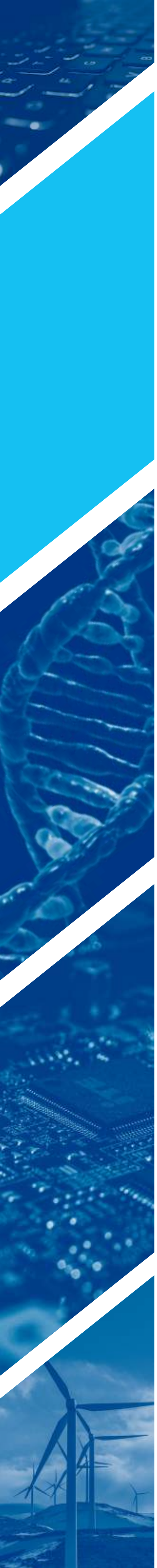


THE UNIVERSITY OF MEMPHIS | Office of Technology Transfer

FedEx INSTITUTE OF TECHNOLOGY THE UNIVERSITY OF MEMPHIS

ADAPTIVE MULTIFACTOR AUTHENTICATION (A-MFA) SYSTEM

Auth-Spectra is a patented technology (US 9,912,657) for Adaptive Multi-Factor Authentication (A-MFA) that uses a combination of passwords, biometrics, cognitive behavior, and other factors in order to create a trustworthy authentication system that intelligently selects the most appropriate authentication factors. A-MFA does this by selecting modalities based on the device in use and surrounding conditions providing the perfect balance between powerful security and low-maintenance usability creating a secure, highly confident authentication framework that you can trust.

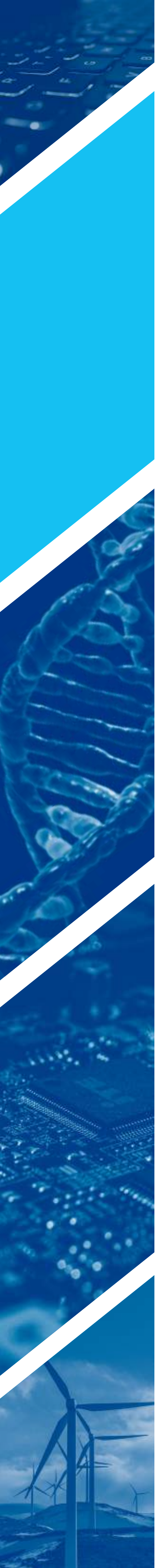
APPLICATIONS

Continuous, high-confidence, identity authentication for:

- Banking, including online funds transfer
- Online testing in education and training settings
- Secure access to Electronic Medical Records
- Access to sensitive sites by government employees and others
- Smart Grid Security
- Internet of Things (IoT) sensory data access
- Use in Blockchain Technology for access verification to open ledger
- Gas pipeline and related industry applications
- General user Internet access & email services
- Opening payslips or sensitive documents using A-MFA
- Specific web services such as PayPal, Netflix and other paid services

Deployable at different levels of Internet Computing:

- Application level (financial applications, email/business/personal applications, social applications)
- User level (root user, administrators, guest user)
- Document level (PDF containing application form, document containing proprietary information, image/video containing confidential and sensitive footage)

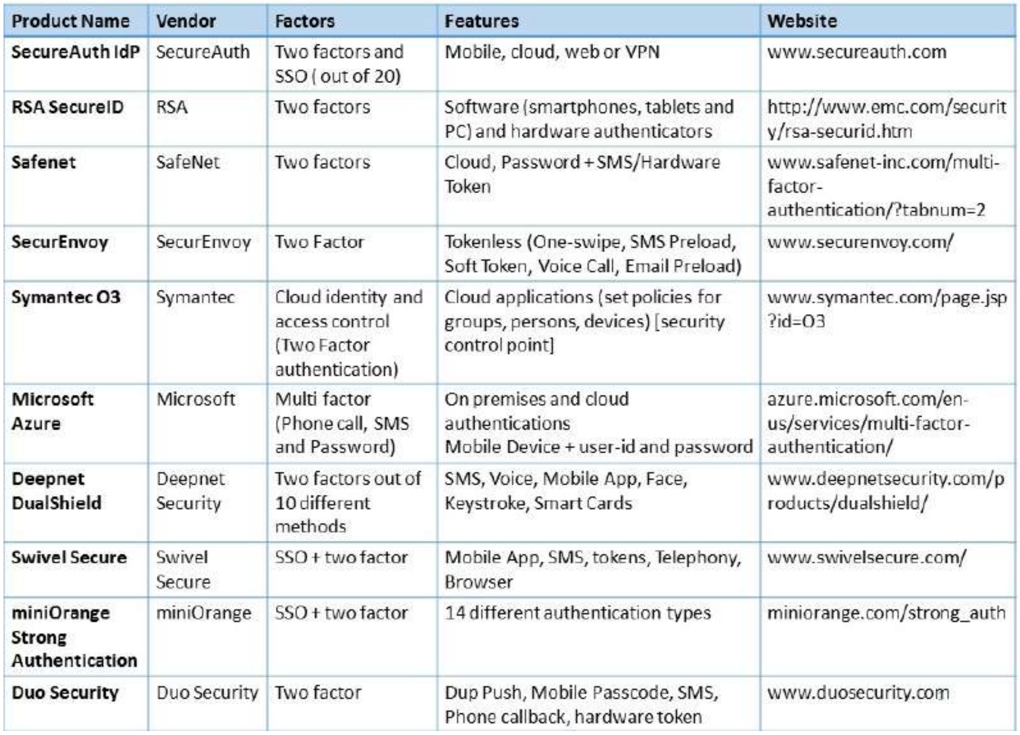


ADVANTAGES OF ADAPTIVE MFA SYSTEM

The major advantages of the implemented framework over other existing MFA technologies:

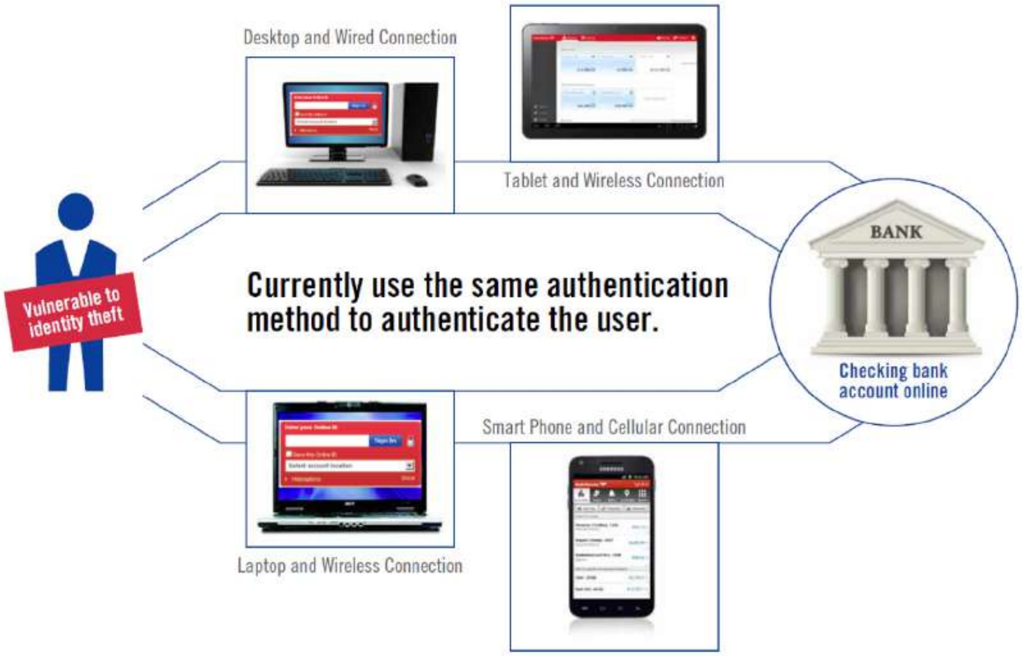
- Assures user identity during an interactive session and beyond the initial log-in.
- If an authentication modality is compromised, the system can adjust to authenticate users with the remaining non-compromised modalities.
- It ensures avoidance of repetitive selections to authenticate users if the operating conditions remain the same.
- Scalable: New authentication modalities can easily be integrated to augment the existing sets of modalities.
- Flexible: Allows for generation of the operating/configuration parameters for the added authentication modalities as they become available.
- Just-in-time selection algorithm chooses optimal authentication modalities for the user's operating environment.

COMPARISON WITH OTHER EXISTING MFA APPROACHES:



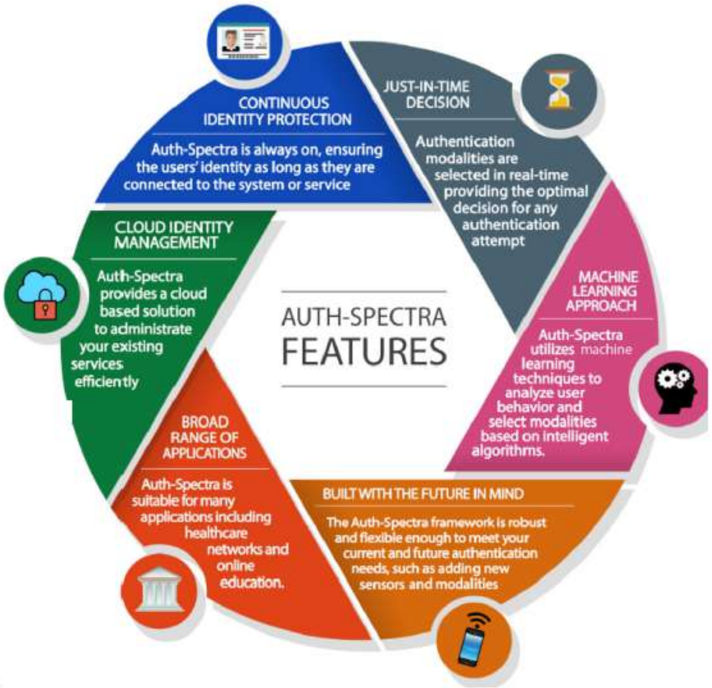
Product Name	Vendor	Factors	Features	Website
SecureAuth IdP	SecureAuth	Two factors and SSO (out of 20)	Mobile, cloud, web or VPN	www.secureauth.com
RSA SecureID	RSA	Two factors	Software (smartphones, tablets and PC) and hardware authenticators	http://www.emc.com/security/rsa-securid.htm
Safenet	SafeNet	Two factors	Cloud, Password + SMS/Hardware Token	www.safenet-inc.com/multi-factor-authentication/?tabnum=2
SecurEnvoy	SecurEnvoy	Two Factor	Tokenless (One-swipe, SMS Preload, Soft Token, Voice Call, Email Preload)	www.securenvoy.com/
Symantec O3	Symantec	Cloud identity and access control (Two Factor authentication)	Cloud applications (set policies for groups, persons, devices) [security control point]	www.symantec.com/page.jsp?id=O3
Microsoft Azure	Microsoft	Multi factor (Phone call, SMS and Password)	On premises and cloud authentications Mobile Device + user-id and password	azure.microsoft.com/en-us/services/multi-factor-authentication/
Deepnet DualShield	Deepnet Security	Two factors out of 10 different methods	SMS, Voice, Mobile App, Face, Keystroke, Smart Cards	www.deepnetsecurity.com/products/dualshield/
Swivel Secure	Swivel Secure	SSO + two factor	Mobile App, SMS, tokens, Telephony, Browser	www.swivelsecure.com/
miniOrange Strong Authentication	miniOrange	SSO + two factor	14 different authentication types	miniorange.com/strong_auth
Duo Security	Duo Security	Two factor	Dup Push, Mobile Passcode, SMS, Phone callback, hardware token	www.duosecurity.com

SAMPLE SCENARIO:


Desktop and Wired Connection
Tablet and Wireless Connection
Vulnerable to identity theft
BANK
Checking bank account online
Smart Phone and Cellular Connection
Laptop and Wireless Connection

Currently use the same authentication method to authenticate the user.

AUTH-SPECTRA FEATURES:



CONTINUOUS IDENTITY PROTECTION

Auth-Spectra is always on, ensuring the users' identity as long as they are connected to the system or service

JUST-IN-TIME DECISION

Authentication modalities are selected in real-time providing the optimal decision for any authentication attempt

MACHINE LEARNING APPROACH

Auth-Spectra utilizes machine learning techniques to analyze user behavior and select modalities based on intelligent algorithms.

BUILT WITH THE FUTURE IN MIND

The Auth-Spectra framework is robust and flexible enough to meet your current and future authentication needs, such as adding new sensors and modalities

BROAD RANGE OF APPLICATIONS

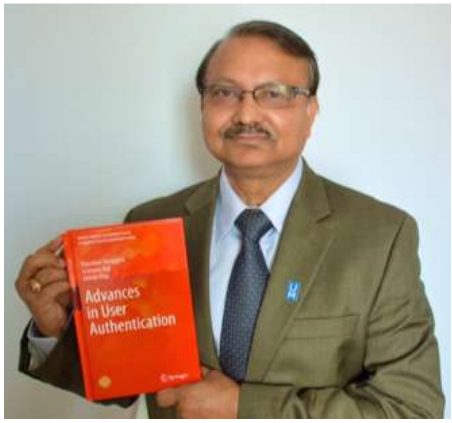
Auth-Spectra is suitable for many applications including healthcare networks and online education.

CLOUD IDENTITY MANAGEMENT

Auth-Spectra provides a cloud based solution to administrate your existing services efficiently

THE INVENTOR

Dipankar Dasgupta is a Professor of Computer Science at the University of Memphis. He joined UofM in January 1997 and since then he has been significantly involved in research, education and service activities. Dr. Dasgupta is at the forefront of research in applying bio-inspired and machine learning approaches to cyber defense. Some of his groundbreaking works, like digital immunity, negative authentication, cloud insurance model, and Auth-Spectrum put his name in Computer World Magazine and other News media. Dr. Dasgupta is an Advisory Board member of the Geospatial Data Center (GDC) Massachusetts Institute of Technology since 2010 and has worked on joint research projects with MIT.



Dr. Dipankar Dasgupta

Dr. Dasgupta published two textbooks, two edited volumes and several co-edited journals and conference proceedings. His latest textbook, *Advances in User Authentication* was published by Springer-Verlag August 2017 (already having 2730 downloads according to Bookmetrix). Dr. Dasgupta's multidisciplinary research resulted in more than 250 publications with 15000+ citations and having an h-index of 56 per Google Scholar. He received five Best Paper Awards at international conferences (1996, 2006, 2009, 2012 and 2017) and two Best Runner-Up Paper Awards (2013 and 2014). Among many other university awards, he is the recipient of the 2012 Willard R. Sparks Eminent Faculty Award, the highest distinction and most prestigious honor given to a faculty member by the University of Memphis. Dr. Dasgupta received the 2014 ACM SIGEVO Impact Award and also designated as an ACM Distinguished Speaker. Since 2007, he has been organizing the Symposium on Computational Intelligence in Cyber Security (CICS) at the IEEE Symposium Series on Computational Intelligence (SSCI) and the annual Cyber Security Summit at the University of Memphis. Dr. Dasgupta has received external funding from different federal agencies including NSF, DARPA, IARPA, NSA, NAVY, ONR DoD and DHS/FEMA. He hasreceived continued research support for last 20 years and is one of the faculty members with an excellent funding record in the University.