THE UNIVERSITY OF ARIZONA.

New Academic Program Workflow Form

General

Proposed Name: Cloud

Transaction Nbr: 00000000000056

Plan Type: Specialization

Academic Career: Undergraduate

Degree Offered: Undergraduate Certificate

Do you want to offer a minor? N

Anticipated 1st Admission Term: Fall 2021

Details

Department(s):

UAZS

DEPTMNT ID	DEPARTMENT NAME	HOST
2910	College of Applied Science and Technology	Y

Campus(es):

DIST

LOCATION	DESCRIPTION
CHANDLER	Chandler
YUMA	Yuma

ONLN

LOCATION	DESCRIPTION
ONLN	UA Online

SOUTH

LOCATION	DESCRIPTION
DOUGLAS	Douglas
NOGALES	Nogales
PIMACCEAST	Pima Community College East

LOCATION	DESCRIPTION
SIERRAVSTA	Sierra Vista

Admission application terms for this plan: Spring: Y Summer: Y Fall: Y

Plan admission types:

Freshman: N   Transfer: N Readmit: N   Graduate: Y

Non Degree Certificate (UCRT only): N

Other (For Community Campus specifics): N

Plan Taxonomy: 11.0101, Computer and Information Sciences, General

Program Length Type: Program Length Value: 0.00

Report as NSC Program:

SULA Special Program:

Print Option:

Diploma: Y   Undergraduate Certificate in Cloud Computing

Transcript: Y   Undergraduate Certificate in Cloud Computing

Conditions for Admission/Declaration for this Major:

Student Admittance/Advising/Completion - a high school diploma or equivalent is required for admission to an undergraduate certificate.
a.   There are no prerequisites or standardized tests required for admission. Students who meet the requirements for admission to BAS programs are eligible for admission to the undergraduate certificate.
b.   Concurrent enrollment in the BS, BA, or BAS programs is allowed but not required
c.   A maximum of 6 units of upper division transfer credit can be evaluated for application to the certificate.
d.   Academic advisors for the BAS in Cyber Operations will also advise the certificate program. No additional advising staff will be needed to support the certificate.
e.   Students will be allowed to enroll in 9 semester hours in the first semester and have the ability to complete the certificate in two semesters.
f.   A student may not use units taken in non-degree status to satisfy this undergraduate certificate¿s requirements.
g.   This certificate will be offered to students enrolled in UA Online degree programs.

Requirements for Accreditation:

N/A

Program Comparisons

University Appropriateness

The University of Arizona has begun leveraging this capability through is cloud consulting arm, supporting University research and collaboration. Cloud computing is expected to increase exponentially over the next few years. As such, to continue to lead in the 4th IR, this certificate will provide students with the skills and abilities to not only understand cloud computing, but be able to design, architect and instantiate cloud resources to support organizational needs. This is a critical need in the United States and internationally, and UA will be leaders in this space.

Arizona University System

NBR	PROGRAM	DEGREE	#STDNTS	LOCATION	ACCRDT

Peer Comparison

see attached.

Faculty & Resources

Faculty

Current Faculty:

INSTR ID	NAME	DEPT	RANK	DEGREE	FCLTY/%
22078226	Paul Wagner	2910	Assit. Prof. Pract.	Master of Science	1.00
00634016	Henry Werchan	2910	Adj. Instor.	Master of Science	.49
22076052	Terry Keene	2910	Adj. Instor.	Master of Science	.49
22082752	Gurmindersingh Khalsa	2910	Adj. Instor.	Master of Science	.49

Additional Faculty:

Assistant Professor of Practice - Network Operations (Year 1)

Current Student & Faculty FTE

DEPARTMENT	UGRD HEAD COUNT	GRAD HEAD COUNT	FACULTY FTE
2910	96	0	4.00

Projected Student & Faculty FTE

	UGRD HEAD COUNT			GRAD HEAD COUNT			FACULTY FTE		
DEPT	YR 1	YR 2	YR 3	YR 1	YR 2	YR 3	YR 1	YR 2	YR 3
2910	15	30	50	0	0	0	5.00	5.00	5.00

Library

Acquisitions Needed:

Physical Facilities & Equipment

Existing Physical Facilities:

Virtual Learning Environment

Additional Facilities Required & Anticipated:

Other Support

Other Support Currently Available:

Supported by CAST staff.

Other Support Needed over the Next Three Years:

Comments During Approval Process

4/6/2020 2:53 PM
PAULEWAGNER

Comments
Approved.

4/6/2020 4:12 PM
LDENNO

Comments
Approved.

4/6/2020 4:15 PM
SWIELAND

Comments
Approved.

UNDERGRADUATE CERTIFICATE – ADDITIONAL INFORMATION FORM

Note: Certificate programs offered at the University of Arizona, at the undergraduate or graduate level, are not approved as eligible programs for federal student financial aid. Although students enrolled in certificate programs are not eligible for any federal student aid programs, students may be eligible for private loans, outside scholarships, and University of Arizona department funding. For more information, please see Federal Student Financial Aid Eligibility for Programs.

I.   **General Information**

    a.   Proposed Title of Certificate: Cloud Certificate -- Undergraduate

    b.   CIP Code: 11.0101, Computer and Information Sciences, General

    c.   Anticipated first admission term: Fall 2021

II.   **Requested by** The College of Applied Science & Technology

III.   **Program Affiliation** – specify whether the UA offers an affiliated undergraduate program – the affiliated program may or may not have the same name as the proposed certificate.

Undergraduate Major in Cyber Operations
Undergraduate Major in Applied Computing
Additional Undergraduate Majors associated with computer science, information sciences, and informatics

IV.   **Certificate Description** The 18-credit hour Cloud Certificate will provide undergraduate students the confidence and training they need to leverage virtualization and cloud technologies to support small and large businesses and government and non-governmental organizations. This certificate will signal to employers that students have dedicated the time and energy necessary to develop the skills and confidence for tackling the complicated infrastructure related to virtualization, Amazon Web Services, and Microsoft Azure. The certificate will service a diverse student population, training both technically minded students the nuances of developing, storing, protecting, and leveraging elasticity provided by cloud technologies. The certificate will require students to have a fundamental knowledge to networking concepts and basic security concepts. The course outline will provide students with a baseline on virtualization technologies, introduction to

cloud technologies, and then follow up with courses focusing on the two leaders in cloud services (Amazon and Microsoft), and then discuss advanced topics on cloud computing.

V. Purpose

The Cloud Certificate is distinct in its accessibility for students from across domains, fields, and disciplines at the University. It serves students who may or may not bring experience or prerequisites required of many computer science, information systems, and network operations. It is important to note that this certificate is designed to support degree and non-degree seeking students alike. UA is expanding its corporate partnerships and this certificate is appropriately designed to support their needs as well as the needs of the Department of Justice (DOJ), Department of Defense (DoD), and other governmental and non-governmental partners.

VI. Target Audience(s)

This program serves students from across the university, and specifically those without the math, information science, or computer science background some expect of network engineers. The required courses are designed to build skills and knowledge in these areas alongside the associated computer, cloud technologies and associated infrastructures.

i. This certificate meets the needs of many of our industry partners, ranging from multi-billion dollar insurance companies to local tech startups and Department of Defense, governmental, and non-governmental organizations.

ii. If a student chooses to do so, they might major in any of the three information science degrees housed in the College of Applied Science & Technology at the University of Arizona – the certificate provides and introductory pathway into any of these degrees:

Undergraduate Major in Applied Computing / Informatics / Network Operations

Undergraduate Major in Cyber Operations

VII. **Certificate Requirements -** complete the table below to list the certificate requirements, including number of credit hours required and any special requirements for completion. Certificate requirements should include sufficient units to provide a substantive program and an appropriate level of academic rigor and in no case be less than 12 units of credit.

Minimum total units required *minimum 12 units*	18
Minimum upper-division units required *minimum 6 units of credit must be upper division UA coursework*	18
Total transfer units that may apply to the certificate.	None
List any special requirements to declare/admission to this certificate	None

Certificate requirements. List all required certificate requirements including core and electives. Courses listed must include course prefix, number, units, and title. Mark new coursework (New). Include any limits/restrictions needed (house number limit, etc.). Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department.	**Core:** **Complete 6 courses (18 units):** NETV 301 Virtualization: Applications and Best Practices (3) (New) NETV/INFV 379 Cloud Computing (3) NETV 380 Introduction to Microsoft Azure (3) (New) NETV 381 Introduction to Amazon Web Services (3) (New) NETV 479 Advanced Cloud Computing: Applications and Best Practices (3) NETV 480 Cloud Security: Incident Response, Penetration Testing, and Advanced Defense (3) (New)

Internship, practicum, applied course requirements (Yes/No). If yes, provide description.	none
Additional requirements (provide description)	none
Any double-dipping restrictions (Yes/No)? If yes, provide description. *A maximum of 6 units may double-dip with a degree requirement (major, minor, General Education) or second certificate.*	None distinct or beyond the University max of 6 units.

VIII. **Current Courses**–using the table below, list all existing courses included in the proposed certificate. You can find information to complete the table using the UA course catalog or UAnalytics (Catalog and Schedule Dashboard> "Printable Course Descriptions by Department" On Demand Report; right side of screen). If the courses listed belong to a department that is not a signed party to this implementation request, upload the department head's permission to include the courses in the proposed certificate and information regarding accessibility to and frequency of offerings for the course(s). Upload letters of support/emails from department heads to the "Letter(s) of Support" field on the UAccess workflow form. Add rows to the table, as needed.

IX.

Course prefix and number (include cross-listings)	Units	Title	Course Description	Pre-requisites	Modes of delivery (online, in-person, hybrid)	Typically Offered (F, W, Sp, Su)	Dept signed party to proposal? (Yes/No)
NETV/INFV 379	3	Cloud Computing	Course covers the theory and application of cloud computing, including Cloud Computing network design and connectivity, server management, best-practices, security, and provider service level agreements. Case studies of industry examples are used as applications to reinforce the discussed theories	None	Online and in person	Fall and Summer	Proposed from dept. housing this course

NETV 479	3	Advanced Cloud Computing: Applications and Best Practices	NETV 479 reviews theory and application of cloud computing from the NETV 379course offering. It builds upon these basics and delves into advanced cloud computing concepts including virtualization, containerization, microservices, cloud storage and programming, software defined architectures (compute, storage and networking), and advanced cloud security. All of the topics are addressed from an overall perspective of official standards, best practices and industry implementations. The course also establishes the economic foundations of cloud computing and how to evaluate different cloud service provider offerings. The course addresses the application of cloud computing to data analytics and big data.	NETV/INFV 379: Cloud Computing and basic programing skills or consent of instructor.	Online and in person	Fall and Spring	Proposed from dept. housing this course

X. **New Courses Needed** – using the table below, list any new courses that must be created for the proposed program. If the specific course number is undetermined, please provide level (ie CHEM 4**). Add rows as needed. Is a new prefix needed? If so, provide the subject description so Curricular Affairs can generate proposed prefix options.

Currently under development are: NETV 301, NETV 380, NETV 381, NETV 480

Course prefix and number (include cross-listings)	Units	Title	Course Description	Pre-requisites	Modes of delivery (online, in-person, hybrid)	Typically Offered (F, W, Sp, Su)	Dept signed party to proposal? (Yes/No)
NETV 301 (New)	3	Virtualization	NETV 301 introduces the theory and application of virtualization. Virtualization is an increasingly ubiquitous feature of current computing architectures. This course is an introduction to virtualization concepts and technologies. It delves into advanced virtualization concepts including containerization, microservices, software defined architectures, and virtualization security. Topics to be covered include: basics of virtual machines, containers and microservices; CPU, memory, storage and network virtualization; paravirtualization, hardware virtualization, and OS-level virtualization (containers); hardware features supporting virtualization and nested virtualization. Actual virtualization software will be used to provide hands-on experience with virtualization.	None	Online and in person	Fall and Spring	Proposed from dept. housing this course

| NETV 380 (New) | 3 | Introduction to Microsoft Azure | NETV 380 develops technical expertise in cloud computing architecture, design and implementation using Microsoft Azure. Microsoft Azure is an ever-expanding set of cloud services to help organization meet their business challenges. Azure provides the ability to build, manage, and deploy applications on a massive, global network using well established tools and frameworks. This course will address designing Azure compute infrastructures, including virtual machines, web applications, serverless and microservices. It will address designing effective network implementations in Azure as well as designing data implementations using different data services, relational database storage, and NoSQL storage. It will include practical hands-on experience solving real-world cloud computing problems with Azure. | NETV/INFV 379: Cloud Computing and basic programing skills or consent of instructor | Online and in person | Fall and Spring | Proposed from dept. housing this course |

| NETV 381 (New) | 3 | Introduction to Amazon Web Services | NETV 381 develops technical expertise in cloud computing architecture, design and implementation using Amazon Web Services (AWS). Amazon Web Services (AWS) is a comprehensive and broadly adopted cloud platform, offering over 175 fully featured services from data centers globally. Millions of customers—including the fastest-growing startups, largest enterprises, and leading government agencies—use AWS to lower costs, become more agile, and innovate faster. This course will address applying AWS business and technical tools and architecting and designing cloud solutions using AWS. This course will address how AWS can help meet compliance, governance, and regulatory requirements. It will include practical hands-on experience solving real-world cloud computing problems with AWS. | NETV/INFV 379: Cloud Computing and basic programing skills or consent of instructor. | Online and in person | Fall and Spring | Proposed from dept. housing this course |

| NETV480 (New) | 3 | Cloud Security: Incident Response, Penetration Testing, and Advanced Defense | NETV 480 addresses the theory and best practice application of security in cloud computing. Cloud computing has become ubiquitous in the information technology and service provisioning sectors, allowing for on-demand, highly elastic, and seemingly infinitely scalable compute and storage capabilities, and supports the secure delivery of business-critical enterprise applications and services. Given the growing importance of cloud delivered services and their very distributed nature, it is imperative that they be afforded proper security. This course will review cloud concepts, architecture, and design, then proceed to addressing cloud data security, cloud platform and infrastructure security, cloud application security, cloud security operations, cloud risk management and compliance management. This course leverages cloud computing security guidelines set forth by the International Organization for Standardization (ISO), European Union Agency for Network and Information Security (ENISA), National Institute of Standards and Technology (NIST), and the Cloud Security Alliance (CSA). | NETV/INFV 379: Cloud Computing and basic programing skills or consent of instructor. | Online and in person | Fall and Spring | Proposed from dept. housing this course |

XI. Faculty & Resources

a. **Current Faculty -** complete the table below. If UA Vitae link is not provided/available, attach a short CV (2-3 pages) to the end of the proposal or upload to the workflow form. UA Vitae profiles can be found in the UA directory/phonebook. Add rows as needed. Delete the <mark>EXAMPLE</mark> rows before submitting/uploading. **NOTE: full proposals are distributed campus-wide, posted on committee agendas and should be considered "publicly visible". Contact Martin Marquez if you have concerns about CV information being "publicly visible".**

Paul Wagner, MS, MBA	Cyber Operations, Teaches CYBV 301, CYBV 326, CYBV 388, CYBV 480	
Henry Werchan, MS	Network Operations, Teaches NETV 379 and NETV 479	
Terry Keene, MS	Network Operations, Teaches NETV 375	
Khalsa Germundersingh, MS	Network Operations, Teaches NETV 375	

b. **Additional Faculty –** Describe the additional faculty needed during the next three years for the initiation of the program and list the anticipated schedule for addition of these faculty members.

Assistant Professor of Practice – Network Operations (Year 1)

c. **Library Acquisitions Needed –** Describe additional library acquisitions needed during the next three years for the successful initiation of the program.

None

d. **Physical Facilities & Equipment -** Assess the adequacy of existing physical facilities and equipment available for the proposed certificate. Include special classrooms, laboratories, physical equipment, computer facilities, etc. Describe additional physical facilities and equipment that will be required or are anticipated during the next three years for the proposed program.

   None

e. **Other Support -** Describe other support currently available for the proposed certificate. Include support staff, university and non-university assistance. List additional staff and other assistance needed for the next three years.

   None

f. **Marketing & Recruitment** - Provide a detailed and robust marketing strategy for this certificate.

   Undergraduate Major Fair
   free, 30 students per year
   Hack Arizona https://hackaz.io/
   free, 30 students per year
   GE courses in computer science across the campus – in class visits about the value of the undergrad certificate
   free, 30 students per year
   Advertising to Current Declared Majors in Cyber Operations (Currently 550 declared majors)
   free, 50students per year
   Statewide Recruitment Activities
   Transfer, military, and career fairs in Yuma County, Cochise County, Maricopa County, Pima County Community College classroom visits in Maricopa County Community College District, Cochise College, Arizona Western College, Pima Community College

g. **Financial -** Provide a copy of the budget for the certificate including start-up costs and the anticipated costs for the first three years. Include some indication of how this fits with the overall department budget.

XII. **Student Learning Outcomes and Assessment** – describe what students should know, understand, and/or be able to do after completing this certificate, and how student outcomes will be assessed.

In completing the Certificate, students will

- Develop architectures using Azure storage, processing and networking capabilities.
- Quantify scalability issues associated with Azure.
- Assess key concepts underlying Azure and evaluate the opportunities and challenges associated with them.
- Implement advanced security issues and challenges of different Azure environments and best practice approaches to mitigate those issues.
- Apply industry best practice security controls to a notional or real-world Azure deployment.
- Assess Azure architectures for costs versus benefits and return on investment.
- Develop architectures using AWS storage, processing and networking capabilities
- Quantify scalability issues as they relate to AWS.
- Assess key concepts underlying AWS and evaluate the opportunities and challenges associated with them.
- Implement advanced security issues and challenges of different AWS environments and best practice approaches to mitigate those issues.
- Apply industry best practice security controls to a notional or real-world AWS deployment.
- Assess AWS architectures for costs versus benefits and return on investment.
- Apply cloud concepts, architecture, and design.
- Critically assess key components of cloud security, including data, application, platform and infrastructure security.
- Demonstrate how cloud security operations supports the DevSecOps life cycle process.
- Identify and assess issues associated with cloud legal, risk and compliance
- Apply applicable best practice and regulatory compliance security guidelines set forth by the International Organization for Standardization (ISO), European Union Agency for Network and Information Security (ENISA), National Institute of Standards and Technology (NIST), and the Cloud Security Alliance (CSA).
- Apply the high-level cloud landscape, architecture and design principles, implementation techniques, design (and anti-design) patterns, and industry best practices.
- Develop a cloud security architecture.
- Analyze and assess the guiding security design principles, design patterns, industry standards, and applied

technologies.
- Map applicable regulatory compliance requirements to the design, implementation, delivery, and management of secure cloud-based services.
- Apply the concepts of storage, processing and networking, and scalability as they relate to virtualization.
- Assess key concepts underlying virtualization and evaluate the opportunities and challenges associated with them.
- Create a virtual machine within a type 2 hypervisor.
- Implement advanced security issues and challenges of different virtualization environments and best practice approaches to mitigate those issues.
- Apply industry best practice security controls to a notional or real-world virtualization deployment.
- Assess virtualization architectures for costs versus benefits and return on investment.

Topics covered:
- AWS Cloud
- AWS Platform
- Security and Compliance
- Cloud Financials
- Migrating to the Cloud
- AWS Infrastructure: Compute, Storage, and Networking
- AWS Security, Identity, and Access Management
- AWS Databases
- AWS Management Tools
- AWS Certification Exam Readiness Workshop
- Basics of Virtual Machines
- Basics of Containers
- How CPU is Virtualized
- How Storage is Virtualized
- How Network is Virtualized
- Nested Virtualization
- Hardware Features Assisting Virtualization
- Deploying Virtual Machines
- Orchestrating Containers
- Datacenters and Virtualization

Assessment Plan
Student Learning Outcomes will be assessed annually through
Conducting hands on exercises in all courses, conducting in-depth investigations, providing a comprehensive report covering investigation and analysis, and using multiple testing methodologies.

XIII. **Certificate Outcomes and Assessment** – identify factors that indicate that completion of the certificate enhances the undergraduate experience. Describe measures for programmatic assessment and provide a detailed plan for assessing certificate outcomes.

Certificate Outcomes
Factors indicating that the Certificate leads to gainful employment and/or advancement include:
Offers of employment to interns at their place of internship, employment at a desirable position (as articulated by the student) within one year of earning the certificate, promotion in professional settings within one year of earning the certificate, and
long-term satisfaction with working conditions (2, 5, and 10 years out from earning the certificate).
Indication from annual surveys of our former students that the certificate was a factor in their employment success.

Assessment Plan
Certificate Outcomes will be assessed
Annually through an outgoing survey of Certificate Students regarding the above factors.
Annually through a survey of employers as identified by those who earned the certificate.

XIV.   Certificate Demand

a. Anticipated Enrollment and General Demand:

According to Forbes, the worldwide spend on cloud computing services is expected to grow at 19.4% from nearly $70B to $141 B (Akraya). This has resulted in over 50,000 jobs available in the US and over 100,000 open positions worldwide (Forbes).

This certificate program will target:
- returning students already working wanting to improve their skills and/or increase their eligibility for promotion,
- students interested in augmenting their current degree program with this particular skill set

Source: https://www.akraya.com/blog/the-must-have-cloud-computing-skills-for-2019
Source: https://www.forbes.com/sites/louiscolumbus/2018/11/27/where-cloud-computing-jobs-will-be-in-2019/#b37d5986add5

Initially, we will target students in our own programs (e.g., BAS Informatics, BAS in Network Operations, BAS in Cyber Security).

3-Year Projected Annual Enrollment:
- 1st Year, 15 students enrolled
- 2nd Year, 30 students enrolled
- 3rd Year, 50 students enrolled

It is estimated that by 2021 95% of global data center traffic will be from the cloud. The expansion of Internet of Things (IoT) devices is linked to this as well. Below are some data points regarding the demand and use of cloud infrastructures:
- Global cloud data center traffic is projected to reach 19.5 ZB per year by 2021, up from 6 ZB in 2015.
- IoT connections will reach 13.7 billion by 2021, up from 5.8 billion in 2016
- Cloud infrastructures continually support various services: Software as a Service, Platform as a Service, Infrastructure as a Service, and additional *as a Service methodologies to support changing business needs

Source: https://www.techrepublic.com/article/95-of-global-data-center-traffic-will-be-from-the-cloud-by-2021/

b. Needs Served by the Certificate

From a recent article in Forbes there will be an increase in the demand for cloud computing expertise. There are currently over 50,000 available jobs in the Unites states. The median salary for cloud computing professionals in 2018 was $146,350 which is an increase of over $22,000.

- Arizona predictions show that computing and math-related position numbers are on the rise
- 2014 - 2024 Estimated Increase for Arizona:

  - Computer and Mathematical Industries – Increase of 29%
  - Great Phoenix area will see an increase in 25,000 new IT jobs

Sources:
https://www.forbes.com/sites/louiscolumbus/2018/11/27/where-cloud-computing-jobs-will-be-in-2019/#b37d5986add5
https://chamberbusinessnews.com/2019/05/22/amazon-web-services-mcccd-collaborate-for-cloud-computing-program/

Related Positions:
- Cloud Infrastructure Architect
- Cloud Customer Operations Engineer
- Cloud Architect
- Software Architect
- Cloud Operations Engineer
- Full Stack Developer
- Cloud Engineer
- Data Engineer
- Front End Developer
- Back End Developer
- Systems Administrator

Local worksites for computing students include:
- Y3K IT Services
- Amazon
- Yuma Proving Grounds
- Allstate

- Redflex Traffic Systems
- Safe Health
- VMware

Similar programs:
- American Public University – Online Undergraduate Certificate in Cloud Computing
- ECPI University - BS CIS Cloud Computing Track
- Purdue University Global IT Degree Programs – BS in Cloud Computing

C. Collaborations

There will be no collaborations with other departments or universities for this certificate program other than donated courses toward this program if depts. choose to do so.

XV. Contacts and Administration

a. List the name and contact information for the primary point of contact for the certificate.

Paul Wagner, Department Head, College of Applied Technology, paulewagener@arizona.edu

b. List the name and contact information for the person or persons who will serve in the role of Director of Undergraduate Studies (DUS) for the certificate. (This is not always the same as the DUS for affiliated programs or head of the managing academic unit.)

Li Xu, Director of Applied Computing, lxu@arizona.edu

THE UNIVERSITY OF ARIZONA®

BUDGET PROJECTION FORM

Name of Proposed Program or Unit:

		Projected	
Budget Contact Person:	**1st Year** 2021-2022	**2nd Year** 2022-2023	**3rd Year** 2023-2024
METRICS			
Net increase in annual college enrollment UG	15	30	50
Net increase in college SCH UG	270	540	900
Net increase in annual college enrollment Grad	-	-	-
Net increase in college SCH Grad	-	-	-
Number of enrollments being charged a Program Fee	-	-	-
New Sponsored Activity (MTDC)	-		
Number of Faculty FTE	-	-	-
FUNDING SOURCES			
Continuing Sources			
UG RCM Revenue (net of cost allocation)			
Grad RCM Revenue (net of cost allocation)			
Program Fee RCM Revenue (net of cost allocation)			
F and A Revenues (net of cost allocations)			
UA Online Revenues	$135,000	$270,000	$450,000
Distance Learning Revenues			
Reallocation from existing College funds (attach description)			
Other Items (attach description)			
Total Continuing	**$135,000**	**$270,000**	**$450,000**
One-time Sources			
College fund balances			
Institutional Strategic Investment			
Gift Funding			
Other Items (attach description)			
Total One-time			
TOTAL SOURCES	**$135,000**	**$270,000**	**$450,000**
EXPENDITURE ITEMS			
Continuing Expenditures			
Faculty	$70,000	$70,000	$70,000
Other Personnel			
Employee Related Expense	$22,050	$22,050	$22,050
Graduate Assistantships			
Other Graduate Aid			
Operations (materials, supplies, phones, etc.)			
Additional Space Cost			
Other Items (attach description)			
Total Continuing	**$92,050**	**$92,050**	**$92,050**
One-time Expenditures			
Construction or Renovation			
Start-up Equipment			
Replace Equipment			
Library Resources			
Other Items (attach description)			
Total One-time			
TOTAL EXPENDITURES	**$92,050**	**$92,050**	**$92,050**
Net Projected Fiscal Effect	**$42,950**	**$177,950**	**$357,950**

Undergraduate Certificate Peer Comparison Chart- Select two peers for completing the comparison chart from (in order of priority) ABOR-approved institutions, AAU members, and/or other relevant institutions recognized in the field. The comparison chart will be used to identify typically required coursework, themes, and experiences for certificate programs within the discipline. The comparison programs are not required to have the same certificate name as the proposed UA program. Information for the proposed UA program must be consistent throughout the proposal documents. Delete EXAMPLE columns once ready to submit/upload.

Certificate name, institution	Proposed UA Program:	Peer 1:	Peer 2:
Current# of enrolled students	⬛		
Certificate program description	The 18-credit hour Cloud Certificate will provide undergraduate students the confidence and training they need to leverage virtualization and cloud technologies to support small and large businesses and government and non-governmental organizations. This certificate will signal to employers that students have dedicated the time and energy necessary to develop the skills and confidence for tackling the complicated infrastructure related to virtualization, Amazon Web Services, and Microsoft Azure. The certificate will service a diverse student population, training both technically minded students the nuances of developing, storing, protecting, and leveraging elasticity provided by cloud technologies. The certificate will require students to have a fundamental knowledge to networking concepts and basic security concepts. The course outline will provide students with a baseline on virtualization technologies, introduction to cloud technologies, and then follow up with courses focusing on the two	https://www.ecpi.edu/programs/cloud-computing-bachelor-degree Cloud computing or software services provided across the internet are ushering in a wave of new opportunities to help businesses become more flexible, efficient and agile. By providing infrastructures, platforms and software as a service, cloud computing allows users to access and implement important business and technology tools whenever and wherever they need. What's more, the Cloud or internet services are creating demand for professionals to manage these vast networks. According to the U.S. Department of Labor, employment of network and computer systems administrators is expected to grow 8% from 2014 to 2024, faster than the average for all occupations, and demand for these workers is high and should continue to grow as firms invest in newer, faster technology and mobile networks.* If you're interested in pursuing a career in the emerging field of Cloud Computing, consider ECPI University. Through ECPI's accelerated schedule, you can earn a Bachelor of Science Degree in Computer and Information Science	https://www.amu.apus.edu/academic/schools/science-technology-engineering-and-math/certificate-ug/cloud-computing.html The undergraduate certificate in Cloud Computing provides you with basic knowledge of virtualization and network installation and security in a cloud environment. You will focus on data security, governance, compliance, and legacy application migration issues, while learning to implement cloud computing solutions in an enterprise. This online certificate is intended for students who want to expand their knowledge of cloud computing without committing to a degree program

	leaders in cloud services (Amazon and Microsoft), and then discuss advanced topics on cloud computing.	with a major in Cyber and Information Security Technology and a track in Cloud Computing in just 2.5 years. * Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2016-17 Edition	
Target careers	Cloud Infrastructure Architect Cloud Customer Operations Engineer Cloud Architect Software Architect Cloud Operations Engineer Full Stack Developer Cloud Engineer Data Engineer Front End Developer Back End Developer Systems Administrator	Network and Datacenter Administrator Network Infrastructure Support Storage Technology Manager Virtual Server Administrator Information Technology Solution Providers Network Implementation Team Network Support and Help Desks Information Security Engineer	
Minimum total units required	18	15	18
Minimum upper-division units required	18	15	18
Total transfer units that may apply to certificate	None	None	None
List any special requirements to declare/admission to this certificate (completion of specific coursework, minimum GPA, interview, application, etc.)	None	None	None
Certificate requirements. List all certificate requirements including core and electives.	NETV 301 Virtualization: Applications and Best Practices NETV 379 Cloud Computing: Theories and Applications	CIS242 AWS Academy Cloud Foundations CIS253 Network Virtualization Fundamentals (3)	ISSC326 Cloud Computing (3) ISSC345 Service Oriented Architecture (3)

Courses listed must include course prefix, number, units, and title. Mark new coursework (New). Include any limits/restrictions needed (house number limit, etc.).	NETV 380 Introduction to Microsoft Azure (3) NETV 381 Introduction to Amazon Web Services (3) NETV 479 Advanced Cloud Computing: Applications and Bet Practices (3) NETV 480 Cloud Security: Incident Response, Penetration Testing, and Advanced Defense (3)	CIS253L Network Virtualization Fundamentals Lab (1) CIS305 Advanced Linux Administration (3) CIS305L Advanced UNIX Administration Lab (1) CIS343 AWS Academy Cloud Architecting (3) CIS491 Externship – CIS Sr. I-a (1)	ISSC386 Green Computing: Foundations and Strategies (3) ISSC387 Green Computing: Advanced Topics (3) ISSC424 Virtualization Security (3) ISSC426 Cloud Security and Privacy (3)
Internship, practicum, applied course requirements (Yes/No). If yes, provide description.	None	Yes CIS491 Externship – CIS Sr. I-a (1) This course provides graduating bachelor's degree students with real-world experience in a work area appropriate for their particular CIS concentration. Students will learn skills in their field as directed by their faculty member assigned course management, completing 45 hours of on-the-job work assignments for each 1 semester hour of course credit. Upon successful course completion, students will be able to provide all paperwork related to the externship, including weekly observation and work attendance reports to their course faculty manager	None
Additional requirements (provide description)	None	None	None

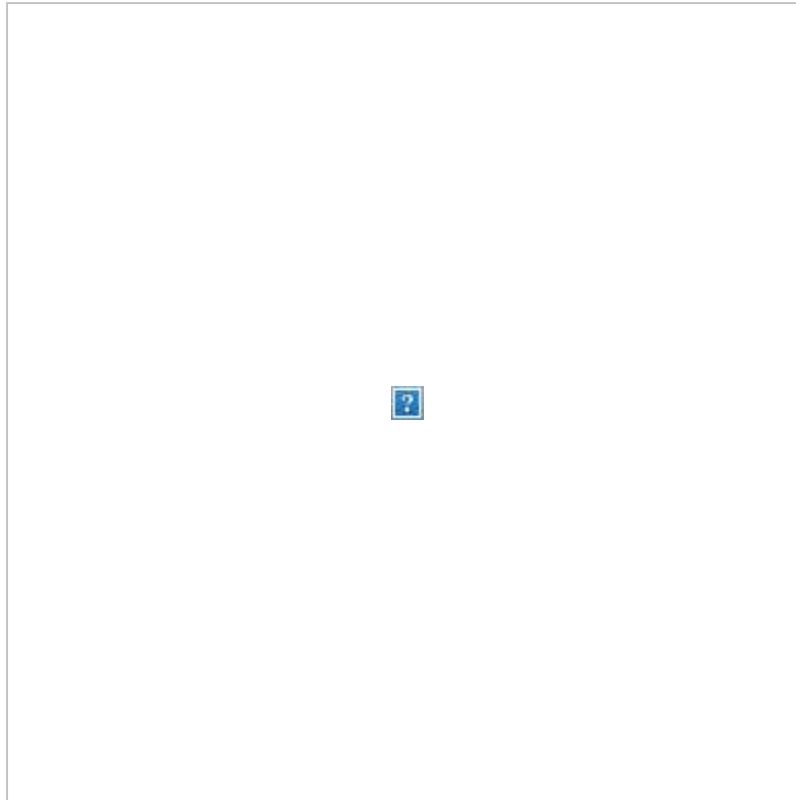*Note: comparison of additional relevant programs may be requested.

Paul E Wagner, MS, MBA

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From: Brooks, Catherine F - (cfbrooks) <cfbrooks@arizona.edu>
Sent: Friday, March 20, 2020 2:16 PM
To: Wagner, Paul E - (paulewagner) <paulewagner@arizona.edu>
Cc: Denno, Linda Lee - (ldenno) <ldenno@arizona.edu>
Subject: Re: CAST Undergraduate Certificates

Hi Paul, Hi Linda. We have no issue at all with your new certificates. I will some day follow up

about your great classes, our students might like to enroll in some of your cloud courses as part of their iSchool training, but that can be a different email thread.

You have my full support from the iSchool to move forward. This email might suffice, but if you need a formalized memo, I can do that also.

I hope the two of you have comfortable working conditions in your homes. Be well, Catherine

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Catherine,

I hope that things are going well for you given the new reality in which we find ourselves. I wanted to reach out to you in regards to two new undergraduate certificates that the College of Applied Science and Technology is going to submit through the curriculum process. I don't believe there are any conflicts but wanted to verify and get your support if possible.

The first is a digital forensics certificate that will tie to our Cyber Operations Program—specifically the Defense and Forensics emphasis. We currently have an introductory (CYBV 388) and advanced course (NETV 477). The certificate would be 18 credit hours and leverage NETV 477. The new courses would include:

From Incident Response (IR) to Digital Forensic
Enterprise and File System Forensics (Linux)
Host and File System Forensics (Windows)
Mobile Device Forensics
Network Forensics

The second certificate is Cloud Computing. This would tie into our Network Operations Program and support our $1.5 M grant that we have in support of Arizona Western College and our Applied Computing Program. We currently have two of the six classes in the catalog; NETV 379 (Cloud Computing) and NETV 479 (Advanced Cloud Computing). The additional courses would include:

Virtualization: Applications and Best Practices

Introduction to Microsoft Azure
Introduction to Amazon Web Services
Cloud Security: IR, Penetration Testing, and Advanced Defense

Both of these certificates would support multiple programs within our college and I believe would provide additional knowledge, skills, and abilities for students within some of your programs. All courses are 300/400 level courses and will be delivered online. The certificates will be developed to align with our current BAS programs and focus more on the application of the topics to ensure that students will have the knowledge and skills to be career ready in this relatively new and exciting discipline.

Please let me know if you have any questions or concerns.

Thank you for your time.

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