topography tells an impressive story of accomplishments. These include networks operating at very high speeds, commercial cloud services providing compelling solutions, the Internet-enablement of scientific instruments, the capability of accessing these instruments remotely, and the sophistication of these instruments in producing data at volumes never seen before. In addition, other prevailing and forthcoming innovations such as the promise of 5G mobile communications, the plethora of Internet of Things (IoT) devices and the scientific community's need for a national scale CI platform dedicated to and optimized for science, add value and complexity to the networking and CI service landscape. Furthermore, these service environments know no national boundaries and make global collaboration in research and education exceptional.

The growth and dependence on the Internet and CI service landscape make resilience and investment a necessity. Moreover, these advances create a perfect nexus for information technology innovation in support of science and research. Coupled with this is the ever-growing challenge of cybersecurity. Service providers need to move in lockstep in combating the growing threats to service and data integrity.

In this context, MAX defines its next five years in this strategic plan. The strategy was honed from conversations with the MAX customer base to understand current and future needs. A SWOT – Strengths, Weaknesses, Opportunities and Threats - analysis of MAX's place in a rapidly evolving ecosystem contributed to this plan, as did the consideration of new networking and CI technologies.

We thank all our customers, our colleagues at Internet2, the mission networks, the Quilt community, and in the private sector, each of whom has, in strategizing their own future plans, helped inform our plans. As we celebrate our 20th anniversary, MAX enthusiastically embarks on this five-year strategic plan to advance its CI platform, create innovative services, research new ones and, ultimately, bring value to our customers and enrich the R&E networking and CI service ecosystem.

Tripti Sinha

Executive Director
Mid-Atlantic Crossroads (MAX)
Assistant Vice President and Chief Technology Officer (CTO)
Advanced Cyberinfrastructure and Internet Global Services (ACIGS)
MAX • Supercomputing • Global DNS Root Services
Division of Information Technology, University of Maryland

THE HISTORY OF MAX

Established in 1999 by a consortium of higher education institutions, with the University of Maryland at the helm, MAX addressed the need for high-performance networking for the research and education community in the Mid-Atlantic region. The network began its operations at OC-48 speeds with four points of presence (PoPs). Now after 20 years, it operates at prevailing 100 Gbps speeds with 15 PoPs in the Washington DC, Northern Virginia, and Baltimore metroplex region. Always looking toward the future, MAX has a storied history of innovation and advanced services. MAX remains continuously ready to evolve and meet the sophisticated needs of the R&E community.

Many events and developments have contributed to the growth of MAX. Listed below are some notable milestones.

1999

- MAX is established by a consortium of universities: the University of Maryland, the George Washington University, Georgetown University, and Virginia Tech.
- MAX's network backbone runs at OC-48 speeds (or 2.5 Gbps) between its four PoPs—an extremely fast networking speed for its time.
- MAX establishes four PoPs that are located at the University of Maryland (College Park, MD), the George Washington University (Washington, D.C./Northwest), CenturyLink/Qwest (Washington, D.C./Northeast), and the University of Southern California (USC) Information Sciences Institute (ISI) – East (Arlington, VA).

2001

- MAX and the Naval Research Laboratory (NRL) collaborate on upgrading the Advanced Technology Demonstration Network (ATDnet), as well as conducting research into feeding characteristics of optical fiber into the dynamic control planes.
- MAX's network backbone starts running gigabit Ethernet (GigE) technology—a new innovation to Wide Area Network (WAN) links. At this point in MAX's history, the backbone becomes a mix of OC-48 and GigE.
- MAX creates a new PoP at Level 3 McLean Gateway (McLean, VA), bringing the total number of MAX PoPs to five.

2003

- MAX, under the leadership of the University of Maryland, leads the successful National Science Foundation (NSF)-funded grant, Dynamic Resource Allocation via GMPLS Optical Networks (DRAGON), in collaboration with USC ISI and George Mason University. As a result, MAX deploys a 10 Gbps research infrastructure and becomes an early adopter of all-optical networking.
- MAX adds a sixth PoP at the William Donald Schaefer Building (Baltimore, MD).

2006

- MAX participates in Internet2's Hybrid Optical Packet Infrastructure (HOPI) project, which eventually evolves into Internet2's Dynamic Circuit Network (DCN).

2007

- MAX upgrades the production network backbone to 10 Gbps, which is Ethernet-based and four times faster than previous OC-48 speeds.

2008

- MAX assists, as an early contributor, in the development of the Global Environment for Network Innovations (GENI) infrastructure.
- MAX introduces two additional PoPs to the network: Equinix (Ashburn, VA) and Coresite (Reston, VA)—resulting in a total of eight MAX PoPs.

2010

- MAX upgrades the research network backbone to 100 Gbps, making MAX an early adopter of 100 Gbps technologies. Furthermore, MAX becomes the first customer for Fujitsu at 100 Gbps speeds and deploys Fujitsu cards with serial numbers 0001 and 0002.
- MAX installs a ninth PoP at the University of Maryland, Baltimore (Baltimore, MD).

2011

- MAX loans a 100 Gbps card to the National Aeronautics and Space Administration (NASA). This enables testing at Supercomputing 2011 (SC11) of a cross-country end-to-end 100 Gbps data transfer between NASA in Greenbelt, MD, and SC11 in Seattle, WA—via MAX, Internet2, and ESnet infrastructures.

2012

- MAX brings on the first 100 Gbps customer: Laboratory for Telecommunications Sciences (LTS).
- MAX continues supporting customer research into 100 Gbps networking, including demonstrations at Supercomputing 2012 (SC12) in Salt Lake City, UT.

2013

- MAX places a stronger focus on research and innovation and the University of Maryland assumes full responsibility for operating MAX.
- MAX upgrades the production network backbone to 100 Gbps.
- MAX connects to Internet2's Advanced Layer 2 Service (AL2S) at 100 Gbps.
- MAX utilizes the AL2S dynamic network service, at Supercomputing 2013 (SC13) in Denver, CO, to facilitate MAX customer demonstrations.
- MAX becomes an official part of the GENI federation with the installation of the GENI rack at the MAX PoP on the University of Maryland campus.
- MAX introduces two more PoPs to the MAX network: Institute for Bioscience and Biotechnology Research (IBBR) (Rockville, MD) and Johns Hopkins University, Montgomery County Campus (Rockville, MD)—bringing the total number to 11 MAX PoPs.
- MAX officially becomes a center at the University of Maryland.
- MAX offers Amazon Web Service (AWS) to customers and becomes one of the first higher education organizations to facilitate AWS Direct Connect service at 10 Gbps.

20 years of connecting the future!

2014

- MAX collaborates with Fujitsu on the first test utilizing Fujitsu's new super-channel capabilities in a deployed network. During the field trial, the MAX network demonstrates 400 Gbps and 800 Gbps networking capabilities.
- MAX and Bytegrid partner to leverage their resources to provide an advanced cyberinfrastructure platform that serves the life sciences R&E community in the Mid-Atlantic region.
- MAX adds two more PoPs at the Bytegrid Facility in Silver Spring, MD and the University of Maryland's Rivertech facility in College Park, MD—bringing the total number of MAX PoPs to 13.
- MAX provides 100 Gbps connectivity to the University of Maryland's High-Performance Computing (HPC) cluster, Deepthought2.
- MAX assumes operation of D-root, one of 13 global DNS root identifiers, from campus-focused enterprise networking services. This realignment was in keeping with MAX's external and global Internet and CI service provider focus for the University of Maryland.

2015

- MAX establishes an in-house Network Operation Center.
- MAX assists NASA with three 100 Gbps connections to Starlight, ESnet, and the NASA facility in Greenbelt, MD for Supercomputing 15 (SC15) in Austin, TX.
- MAX establishes a 100 Gbps connection to the Maryland Advanced Research Computing Center's (MARCC) HPC cluster, Bluecrab, connecting it directly to the University of Maryland's Deepthought2.
- MAX and the National Oceanic and Atmospheric Administration (NOAA) partner to establish a Trusted Internet Connection (TIC). MAX becomes the first regional R&E network in the nation to host a TIC on-net.
- MAX expands D-root service with new equipment located within MAX PoPs.

2016

- MAX partners with ConnectArlington to promote economic development and extend the MAX network to federal agencies, research labs, and startup companies in Arlington, VA.
- MAX adds a 14th PoP in Clarendon (Arlington, Virginia).
- MAX partners with the U S Army Research Lab (ARL) to offer enhanced HPC resources to ARL's Open Campus community and the MAX community.
- The University of Maryland hosts its first exhibition booth at Supercomputing 2016 (SC16) in Salt Lake City, UT and MAX demonstrates intelligent network services and advanced hybrid cloud capabilities.
- MAX facilitates 400 Gbps of connectivity to SC16.
- MAX receives the *Regional Embedded Cloud for As-a-Service Transformation (RECAST) Grant* to develop and deploy a regional Software Defined ScienceDMZ (SD-SDMZ), serving as a mechanism to provide flexible edge services that include traditional data transfer functions.

2017

- MAX partners with Ciena to jointly enable a 200 Gbps alien wavelength network connection. This joins together MAX and Ciena's robust research infrastructures to facilitate technology development and testing in the areas of multi-domain, multi-layer software-defined networking (SDN).
- MAX adds a 15th PoP at a Carrier Hotel (Washington, DC).
- MAX establishes the first SD-SDMZ, the MAXedge, in the R&E community.
- MAX adds HPC to the overarching purview by assuming management of the University of Maryland's HPC resources and starting its own HPC cluster, Juggernaut, which connects at 100 Gbps.
- MAX demonstrates SD-SDMZ capabilities at the University of Maryland's booth at Supercomputing 2017 (SC17) in Denver, CO and at Internet2's 2017 Tech Exchange.
- MAX moves D-root network advertisements to the MAX network Border Gateway Protocol (BGP) Autonomous System Number (ASN).

2018

- MAX increases service offerings to include DDoS Mitigation Service.
- MAX enriches the edge facility, MAXedge, with high-end compute and storage resources.
- MAX offers managed Alien Wave services.
- MAX partners with NASA, NRL, Metropolitan Research and Education Network (MREN), and Ciena to enable 600 Gbps capacity via Alien Wave services to Supercomputing 2018 (SC18) in Dallas, TX.
- MAX tests 100 Gbps data transfer, disk-to-disk between Juggernaut in the MAXedge and the SC18 University of Maryland booth.
- MAX demonstrates end-to-end SDN orchestration with CalTech and ESnet at SC18.

2019

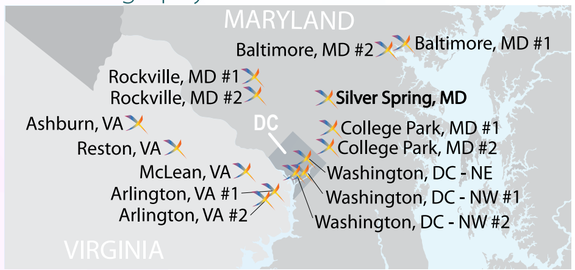
- MAX celebrates 20 years of connecting the future!

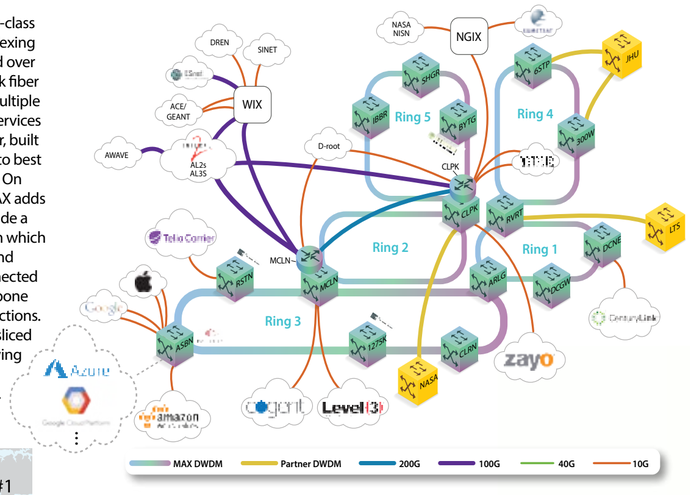
MAX TODAY

MAX's service geography spans an extensive region that encompasses strategic points within the research and education community in the Washington DC, Northern Virginia, and Baltimore metroplex region. The MAX network is purpose-built for research-focused customers of all sizes, including small startups in the University of Maryland's Discovery District, colleges and universities throughout the region, and Federal government agencies with national-scope networks. This massively-scalable network requires flexibility in design and deployment, as it allows MAX to service customers at speeds ranging from 100 Mbps to 100 Gbps.

This scalability begins with a carrier-class Dense Wavelength Division Multiplexing (DWDM) network that is distributed over multiple dedicated and diverse dark fiber rings as the base layer. MAX runs multiple protected 10 Gbps and 100 Gbps services simultaneously on each pair of fiber, built end-to-end to supply services and to best serve the needs of MAX customers. On top of this redundant substrate, MAX adds switched and routed layers to provide a base set of common protocols from which all other services can be exposed and accessed. The MAX network is connected to the Internet2 national R&E backbone by two redundant 100 Gbps connections. This multi-layered network is then sliced to expose different resources, allowing customers to pick and choose the services that best meet their needs.

MAX Geography



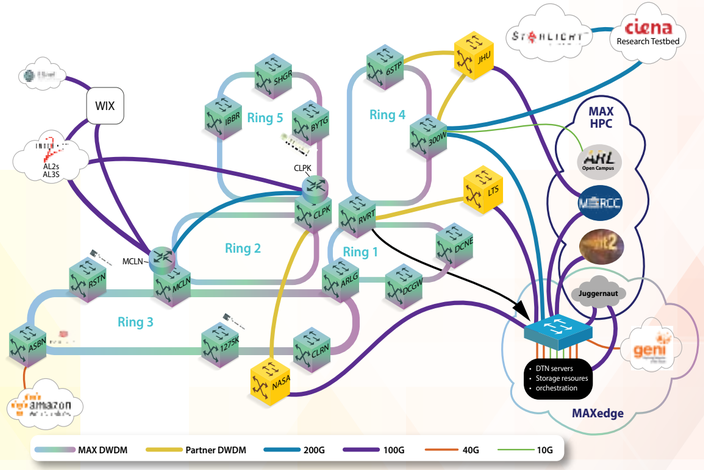


The MAX Production Network Topology

MAX provides a wide suite of services through this topology that provide customers with access to MAX cyberinfrastructure and regional resources, and in turn to the larger national and international R&E cyberinfrastructure resources. In addition, MAX provides direct access to its own dedicated research network, several cloud and content providers, and a mix of commodity services—all to help complete the full palette of high-capacity services required by the R&E community.

The MAX research infrastructure rides on a dedicated wavelength of the MAX production DWDM optical network. It includes an SDN-controlled 100 Gbps network, a Software Defined ScienceDMZ named MAXedge, and network-rich compute and storage resources. The MAX research network has multiple 100 Gbps direct connections to the extended set of national research network infrastructures—including Internet2 AL2S and ESnet—as well as to the public cloud service providers that include AWS. MAX is also a part of the NSF Global Environment for Network Innovation (GENI) consortium. The MAX research team operates the production GENI Aggregate Manager (AM) and Stitching Computation Service (SCS) for the R&E community.

In recent years, MAX has added High-Performance Computing to its portfolio by managing the University of Maryland's enterprise HPC resources, by creating MAX's HPC resource, Juggernaut, and by developing an advanced and innovative intelligent edge resource, MAXedge, with compute and storage resources.



The MAX Research Network Topology

High performance at MAX begins with the MAX team

THE FOUNDATION OF MAX

By focusing on its core values, team members, culture, and the four MAX pillars (Network, Services, Research, and Innovation) MAX will continuously strengthen its vision and mission.

Vision To create world-class networking and cyberinfrastructure services that power research, education and scientific discoveries.

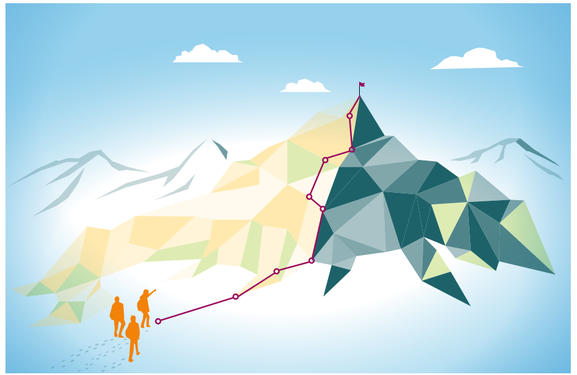
Mission MAX provides a customer-centric, leading-edge and always-evolving networking and cyberinfrastructure platform with innovative services designed for the needs of the research and education community.

Team For MAX to fully realize its vision and accomplish its mission, it relies on its core strength, the talented MAX team. MAX team members support and respect each other and collectively deliver on the MAX mission. MAX creates a culture which thrives on collaboration, support, and high performance.

The MAX team embodies the words of Phil Jackson – ***"The strength of the team is each individual member. The strength of each member is the team."***

THE MAX CULTURE

Max creates a work environment that adheres to a set of attributes, which define a distinct MAX culture.



Boldly climb the mountain and see over the summit

MAX encourages all team members to investigate evolving technologies, try new solutions, and apply unique approaches to solving complex problems. MAX team members fearlessly enter uncharted territory.

Be thought leaders

MAX strives to be a trailblazer through its pioneering technologies and services.

Fail fast

MAX encourages exploration and fast failures. Failure is collectively viewed as a lesson that contributes to refining and improving a solution.

Encourage fun and accept differences

MAX makes work fun and enjoyable. MAX embraces the unique qualities of all team members and strengthens interpersonal relationships by celebrating occasions like accomplishments, birthdays, and anniversaries.

Create a collaborative office space

MAX office space is inviting and is designed to inspire team collaboration and conversation.

CORE VALUES

MAX follows four main core values that affirm its positive and productive work environment, as well as the attentive service given to customers. With these four core values, MAX enables and challenges its team to provide the best possible service.

RESPECT MAX values each customer's work, research, and service needs.

INTEGRITY MAX is synonymous with the qualities of ethics, trust, reliability, and responsibility.

CUSTOMER FOCUS MAX places the customers' needs first and dedicates skills and resources to exceed customer expectations.

INNOVATION MAX is innovative in its solutions and services to support the complex and evolving needs of the research and education community.

THE FOUR MAX PILLARS

There are four pillars that define the MAX organizational approach to delivering its mission. The purpose and relation between these four pillars establish the fundamentals of MAX processes and solutions.

Applied Cyber Innovation for Higher Education and Research

Network

At the foundation of MAX is a robust and flexible networking architecture that supports the high demands of science applications and large data flows. It continually evolves to meet the current and future high-performance cyberinfrastructure needs of its customers. This advanced infrastructure facilitates the high-speed transmission of data, supports core and advanced services, and enables big data flows. The network is connected to national and international R&E networks, thereby providing high-performance communications and collaborations for the research and education community.

Research

MAX facilitates research for its customers in the domain science research community through its advanced CI and service offerings. Moreover, MAX is also engaged in research studies through agency-sponsored grants. When responding to calls for grant proposals, MAX ensures that all projects align with its organizational mission, as well as with its customers' needs. The research activities are focused on identifying and defining the next generation of CI services. These will ultimately direct the future of networking at MAX and within the general information technology community.

Services

With its cutting-edge networking infrastructure and innovative edge resource, MAX provides both core and advanced services to its customers. At its most basic level, MAX offers high-performance CI solutions to transport, compute, and analyze data at various speeds. In addition, MAX works closely with customers who require tailored networking and CI solutions to accomplish specialized tasks that are unachievable through standard commercial offerings. MAX's broad service offering enables customers to reach their organizational goals and conduct critical research studies that will lead to scientific innovations.

Innovation

The MAX mission comes full circle at the pillar of innovation, which results from research discoveries that are enabled through high-performance and advanced CI services. As new innovations emerge, they often lead to more efficient networking solutions and improved CI services. Although MAX directly benefits from such innovations, the surrounding community is also impacted by the new opportunities for economic development in the technological and entrepreneurial space. MAX continues to strive for innovation, especially when it provides benefits to society as a whole.

MAXimizing THE FUTURE: The Next Five Years

MAX's growth for the next five years is defined through six strategic goals. These goals speak to a holistic approach to advancing the mission of MAX by adding value, expanding resources, marketing the MAX brand, and maintaining financial sustainability.

Strategic Goal 1 Advanced Networking, Operational Excellence, and the MAX Network Footprint

MAX will provide a high capacity and reliable transport infrastructure. The infrastructure will be well-resourced and connected to regional, national, commercial, and international networks. Additionally, the network will provide direct access to commercial and private cloud services. MAX will manage the infrastructure with relentless attention to operational excellence, in which the MAX network footprint will grow to meet the needs of its customers in the Mid-Atlantic region.

1.1 MAX will continue to increase its bandwidth and throughput capability to stay ahead of the growing needs of its customers.

1.2 MAX peers with many national, commercial, and mission networks, and will continue to grow such peerings to ensure direct and versatile access for customers' needs.

1.3 MAX will embrace cloud services with well-provisioned cloud connectivity and will attend to customers' special needs for direct connections, cloud exchange, and similar services.

1.4 MAX will employ best practices in operating its infrastructure and services. It will use network and service telemetry to ensure adequate service capacity at all times.

1.5 The MAX network footprint will continue to grow and expand to meet the needs of its customers in the Mid-Atlantic region. New PoPs will be added to increase service value and network reachability.

Strategic Goal 2 Flexible Transport, Security, and Intelligent Edge Services

MAX will offer creative and flexible transport services at both the optical layer as well as at the Ethernet and IP layers. MAX will enhance its intelligent, advanced, and innovative edge resource—MAXedge. The MAXedge will provide the capability to orchestrate and program its resources. It will be highly resourced with midscale and HPC clusters, with advanced storage solutions and with high-capacity networking to external resources. Access to the MAXedge is optimized for scientific workflows. Cyber security threats continue to grow. Network operators need to ensure the integrity of in-flight data transmission and protect against network intrusions. MAX will expand its offering of security-related services.

2.1 MAX will expand managed Alien Wave optical services to facilitate customers' needs.

2.2 MAX will be creative in how it provisions customer-centric Ethernet and IP services.

2.3 MAX will expand its HPC resources and expertise to address the growing needs of the R&E community—increasing both compute and storage capacity. MAX will be creative in how it provisions HPC services to maximize utilization of these resources.

2.4 MAX will be creative in satisfying customer needs for edge cloud services. This includes provisioning network connections between enterprise, regional, and public cloud facilities, as well as providing customers self-service MAXedge resources.

2.5 MAX will offer network security-related services like secure transport and DDoS mitigation. MAX will continue to partner on other security services like Trusted Internet Connection (TIC) and continue to explore new threat mitigation technologies that enhance security.

Strategic Goal 3 Customer Engagement and Partnerships

The MAX service suite is built in support of the R&E community. MAX will have direct engagement with its customers and respond to their needs to enhance service functionality and user experience. By partnering with other organizations that provide complementary services, MAX can empower its customer base with best-of-breed solutions.

3.1 MAX will continue to strengthen relationships with customers during the next five years through personalized engagement to understand their service needs. By maintaining a close connection with its customers, MAX will keep its finger on the pulse of their evolving requests and can adapt its service offerings accordingly. The intent is to enrich the user experience of MAX services.

3.2 MAX will continue engaging in existing partnerships to provide value-added services to its customers. MAX will also partner with other service providers in the ecosystem to increase value. The purpose of such partnerships is to bring complementary and transformative solutions to the R&E community as a total package.

Strategic Goal 4 Research and Development

MAX will continue to be a thought leader by engaging in innovative R&D. R&D will be achieved through sponsored research activities and with strategic and synergistic partnerships with private sector corporations. MAX has a history of offering innovative solutions and investigating leading-edge technologies with a keen focus on R&D.

4.1 MAX's network will continue to be resourced with advanced and evolving technologies, as MAX has segmented its network to provision an advanced research network for R&D. State-of-the-art solutions will be trialed in this network before being deployed in the production network.

4.2 MAX will seek opportunities to conduct research in support of innovative ideas in cyberinfrastructure and Internet technologies.

4.3 MAX will be a supporter, enabler, and collaborator for customers' ongoing and future research projects—providing researchers with custom network, compute and storage infrastructure solutions, and professional hands-on expertise.

4.4 MAX will develop new services and features within existing services using the results of its research efforts as well as employ a Development and Operations (DevOps) model to rapidly build out services based on user requirements and feedback.

4.5 MAX will investigate opportunities to partner with private sector companies on its innovations.

4.6 MAX will broaden its customer base by being a leader in investigating and deploying emerging technologies, innovative research projects, and development focused on modern infrastructure needs.

Strategic Goal 5 Financial Planning and Competitive Value

Providing networking and cyberinfrastructure services is capital intensive by nature. MAX will continue following sound financial planning strategies to ensure sustainability and growth. MAX will also maintain its competitive edge by providing cost-efficient services that deliver unparalleled value to its customers.

5.1 MAX will track key financial performance indicators and use forecasting to ensure fiscal health at all times.

5.2 MAX will constantly evaluate developments in the networking and cyberinfrastructure industries and will ensure that it is financially prepared to refresh its technology at the appropriate time.

5.3 MAX will actively monitor service pricing to provide customers MAXimum value while fulfilling its mission. MAX will remain committed to customer retention and growth and consistently provide value-added services with optimum benefits to its customers.

Strategic Goal 6 Marketing, Sales, and Communications

The MAX brand is rooted in organic growth. Customer acquisition is based on reputation and by word-of-mouth. MAX will take a more formal and structured approach to communicating, marketing, and further positioning its brand.

6.1 MAX will create a marketing strategy to inform its target community about the MAX brand.

6.2 MAX will create a communications plan to attract diverse disciplines onto its cutting-edge CI service platform.

6.3 MAX will continue to enrich its annual customer meeting to further establish the MAX brand and hold workshops highlighting new advances in the networking and CI ecosystem.

6.4 MAX will actively seek customers within the vibrant community in the Mid-Atlantic region to fulfill their advanced CI service needs.

6.5 MAX will employ social media tools to communicate and advance the MAX brand.

Ensuring Currency and Relevance of the Plan

The information technology landscape and ecosystem are changing at an amazing pace of innovation. The shelf life of ideas and plans is often short, and MAX wants to ensure the currency and relevance of its strategic plan. The mechanics of this is realized through a checkpoint within the strategic plan's five-year lifetime. MAX will employ a 3+2 MAX-Checkpoint to create such assurance.

3+2 MAX-Checkpoint

MAX will be implementing a 3+2 MAX-Checkpoint that will ensure MAXimum relevance within its strategic goals. MAX is aware that technology and customer needs are always evolving, making it necessary to provide the most innovative and effective services possible.

Once the third year is reached, MAX will reassess whether its current trajectory and strategic plan are still relevant within the research and education community. In the remaining two years, MAX will devote its efforts to adjusting and adapting technologies and services to the newly assessed requirements of customers. By implementing the 3+2 MAX-Checkpoint, MAX will also more accurately envision a better five-year strategic plan in the coming years.

SUMMARY

The MAX 2019-2024 Strategic Plan responds to the quickly changing landscape of networking and cyberinfrastructure services. MAX will build upon its platform of excellence to face the challenges of the next five years. The strategic goal is to continue to offer value to customers, engage more directly, and offer customized differentiated services. The 3+2 MAX-Checkpoint will serve to further course correct MAX's path and recalibrate the relevance of its approach. No doubt, in 2025 and beyond, the landscape will be different and MAX will be ready to MAXimize the future yet again.

Ready for 2019-2024 and preparing for 2025 and beyond

THE MAX TEAM

GLOSSARY

3+2 MAX-Checkpoint – a MAX-specific program to assure currency and relevance within a 5-year strategic plan. By the third year, the current trajectory of MAX's strategic plan is reassessed and the following two years are devoted to adjusting and adapting technologies and services.

Alien Wave – a "colored" optical signal from equipment not under direct control of the transmission network operator.

Amazon – a multinational technology company in Seattle, Washington doing business as Amazon.com, Inc., which focuses in e-commerce, cloud computing, and artificial intelligence.

ARL (Army Research Laboratory) – the U.S. Army's corporate research laboratory, which is headquartered at the Adelphi Laboratory Center (ALC) in Adelphi, Maryland.

AWS (Amazon Web Services) – a comprehensive, evolving cloud computing platform provided by Amazon. It provides a mix of infrastructure as a service (IaaS), platform as a service (PaaS), and packaged software as a service (SaaS) offerings.

AWS Direct Connect – an established, dedicated connection from an on-premise network to the Amazon Cloud.

Bluecrab – the main HPC cluster at MARCC. It consists of about 850 nodes, mostly dual-core Haswell (about 22,000 cores).

CI (Cyberinfrastructure) – information technology services or systems that support or provide advanced capabilities.

ConnectArlington – a digital telecommunication service for Arlington County that provides fiber-optic, high-speed, dedicated network that connects county and school buildings.

Commercial Networks – are networks that focus on base-level "commodity" service, rather than specialized missions or high-performance service.

D-root – one of the 13 global DNS root service identifiers that provide Domain Name System (DNS) services for the Internet. University of Maryland is the operator of the service which is managed by MAX.

DCN (Dynamic Circuit Network) – an advanced computer networking technology that uses Internet protocols to provide on-demand circuit services over packet-switched networks.

DDoS Mitigation Service – a set of resources to resist and mitigate the impact of distributed denial-of-service (DDoS) attacks on networks attached to the Internet—protecting the target and relay networks.

Deepthought2 – the University of Maryland's flagship HPC cluster that is networked by MAX at 100 Gbps. It consists of almost 500 nodes, mostly dual-core Ivy Bridge (about 10,000 cores).

DevOps (Development and Operations) – a set of software development practices that combines software development with information technology operations to shorten the systems development life cycle—delivering features, fixes, and updates frequently in close alignment with business objectives.

DNS (Domain Name System) - a hierarchical and decentralized naming system for computers, services, or other resources connected to the Internet or a private network. DNS translates domain names to IP addresses.

DRAGON (Dynamic Resource Allocation via GMPLS Optical Networks) System – was a system developed as part of an NSF funded research project that focused on researching SDN-style data plane and control plane separation.

DWDM (Dense Wavelength Division Multiplexing) – an optical multiplexing technology used to increase bandwidth over existing fiber networks.

ESnet (Energy Sciences Network) – a high-performance network built to support scientific research. ESnet is funded by the U.S. Department of Energy's (DOE) Office of Science (SC) and managed by Lawrence Berkeley National Laboratory. ESnet provides services to more than 40 DOE research sites and connects to 140 research and commercial networks.

Ethernet – the traditional technology for connecting local area networks (LANs), and enables devices to communicate with each other via a set of rules or a common network language—a protocol.

Federal Customer – a MAX federal government customer.

GENI (Global Environment for Network Innovations) – provides a virtual laboratory for networking and distributed systems research and education. It is well suited for exploring networks at scale, thereby promoting innovations in network science, security, services, and applications.

Higher Education Customer – a MAX higher education customer.

HOPI (Hybrid Optical Packet Infrastructure) – was an Internet2 testbed which supported the development of new dynamic circuit network services and supporting technologies.

HPC (High-Performance Computing) – the use of parallel processing for running advanced application programs at high speeds efficiently.

Internet2 – a member-driven advanced technology community working in partnership with higher education institutions, industry, and government to develop and deploy advanced network applications and technologies.

Internet2's AL2S (Advanced Layer 2 Service) – provides scalable and flexible global access to an open exchange network where members can support data-intensive science or production applications by building short or long-term Layer 2 circuits between endpoints on the Internet2 network and beyond.

IP (Internet Protocol) – the communication method by which data is sent from one host to another on a network.

Juggernaut – MAX's high-performance computing cluster, providing compute and storage resources to the MAXedge edge resource. Although currently small (20 nodes, about 750 cores) it is growing.

Managed Alien Waves Service - an alien wave across MAX's production infrastructure, managed on behalf of a MAX customer.

MARCC (Maryland Advanced Research Computing Center) – a shared computing facility located on the Johns Hopkins University Bayview Campus and funded by a State of Maryland grant. MARCC is jointly managed by the Johns Hopkins University and the University of Maryland.

MAXedge - an intelligent, advanced and innovative edge computing facility operated by MAX. It is built upon cloud computing and SDN technologies and provides secure and high-performance services in a multi-tenancy, on-demand and as-a-service fashion.

Mission Network – a network built around a defined mission.

National Network – a network that provides shared network services and connectivity options to its community.

NASA (National Aeronautics and Space Administration) – an independent agency of the United States Federal Government responsible for the civilian space program, as well as aeronautics and aerospace research.

NOAA (National Oceanic and Atmospheric Administration) – an American scientific agency within the United States Department of Commerce that focuses on the conditions of the oceans, major waterways, and the atmosphere.

NSF (The National Science Foundation) – a United States government agency that supports fundamental research and education in all the non-medical fields of science and engineering.

N-Wave – NOAA's Enterprise network which connects researchers to the data and resources needed to advance environmental science. N-Wave is built on partnerships and relationships among NOAA and the academic and state research network communities.

NRL (Naval Research Laboratory) - the corporate research laboratory for the United States Navy and the United States Marine Corps, which is headquartered in Washington, DC.

PoP (Point of Presence) – a location that MAX has built its infrastructure into to serve as an aggregation point for customer connections. Some MAX PoPs are exchange points for the additional purpose of connecting to other providers.

The Quilt – the national coalition of non-profit regional research and education networks in the U.S. The Quilt represents 40 networks across the country.

Research Customer – a MAX research network customer.

SC (SuperComputing) – an annual technical conference that showcases high-performance computing, networking, storage, and analysis.

ScienceDMZ – refers to a computer subnetwork that is designed to be secure and whose performance is not limited by security services like firewalls and intrusion prevention services.

SD-SDMZ (Software Defined ScienceDMZ) – a term used by MAX to define a ScienceDMZ facility that is built on cloud computing technologies and serves its users in an as-a-service fashion.

SDx (Software Defined Everything) – a technology where software performs and/or automates the function(s) of a physical device.

SDN (Software Defined Network) – an architecture that defines how a networking and computing system can be built using a combination of open, software-based technologies and commodity networking hardware that separate the control plane and data plane of the networking stack.

Starlight - an international and national communications exchange facility for global advanced networks in Chicago.

TIC (Trusted Internet Connection) – a secure external network connection that provides firewalls, inspections, and captures of all dataflows to all federal agencies' public-facing networks.

WAN (Wide Area Network) – any telecommunications/computer network that extends over a large geographical distance.

5825 University Research Court, Suite 2500
College Park, Maryland 20740

(301) 405-0700

www.maxgigapop.net