National Business and Industry Leadership Team (BILT) Knowledge Domains - updated Sept 2018

* Skills for an entry-level IT worker looking for a job 2-3 years from Fall 2017.

* Be sure ITIL (change management and root/cause analysis) elements are covered as needed in every course. ISO 9000/9001 Quality Management criteria.

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KSA *	Knowledge, Skill, Ability	Topics	# votes (4 = most important)					Security Domain (CISSP/SSCP) alignment*
			4	3	2	1	Avg	
K1	Linux / Unix OS	Version current within 3 years, as of now the operating system of the IoT	8	2			3.8	**2 Communications and Network Security** **3 Identity and Access Management**
K2	**Windows Server OS**	Version current within 3 years, need this background for AWS and Azure	4	6			3.4	**2 Communications and Network Security** **3 Identity and Access Management**
K3	**Operating System Maintenance**	Includes topics such as account management, installing apps, command line, directory, file structures, OS scripting, configuration modification, backup/restore, OS admin, scheduler, stopping/starting services, change control, documentation, awareness of KPI and SLA/OLA, log files and patches, ACL.	7	4			3.6	**5 Security Assessment and Testing** **6 Security Engineering** **7 Security Operations**
K4	**OSI Model**	Layer 1: physical layer Layer 2: data link layer Layer 3: network layer Layer 4: transport layer Layer 5: session layer Layer 6: presentation layer Layer 7: application layer Provide basic framework for how it all works, including how cloud computing has impacted the conceptualization of the seven layers. Plus and awareness of IP multimedia services. Understand that OSI is the framework for all problem solving and troubleshooting	10	1			3.9	**2 Communications and Network Security**

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			4	3	2	1	Avg	
K5	**Enterprise Mobility and Collaboration**	Collaboration Infrastrucutre and Architechtural Awareness - Making enterprise mobility work. Also an awareness of the security requirements. * PSTN (SIP gateways) * messaging * VOIP * videoconferencing * voicemail, meeting, and recoding servers * contact center servers (PBX, call manager, gateways)	3	5	1		2.8	**2 Communications and Network Security**
		Endpoint and Applications - Applying collaboration technologies to solve business problems. Operational-level proficiency to install, use, configure, and operate from a user viewpoint. Understand domain and relevance. Case studies. * "messaging" (e.g. SMS, Jabber, Slack, Spark, Skype-like, etc) * use VOIP * videoconferencing * user interfaces * soft phones	2	2	5		3.4	
K6	**Network Devices-Connectivity Components**	Includes such topics as NICs, switches, routers, gateways, cables and connectors, APs, modems, sensors, wireless LAN controllers. General knowledge for entry level IT position. * Note: This runs on K5 "Enterprise Mobility and Collaboration" above - K6, K7, and K8 will be merging together over time.	6	3			3.7	**2 Communications and Network Security** **5 Security Assessment and Testing**
K7	**WAN Technologies**	Includes such topics as packet and circuit switching, PRI ISDN, MPLS, SIP and Web RTC protocols, WAN connectivitiy via BGP, VPN . * Note: this runs on K5 "Enterprise Mobility and Collaboration" above - K6, K7, and K8 will be merging together over time.	6	3			3.7	**2 Communications and Network Security** **5 Security Assessment and Testing** **7 Security Operations**

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| KSA* | Knowledge, Skill, Ability | Topics | # votes (4 = most important) | | | | | Security Domain (CISSP/SSCP) alignment* |
			4	3	2	1	Avg	
K8	**Wireless Infrastructure and WLANs**	Includes such topics as cellular telephone, personal area networks, satellite data communications, microwave point to point, broadband mobile access/LTE, wireless spectrum, wireless IEEE 802 standards, near-field communications, WiFi, Bluetooth, MDM, disruptive impact of 5G, CBRS. Focus on enterprise wireless solutions (i.e. Cisco, Aruba, Ruckus), not carrier wireless. * Note: this runs on K5 "Enterprise Mobility and Collaboration" above - K6, K7, and K8 will be merging together over time.	6	4			3.6	**5 Security Assessment and Testing** **7 Security Operations**
K9	**Troubleshooting**	May include use of diagnostic software (such as cloud-based monitoring, listening, and remediating systems - e.g. Data Dog [infrastructure monitoring] and New Relic [software monitoring] and VictorOps [DevOps tool]) and use of hardware including hand tools as well as knowledge of troubleshooting methodology, critical thinking, situation assessment, documentation, inspection routines, and fiber/fiber splicing awareness. Understand the scope and details of the problem (and how to gather/analyze that data); understand error messages (and how to research them); use correct data for decision-making; apply the OSI model to troubleshoot (to apply the right tools to the right layer); employ communicaton and collaboration "soft skills" to resolve problem in a stressful, high-pressure environment; demonstrate openness and transparency (i.e. don't hide mistakes), and successfully document how the problem was resolved to communicate with rest of team. Consider hands-on troubleshooting and real-time solutions of unknown problems.	8	1			3.9	**2 Communications and Network Security** **5 Security Assessment and Testing**
K10	**Infrastructure Monitoring and Restoration**	Includes such topics as backup and recovery, centralized log monitoring and correlation, types of alarms, network monitoring and provisioning software, fault tolerance, mass storage and backup devices, network and computer system redundancy including storage, power, connectivity and hot swapping, disaster recovery planning, business continuity, MDM (mobile device management) exposure but not required, sensors, automated tools (e.g. HP OpenView, SolarWinds, SystemCenter), optimizing performance. This should cover both physical and virtual infrastructures - students need hands-on in either physical or virtual or their education is incomplete	6	3	1		3.5	**1 Asset Security** **4 Security and Risk Management**

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			4	3	2	1	Avg	
K11	Cybersecurity Awareness	Awareness and knowledge of network security should be woven into all other IT courses; take a moment at key points in all curriculum to ask "Is this secure? Why or why not?" and "What would you do to make it more secure?"; add to the class tests these questions, concepts, and elements - build it, open it, secure it, and challenge it. Topics should cover all 8 generally recognized security domains below. A deeper dive into one of these domains will depend on the class content and the student's need.	10				4.0	
		1 Asset Security - physical security, biometrics, information security, anti-theft and tamper proof devices						**1 Asset Security**
		2 Communications and Network Security - security protocols, encryptions public, private, symmetric, and secret key, SSL, IPSEC, WPA2 and WPA3, SSH, Trojan horses, firewalls, DMZ, DNS, ACL, VPN.						**2 Communications and Network Security**
		3 Identity and Access Management - social engineering, password management, authentication, password practices and procedures, Certificate management, digital certificates						**3 Identity and Access Management**
		4 Security and Risk Management - risk analysis, data security						**4 Security and Risk Management**
		5 Security Assessment and Testing - Security tools, Basic hardening do's and don't's, hack attacks, vulnerability scanners, intrusion detection systems, Staying current with security advisories (how/where to find them)						**5 Security Assessment and Testing**
		6 Security Engineering - Managing environments at scale, virus, worm, honeypot, and backdoor concept, network virus protection						**6 Security Engineering**
		7 Security Operations - business impact analysis, recover strategies, plan development, testing and exercises, sustain BCP, deliver BCP						**7 Security Operations**
		8 Software Development Security - Configuration management, Application interactions, Change control process, buffer overflows, cross-site scripting						**8 Software Development Security**
K12	Network Devices-Connectivity Components (including Virtualization Technologies)	Working knowledge (non vendor specific) of such topics as installation/configuration of server and desktop virtualization solutions, management of virtualization solutions, administer/install/patch/recovery, virtual network configuration and optimization, identify solutions, SDN. This should also include a high level of cloud. Understand difference between server virtualization and network virtualization and how they interact together. May fade over time with the rise of automation.	10				4.0	**2 Communications and Network Security** **5 Security Assessment and Testing**

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KSA *	Knowledge, Skill, Ability	Topics	# votes (4 = most important)					Security Domain (CISSP/SSCP) alignment*
			4	3	2	1	Avg	
K13	**Information and Storage Management**	Awareness of proprietary data management systems and tools to store, restore, automate data elements/information. Includes such topics as evaluation of storage architectures such as DAS, SAN, NAS, CAS; understanding backup, recovery, disaster recovery, business continuity, and replication; understanding logical and physical components of an information storage infrastructure, tiered storage; storage as a service (SaaS); hyper convereged, block-based, file-based, object-based, and unified storage; software-defined storage; storage netowrking technologies such as FC SAN, IP SAN, and FCoE SAN; business continuity solutions such as backup and replication.	3	4			3.4	**3 Identity and Access Management** **4 Security and Risk Management**
K14	**Cloud and Cloud Services**	Understanding what the cloud is, what are public/private cloud services, what is in a hybrid cloud, and what are the challenges and difficulties of using the cloud (including business requirements). Plus also awareness of mashups and API (application programming interface). Understanding the role of cloud architect; architects must master fundamentals that sit "below" the cloud. Includes such topics as server virtualization as a service, desktop virtualization as a service, storage virtualization as a service, I/O virtualization as a service, security in the cloud, awareness of and exposure to different "X as a service" aaS types (differences between them), serverless architecture (Lamda), microservices. Note the further, ongoing virtualization of Applications as a Service (AaaS) hosted in cloud environments. Consider a hybrid cloud solution (i.e. RFP to real-world business problems) as a capstone project.	7				4.0	**4 Security and Risk Management** **6 Security Engineering** **7 Security Operations**
K15	**Soft Skills**	Oral communication, written communication, leadership, teamwork and collaboration, appreciation of diversity and inclusion, conflict management, customer service, work ethic, professionalism, integrity, attention to detail, adaptability, organization, stress management, multi-tasking, problem solving, decision-making, intellectual risk-taking, thoughtful reflection, initiative, creativity, dedication, perseverance, pride in work, numerical and arithmetic application, following directions, information gathering, resource allocation, time management, technology and tool usage, critical thinking, willingness to continue learning, technical writing, presentation, observational communication (body language, etc), imagination, chaos theory managment, consequential thinking (if/then), connectional thinking (systems-complex-thinking), contrarian thinking (why? thinking?), Soft skills should be threaded into every course and perhaps called out on the syllabus for emphasis.	8				4.0	**3 Identity and Access Management** **4 Security and Risk Management** **7 Security Operations**

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K16	**Basic Project and Process Management**	Basic understanding of principles including the individual's role in the process and accountability (and how your work impacts others). Specifically, PMLC, ITIL, and SDLC as a framework of understanding team building, project management, project scope, and time management concepts interwoven into classes likely through projects - ideally, each student has a different job working toward a common goal. (Don't wait until the final capstone to address these.) Note that project management skills allow IT to communicate with and present to business people (CEOs) regarding technology needs, plans, strategies.	8				4.0	**4 Security and Risk Management 7 Security Operations 8 Software Development Security**
K17	**Script Automation and Application Programming Interfaces**	Global automation in a single push; writing, executing and debugging (Python, Java, etc). This can be a differentiator: understanding the basics/benefits of combining scripting and API will help students. Open source is one cost/free approach. This is used throughout all of the Ks above. Awareness of the tools that make this possible (Puppet, Chef, Ansible, etc).	8				4.0	**5 Security Assessment and Testing 8 Software Development Security**
	Certifications to Consider	Certifications show deeper level of interest, commitment, and follow-through, but can also help job applicants get past HR gatekeeprs and passed along to the hiring manager. They are "door openers."						
C1	**A+ Certification**							
C2	**Network+ Certification**							
C3	**Security + Certification**							
C4	**CCNA Certification**							
C5	**SSCP / CISSP**							
C6	**CWNP**							
C7	**CWNA**							

Acronym Glossary
aaS (K14) as a service
ACL (K3, K11) access control list
API (K14, K17) application programming interface
AWS (K2) Amazon Web Services
BCP (K11) business continuity planning
BGP (K7) border gateway protocol

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	BILT business and industry leadership team							
	CAS (K13) content-addressable storage							
	CBRS (K8) Citizens Broadband Radio Service							
	CCNA (Cs 5-7) Cisco Certified Network Associate							
	CISSP (Cs) Certified Information Systems Security Professional)							
	CWNA (Cs) Certified Wireless Network Adminstrator							
	CWNP (Cs) Certified Wireless Network Professional							
	DAS (K13) direct-attached storage							
	DMZ (K11) demilitarized zone, or perimeter network							
	DNS (K11) domain name system							
	FC SAN (K13) fiber channel storage area network							
	FCoE SAN (K13) fiber channel over ethernet storage area network							
	I/O virtualization (K14) input/output virtualization							
	IEEE (K8) Institute of Electrical and Electronics Engineers							
	IoT (K1) Internet of Things							
	IP SAN (K13) dedicated storage area network							
	IPSEC (K11) internet protocol security							
	ISDN (K7) integrated services for digital network							
	ISO (header) International Organization for Standardization							
	ITIL (header and K16) Information Technology Infrastructure Library							
	KPI (K3) key performance indicator							
	LAN (K6) local area network							
	LTE (K8) long-term evolution (4G wireless)							
	MDM (K5, K8, K10) mobile data management							
	MPLS (K7) multiprotocol label switching							
	NAS (K13) network-attached storage							
	NICs (K6) network interface controller							
	OSI model (K4, K9) open systems interconnection							
	PBX (K5) private branch exchange							
	PMLC (K16) project management life cycle							
	PRI (K7) primary rate interface							
	PSTN (K5) public switch telephone network							
	RFP (K14) request for proposal							
	SaaS (K13) software as a service							
	SAN (K13) storage area network							
	SDLC (K16) systems development life cycle							
	SDN (K4, K7, K12) software-defined networking							
	SIP (K7) session initiation protocol							
	SLA/OLA (K3) service-level agreement, operational-level agreement							
	SMS (K5) short message service							
	SSCP (Cs) System Security Certified Practioner							
	SSH (K11) secure shell							
	SSL (K11) secure shell							
	VoIP (K5) voice over IP							
	VPN (K7, K11) virtual private network							
	WAN (K7) wide area network							
	Web RTC (K7) real time communications							

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			4	3	2	1	Avg	

WLANs (K8) wireless local area network
WPA2 (K11) Wi-Fi Protected Access 2
WPA3 (K11) Wi-Fi Protected Access 3

* CISSP overview - https://resources.infosecinstitute.com/the-cissp-domains-an-overview/#gref