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CertNexus Certified Internet of Things Practitioner™ (CIoTP) Exam ITP-110

Exam Information

Candidate Eligibility:

The *Certified Internet of Things Practitioner™ (CIoTP)* exam requires no application fee, supporting documentation, or other eligibility verification measures for you to be eligible to take the exam. An exam voucher will come bundled with your training program or can be purchased separately here. Once purchased, you will receive more information about how to register for and schedule your exam through Pearson Vue. You can also purchase a voucher directly through Pearson Vue. Once you have obtained your voucher information, you can register for an exam time here. By registering, you agree to our Candidate Agreement included here.

Exam Prerequisites

While there are no formal prerequisites to register for and schedule an exam, we strongly recommend you first possess the following knowledge:

- Understanding of the business benefits and challenges of IoT systems.
- Understanding of a typical IoT ecosystem, including the physical elements, edge/fog computing elements, network and connectivity elements, cloud and cloud platform elements, and the applications and things within various market sectors.
- Understanding of common IoT security and privacy threats and countermeasures.
- Understanding of common IoT safety hazards and risk management approaches.
- Understanding of the IoT system development life cycle.

You can obtain this level of skill and knowledge by taking the following courseware, which is available through training providers located around the world, or by attending an equivalent third-party training program:

- *CertNexus Internet of Things (IoT) Practitioner™ (Exam ITP-110)*

Exam Specifications

Number of Items: 100

Passing Score: 60% or 61% depending on exam form. Forms have been statistically equated.

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CertNexus Certified Internet of Things Practitioner™ (ITP-110) Exam Objectives are subject to change without notice.

Duration: 120 minutes (**Note**: exam time includes 5 minutes for reading and signing the Candidate Agreement and 5 minutes for the Pearson VUE testing system tutorial.)

Exam Options: In person at Pearson VUE test centers

Item Formats: Multiple Choice/Multiple Response

Exam Description

Target Candidate:

This certification exam is designed for practitioners who are seeking to build a vendor-neutral, cross-industry foundational knowledge that will enable them to design, implement, operate, and/or manage an IoT ecosystem.

Exam Objective Statement:

This exam will certify that the candidate has foundational knowledge of IoT concepts, technologies, and tools that will enable them to become a capable IoT practitioner in a wide variety of IoT-related job functions.

To ensure exam candidates possess the aforementioned knowledge, the *Certified Internet of Things Practitioner™ (CIoTP)* exam will test them on the following domains with the following weightings:

Domain	% of Examination
1.0 The Impact of IoT	18%
2.0 IoT Ecosystems	46%
3.0 Security, Privacy, and Safety	28%
4.0 The IoT System Development Life Cycle	8%
Total	**100%**

The information that follows is meant to help you prepare for your certification exam. This information does not represent an exhaustive list of all the concepts and skills that you may be tested on during your exam. The exam domains, identified previously and included in the objectives listing, represent the large content areas covered in the exam. The objectives within those domains represent the specific tasks associated with the job role(s) being tested. The information beyond the domains and objectives is meant to provide examples of the types of concepts, tools, skills, and abilities that relate to the corresponding domains and objectives. All of this information represents the industry-expert analysis of the job role(s) related to the certification and does not necessarily correlate one-to-one with the content covered in your training program or on your exam. We strongly recommend that you independently study to familiarize yourself with any concept identified here that was not explicitly covered in your training program or products.

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Objectives:

Domain 1.0 The Impact of IoT

Objective 1.1 Identify and describe the possible benefits that IoT provides to a business or organization.

- Increase business intelligence
- Enhance existing revenue streams
- Create new revenue streams
- Enter and create new markets
- Reduce costs
- Increase productivity and agility
- Increase operational efficiency
- Decrease time to market
- Reduce natural resources usage
- Increase opportunities for innovation
- Improve customer experience
- Increase safety
- Improve competitive position

Objective 1.2 Identify and describe the possible challenges that IoT presents to a business or organization.

- Applicability of automation throughout the organization
- Scalability of legacy solutions to modern solutions
- Connectivity and coverage concerns
- Transformation from a product-oriented business to an everything-as-a-service business
- Cultural transformation and adoption both in business and technology
    - Innovation
    - HR practices and processes (hiring, training, advancement)
    - Skill adjacencies
    - Management commitment
- Security, privacy, and safety concerns
- Cost of transition
- Digital disruption
- Immaturity of standards, regulations, and oversight
- Retrofitting modern design into an existing infrastructure

Domain 2.0 IoT Ecosystems

Objective 2.1 Identify common IoT terminology.

- Things
- Edge/Fog computing

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- Cloud
- Data analytics
- AI
- ML
- IIoT
- M2M
- IoT gateway

Objective 2.2 Understand the functionality of the typical physical and edge/fog computing elements.

- Sensors
  - Position
  - Proximity
  - Sound
  - Temperature
  - Humidity
  - Accelerometer
  - Gyro
  - Magnetometer
  - Infrared
  - Camera
  - Voltage
  - Current
  - Pressure
  - Ambient light
  - Radiation
  - Chemical
  - Motion
- Actuators
  - Solenoid
  - Motor
  - Servo
  - Relay
  - Switch
  - Stepper motor
- Power sources
  - Backup generators (fixed applications)
  - Generators/alternators (mobile applications)
  - Battery
  - Solar
  - Wind
  - Water

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    - Power grid
- Input/output
    - ADC
    - DAC
    - I/O modules
- Edge and fog computing
    - Edge/fog computing capabilities
        - Application processing
        - Real-time processing
        - HMI
        - Monitoring
        - Storage
        - Device management
        - Safety and security
        - Analytics/AI
    - Computing elements
        - Things/end-point devices
            - Connect to sensors and actuators directly to collect data
            - Optionally connect to and send data to the cloud or an IoT gateway
            - Receive and act upon device commands from the cloud or the IoT gateway
        - IoT gateway
            - Implementations (vary by industry)
                - Dedicated hardware device
                - Software function
            - Aggregate end-point device data
            - Connect to and send data to the cloud
            - Optionally perform analysis of data
            - Receive device commands from the cloud and send to end points
    - Hardware platforms
        - Maker/proof of concept platforms
            - Arduino
            - Raspberry Pi
            - BeagleBone
        - Commercial MCUs and application processors
            - ARM
            - x86
    - Programming languages

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        - Java
        - Python
        - C/C++
        - Swift
        - Rust
        - Go
        - Assembly language
        - Java Script
        - C#
    - Frameworks
        - Node
        - .NET
        - Angular
    - Operating systems
        - Linux
        - FreeRTOS
        - Contiki
        - Wind River VxWorks
        - Android Things
        - ARM Mbed OS
        - Apple iOS
- Location awareness
    - GPS
    - Galileo
    - GLONASS
    - BeiDou

Objective 2.3 Understand the functionality of the typical elements of IoT networks and connectivity.

- Wired protocols/technologies
    - Industrial Ethernet standards
        - PROFINET
        - EIP
        - EtherCAT
        - IEEE 1588 v2
        - TSN
    - Legacy field buses
        - PROFIBUS
        - Modbus
        - HART
- Wireless protocols/technologies
    - Near range

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        - NFC
        - Passive RFID
        - Active RFID
    - Medium range
        - 802.15.4
            - Zigbee
            - Thread
        - Z-Wave
        - Bluetooth/BLE
        - 802.11 (Wi-Fi)
    - Long range
        - Cellular
        - Satellite
        - Sigfox
        - LoRa/LoRaWAN
        - RPMA
- Applications/messaging protocols
    - MQTT
    - AMQP
    - HTTP/HTTPS
    - CoAP
- IoT networking
    - IP addressing
        - IPv4
        - IPv6
    - Routing and QoS
    - Encryption
    - SDN/NFV
    - Encapsulation and bridging

Objective 2.4 Understand the functionality of the typical elements of the cloud and cloud platforms.

- Deployment models
    - On premise
    - Cloud
        - Public cloud
        - Private cloud
    - Hybrid
- Cloud service models
    - SaaS
    - PaaS
    - IaaS

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- Cloud platforms
    - Microsoft Azure
    - Amazon Web Services
    - Google Cloud Platform
    - IBM Cloud
    - Oracle Cloud
    - SAP Cloud Platform
    - Huawei FusionSphere
- Common functions of IoT platforms
    - Device management
    - Security management
    - Data management
- Virtualization technologies
    - Hypervisors
    - Containers
- IoT data analytics
    - Techniques
        - Streaming analytics
        - Predictive analytics
        - Prescriptive analytics
    - Tools
        - Spark
        - Hadoop
        - Cassandra
- AI
    - Techniques
        - Machine learning/cognitive computing
        - Computer vision
        - Natural language processing
    - Tools
        - TensorFlow
        - Caffe
        - Theano
        - Torch

Objective 2.5 Identify the various IoT market sectors and describe the applications and things common to that sector.

- Agriculture
    - Applications
        - Fuel management
        - Fleet management

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        - Crop management
        - Livestock management
        - Weather forecasting
        - Soil optimization
        - Water management
    - Examples of things
        - Harvester
        - Planter
        - Sprayer
        - Drones
        - Irrigation systems
        - Livestock monitor
- Security/public safety
    - Applications
        - Traffic management/control
        - Public safety monitoring/control
        - Environmental monitoring
        - Emergency services (police/fire/EMS/HAZMAT)
    - Examples of things
        - Cameras
        - Traffic sensors
        - Drones
        - Detectors (smoke/carbon monoxide/radon)
        - Radio/communication systems
        - Body cameras
        - Vehicles
- Retail
    - Applications
        - Access control
        - Security
        - Inventory management
        - Vending and payment
        - Proximity-based/location-based monitoring
            - Advertising
            - Directions
            - Crowd control
        - Distribution systems
            - Warehouse
            - Transportation
            - Logistics

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        - Customer analytics
        - Real-time pricing
        - Energy management
    - Examples of things
        - Card readers
        - POS
            - Cash register
            - Mobile payment capture
        - Self-serve kiosks
        - BLE/NFC beacons
        - Mobile devices
            - Smartphones
            - Tablets
        - Digital signage
- Transportation and logistics
    - Applications
        - Fleet management
        - Fuel and engine management
        - Operations and maintenance
            - Diagnostics
            - Predictive maintenance
            - Regulatory compliance
        - Telematics
    - Examples of things
        - Aircraft
        - Vehicles
        - Locomotives
        - Ships
        - Radar systems
        - GPS
        - Engines
- Manufacturing
    - Applications
        - Factory/process/machine automation
        - Robotics
        - Asset and inventory management
        - Supply chain management
        - Predictive maintenance
        - AR
    - Examples of things

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        - PLC/PAC/CNC
        - Robots/cobots
        - Motor drives
        - Machine vision cameras
- Healthcare, medical, and life science
    - Applications
        - Telemedicine/remote care/remote monitoring
        - Connected hospital
        - Robotic surgery
        - Patient monitoring
        - Drug supply chain monitoring
        - Tracking laboratory samples
        - Cold chain monitoring
    - Examples of things
        - Surgical robots
        - Sleep monitors
        - Pacemakers
        - Insulin pumps
        - Glucose monitor
        - CPAP machines
        - Lab equipment
- Consumer and home
    - Applications
        - Home automation
        - Home security
        - Water/gas/electric management
        - Connected appliances
    - Examples of things
        - Thermostat
        - Smart hub
        - Surveillance cameras
        - Garage door opener
        - Refrigerator
        - Wearables
- Energy and utilities
    - Applications
        - Smart grid
        - Energy management
        - SCADA
        - Automatic meter reading

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        - Power distribution automation
        - Inspection and preventive maintenance
        - Flow control
        - Energy trading
    - Examples of things
        - Protection relays
        - Connected meters
        - Solar panels
        - Wind turbines
        - Water/oil/gas pipelines
- Buildings
    - Applications
        - Automated lighting
        - Waste management
        - Building management systems
        - Surveillance and security
        - Occupancy management
        - Self-aware buildings
        - Air quality management
    - Examples of things
        - Card readers
        - Cameras
        - Toll gates
        - HVAC systems
        - Power distribution systems
        - Monitoring devices (environment, presence, etc.)
        - Elevators/escalators
- Defense
    - Applications
        - Cost efficiency
        - Warfighter effectiveness
        - C2
        - ISR
        - Intracommunications
        - Unmanned systems
        - Human performance
        - Logistics tracking
        - Medical tracking
    - Examples of things
        - Tanks

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        - Aircraft
        - Drones
        - Ships
        - Submarines
        - Connected warfighter
        - Satellites
- Smart city
    - Applications
        - Route optimization
        - Smart parking
        - Smart lighting
        - Traffic management
        - Security and threat detection
        - Noise management
        - Air quality control
        - Waste management
        - Structural integrity monitoring
        - Public transportation
    - Examples of things
        - Connected garbage receptacle
        - Street lights
        - Traffic lights
        - Connected vehicles
        - Connected manhole
        - Cameras
        - Light rail/subway systems

Domain 3.0 Security, Privacy, and Safety

Objective 3.1 Understand common IoT security and privacy threats.

- Malware
    - Trojan horse
    - Backdoor
    - Keylogger
    - Ransomware
    - Spyware
    - Worms
    - Viruses
- Network attacks
    - DoS/DDoS
        - Botnets
    - MITM

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        - Wireless attacks
        - Spoofing
        - Pharming
    - Password attacks
        - Password cracking
        - Password sniffing
    - Social engineering
        - Phishing
        - Spearphishing
        - Shoulder surfing/dumpster diving
        - Impersonation
    - Elevation of privilege
    - Fuzzing
    - Cross-site scripting
    - Code injection
    - Buffer overflow
        - SQL injection

Objective 3.2 Understand common IoT security and privacy countermeasures.

- CIA triad
    - Confidentiality
        - Data encryption
    - Integrity
        - Blockchain
        - Nonrepudiation
    - Availability
        - DoS/DDoS defense
        - High availability
- AAA
- Firmware/software
    - Secure firmware updates
    - OS hardening
    - Secure coding
    - Code review/scanning
    - Application security
- Physical security
- Vulnerability assessment
    - Penetration testing
- Data anonymization

Objective 3.3 Identify and describe common IoT safety concerns.

- Physical/loss of life accidents

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        - Autonomous vehicle accidents
        - Aircraft accidents
        - Transportation accidents
        - Workplace accidents
        - Industrial disasters
    - Infrastructure outages
        - Mass power outages
        - Mass Internet outages
    - Biological/medical
        - Water supply contamination
        - Failure/hacking of diagnostic/treatment devices
    - Supply chain disruption
        - Contamination of the food supply
        - Slipping in counterfeit or substandard parts into the supply chain
        - Interruption of logistics

Objective 3.4 Explain common safety risk management approaches.

- Hazard classification and analysis
- Root cause analysis
- Quality management systems
- CAPA
- Safety certification

Domain 4.0 The IoT System Development Life Cycle

Objective 4.1 Identify and describe the phases of the IoT SDLC.

- Initiation
- System concept development
- Planning
- Requirements analysis
- Design
- Development
- Integration and testing
- Implementation
- Operations and maintenance
- Disposition

Recertification Requirements

The *Certified Internet of Things Practitioner (CIoTP)* certification is valid for 3 years from the time certification is granted. You must retake the most up-to-date version of the exam prior to the 3-year period's end to maintain a continuously valid certification.

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Certified Internet of Things Practitioner (CIoTP) Acronyms

Acronym	Expanded Form
AAA	authentication, authorization, and accounting
ADC	analog-to-digital converter
AI	artificial intelligence
AMQP	Advanced Message Queuing Protocol
AR	augmented reality
ARM	Acorn RISC Machine/Advanced RISC Machine
C2	command and control
CAPA	corrective action/preventive action
CIA	confidentiality, integrity, and availability
CNC	computer numerical controller
CoAP	Constrained Application Protocol
CPAP	continuous positive airway pressure
BLE	Bluetooth Low Energy
DAC	digital-to-analog converter
DDS	Data Distribution Service
DDoS	distributed denial of service
DoS	denial of service
EIP	EtherNet/IP
EMS	emergency medical Services
GLONASS	Global Navigation Satellite System
GPS	Global Positioning System
HART	Highway Addressable Remote Transducer
HMI	human-machine interface

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HR	human resources
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
HVAC	heating, ventilation, and air conditioning
IaaS	infrastructure as a service
IEEE	Institute of Electrical and Electronics Engineers
IIoT	Industrial Internet of Things
I/O	input/output
IoT	Internet of Things
IPv4/IPv6	Internet Protocol version 4/version 6
ISR	intelligence, surveillance, and reconnaissance
LoRa	long range
LoRaWAN	long range wide area network
M2M	machine-to-machine
MCU	microcontroller unit
MITM	man-in-the-middle
ML	machine learning
MQTT	Message Queuing Telemetry Transport
NFC	near-field communication
NFV	network function virtualization
OPC UA	OPC Unified Architecture
OS	operating system
PROFIBUS	Process Field Bus
PROFINET	Process Field Net
QoS	Quality of Service

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RFID	radio-frequency identification
RPMA	Random Phase Multiple Access
RTOS	real-time operating system
PaaS	platform as a service
PAC	programmable automation controller
PLC	programmable logic controller
POS	point of sale
SaaS	software as a service
SCADA	supervisory control and data acquisition
SDLC	system development life cycle
SDN	software-defined network
SQL	Structured Query Language
TSN	Time-Sensitive Networking

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