Technology Convergence

Networking, Cloud and Security – Past, Present, Future

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Welcome and Introduction

Western Governors University

- 175,000+ Students
  - 27,300+
- 365,000+ Graduates
  - 35,500+

16% Military

School of Technology

- 56,800+ Students
  - 15,700+
- 43,300+ Graduates
  - 11,100+

28% Military

NetEng and Cloud

- 7,500+ Students
  - 3030+
- 3,500+ Graduates
  - 1350+

41% Military

Goals for Today

1. Discuss the Relationship between Collaboration Technologies and Organizational Needs

2. Tie Network Engineering, Cloud and Security together as one Converging Discipline

3. Identify Future Workforce Needs, Skills and Capabilities

Technology and Organizational Ambition

Chicken or the Egg?

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Connectivity Convergence – Brief History

- 50's through 70's - Centralized (1969 – ARPANET)
- 80's and 90's – Distributed/Client Server (Ethernet, WWW, Internet)
- 2000's to present – Collaboration/XaaS (Cloud)
- 2009-ish – Present - IoT/Fog (1999 – Kevin Ashton)

The point in time when more 'things or objects' were connected to the Internet than people was between 2008 and 2009 - Cisco Systems

Four Phases of the Internet

Phase 1	Phase 2	Phase 3	Phase 4
Connectivity	Networked economy	Collaborative experiences	Internet of everything
Digitise access to information	Digitise business process	Digitise interactions (business and social)	Digitise the world, connecting
• email • web browser • search	• e-commerce • digital supply chain • collaboration	• social • mobility • cloud • video	• people • process • data • things

https://www.open.edu/openlearn/mod/oucontent/view.php?id=48444&section=1.1

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Low Higher

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One Way

Collaboration

Technology and Organizational Ambition

From Connectivity to Collaboration

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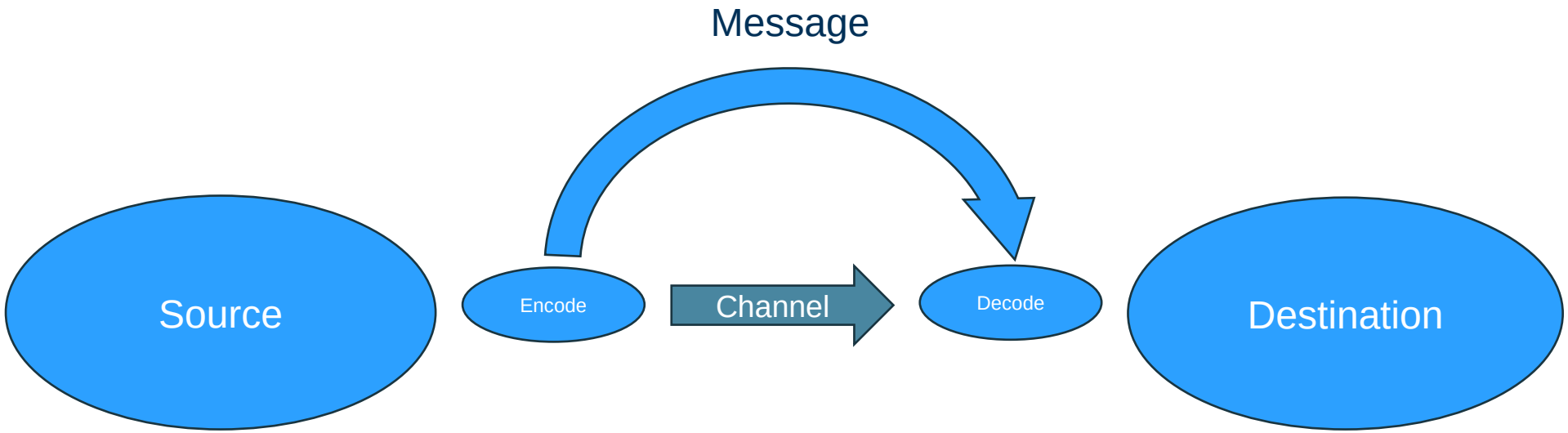
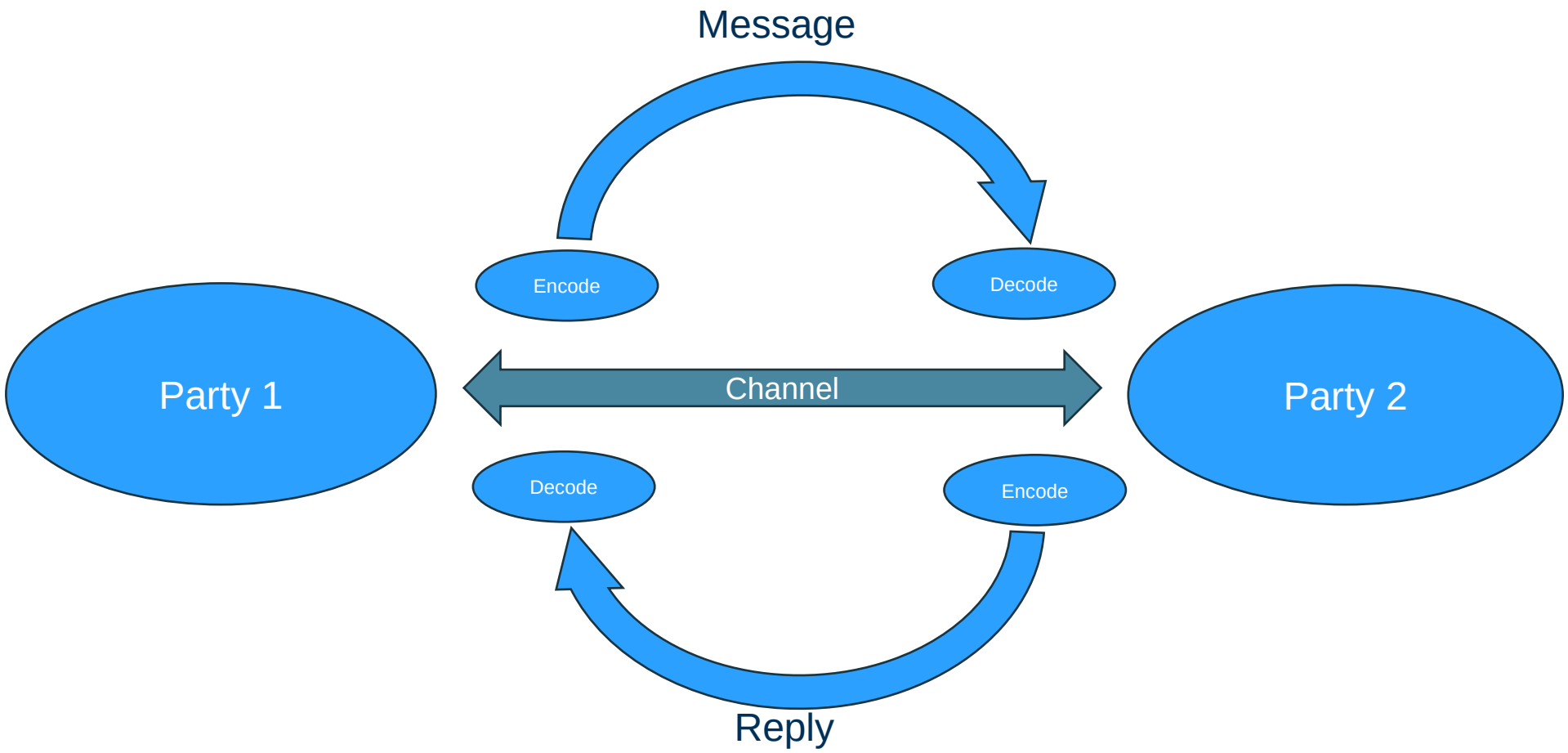
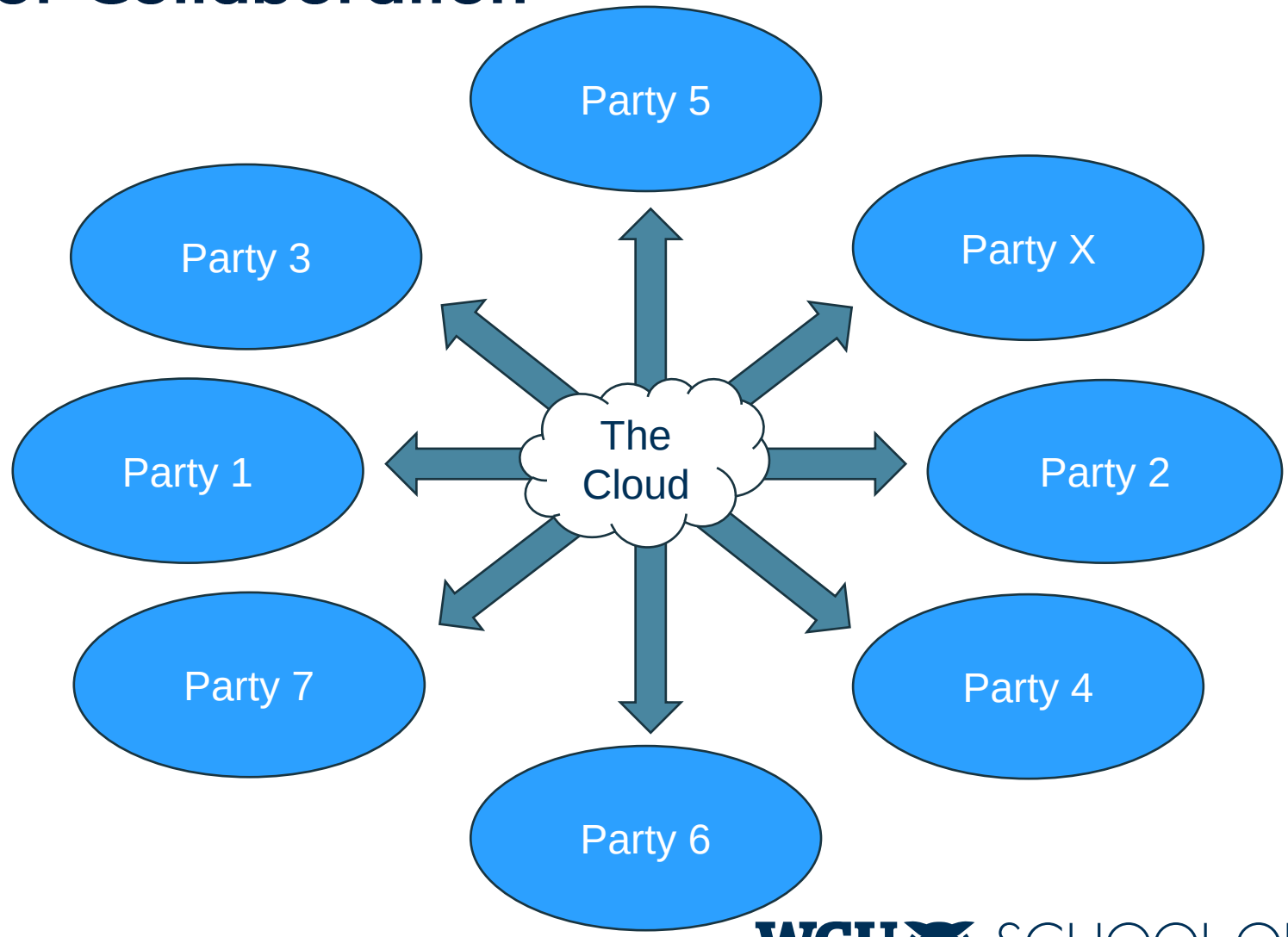
Elements of Communication – One Way



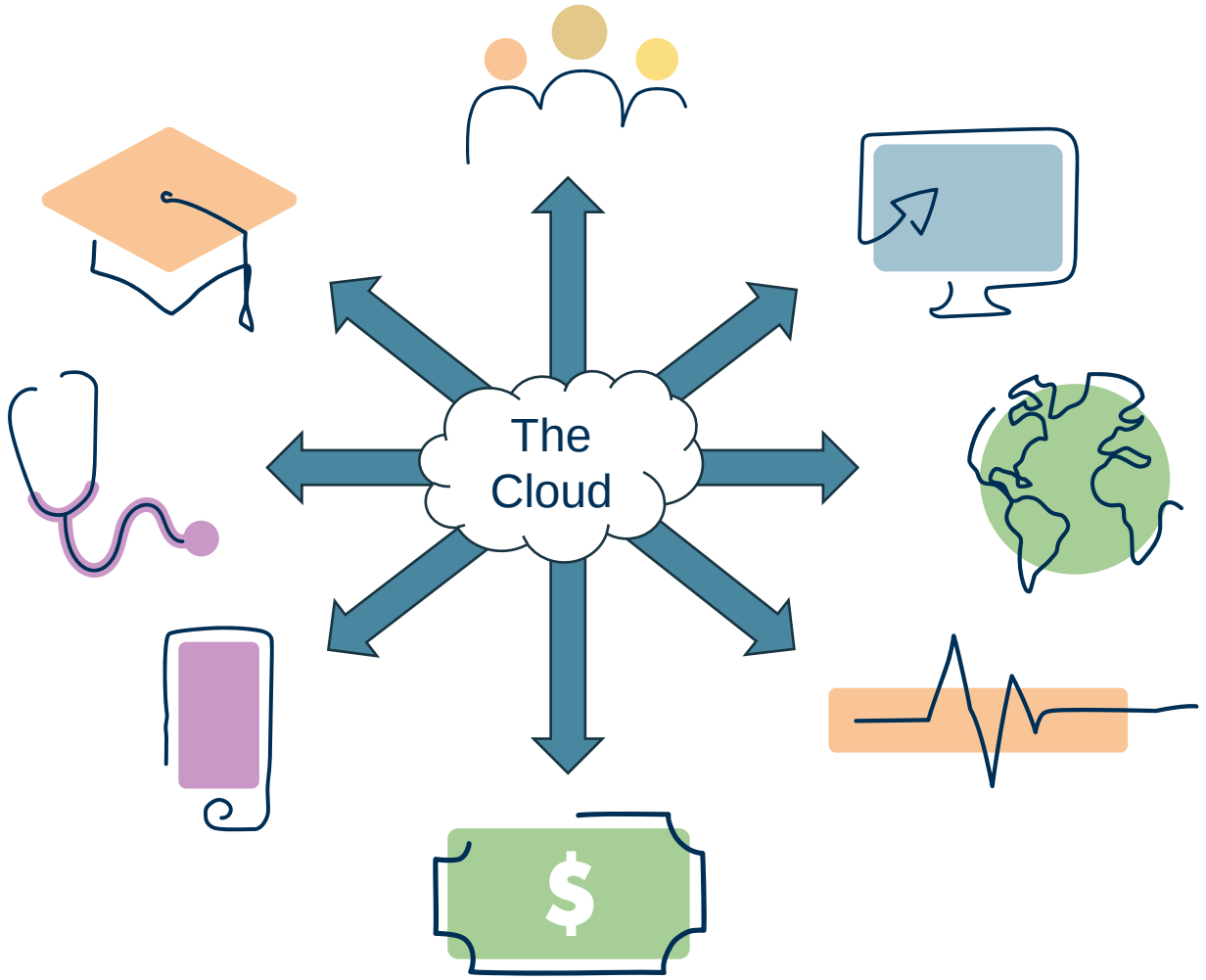
Elements of Communication – Two Way



Elements of Collaboration



Elements of Collaboration – Connectivity



Elements of Collaboration – Total Connectivity

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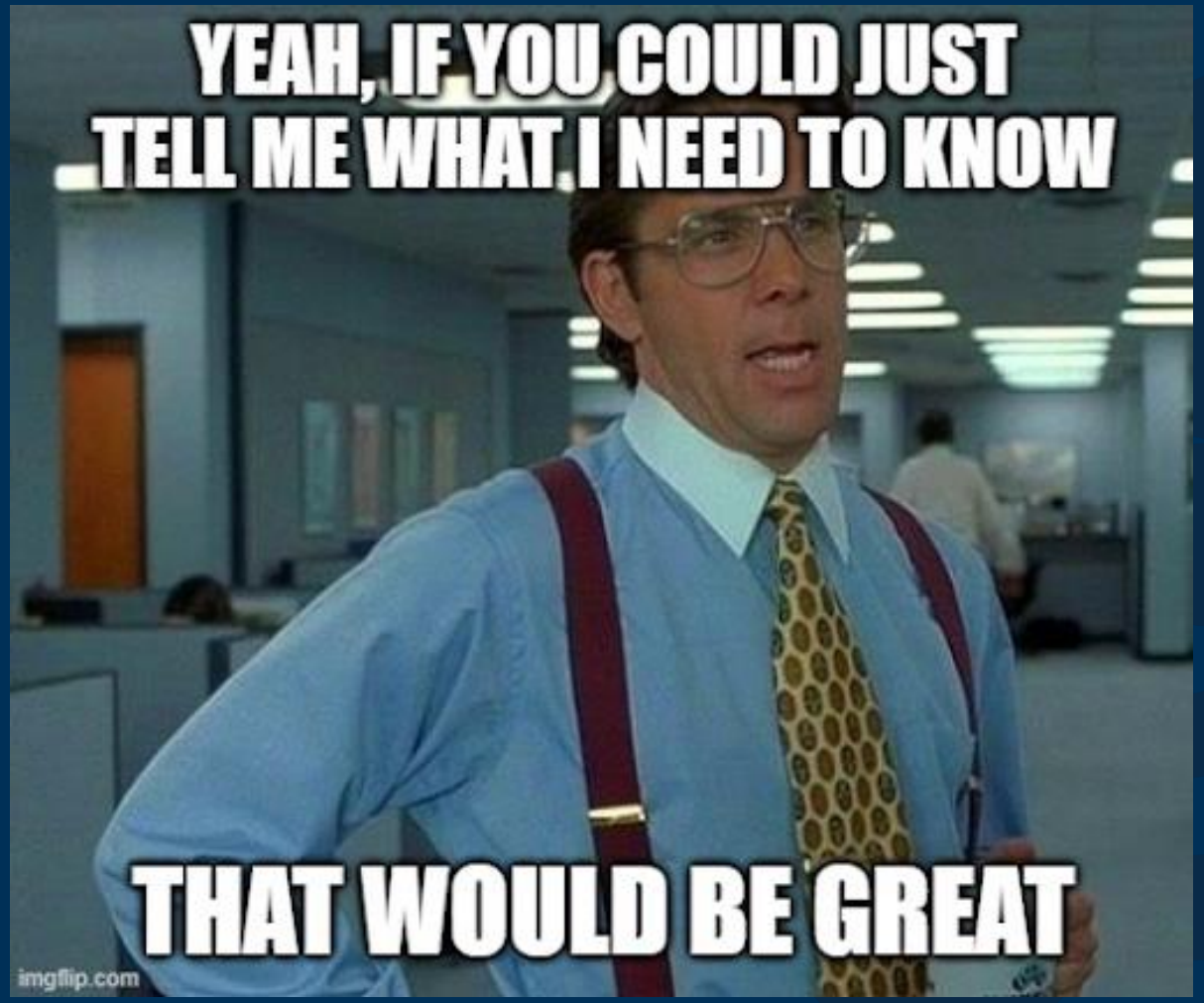
Technology and Organizational Ambition

From Data to Influence



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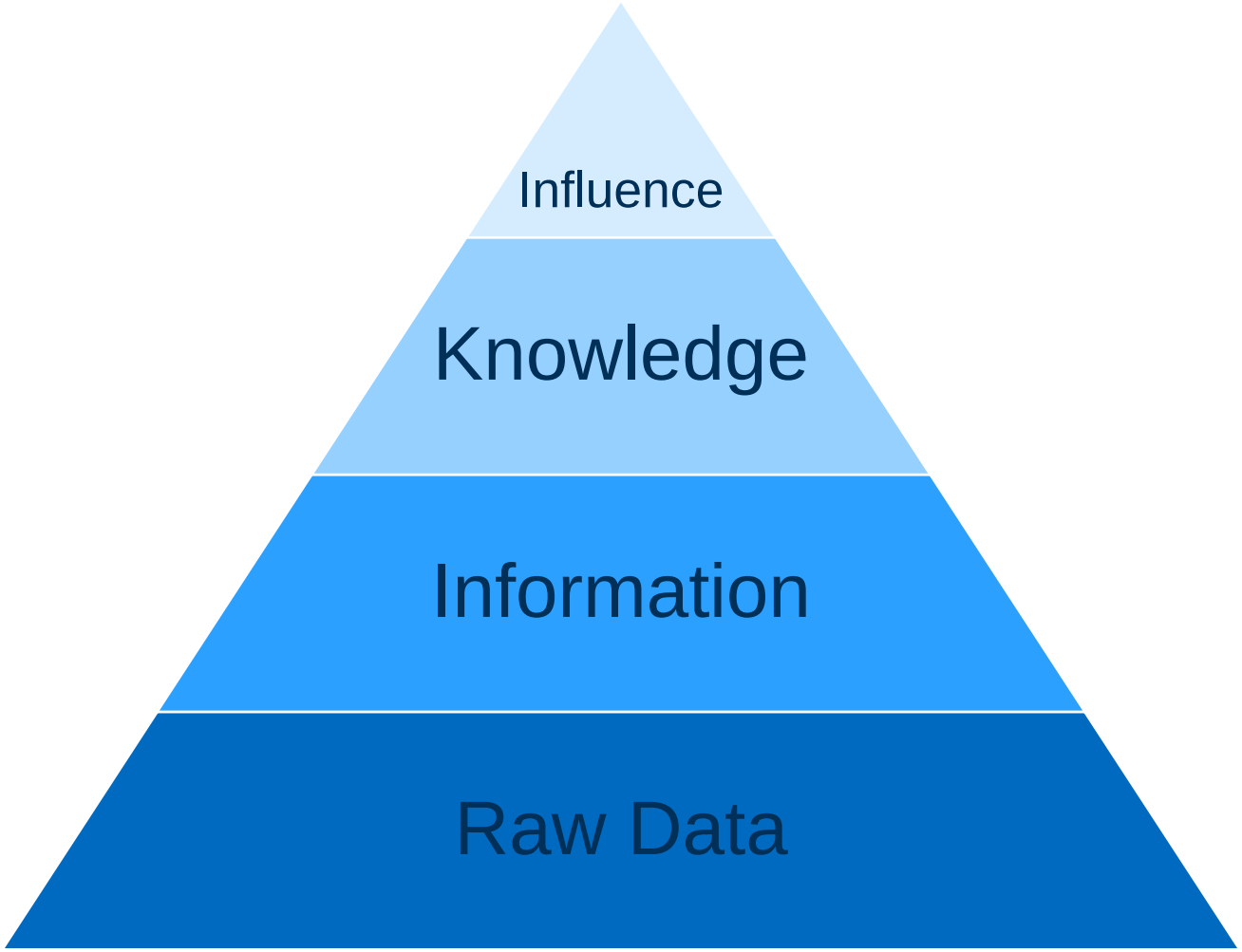

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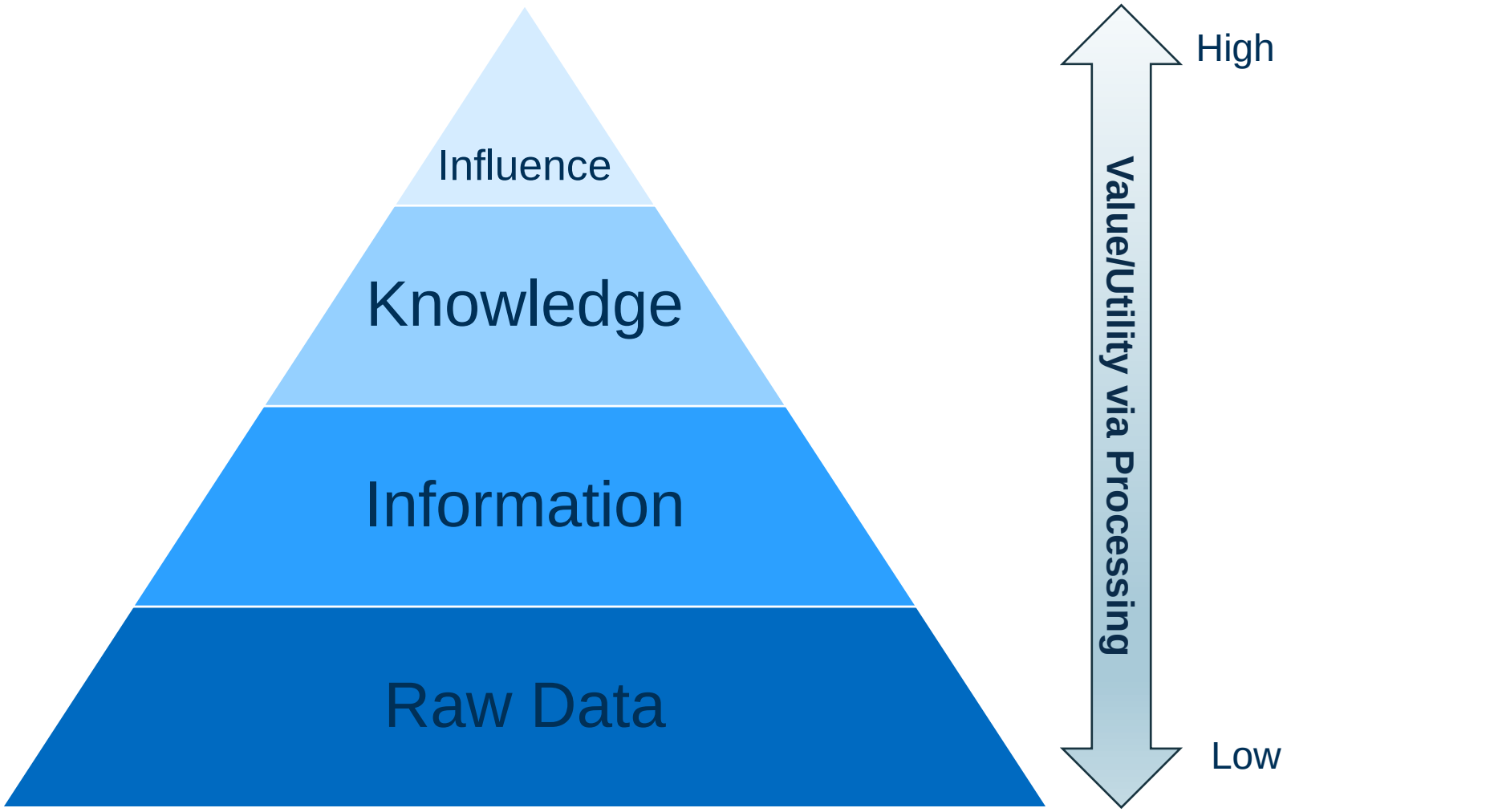

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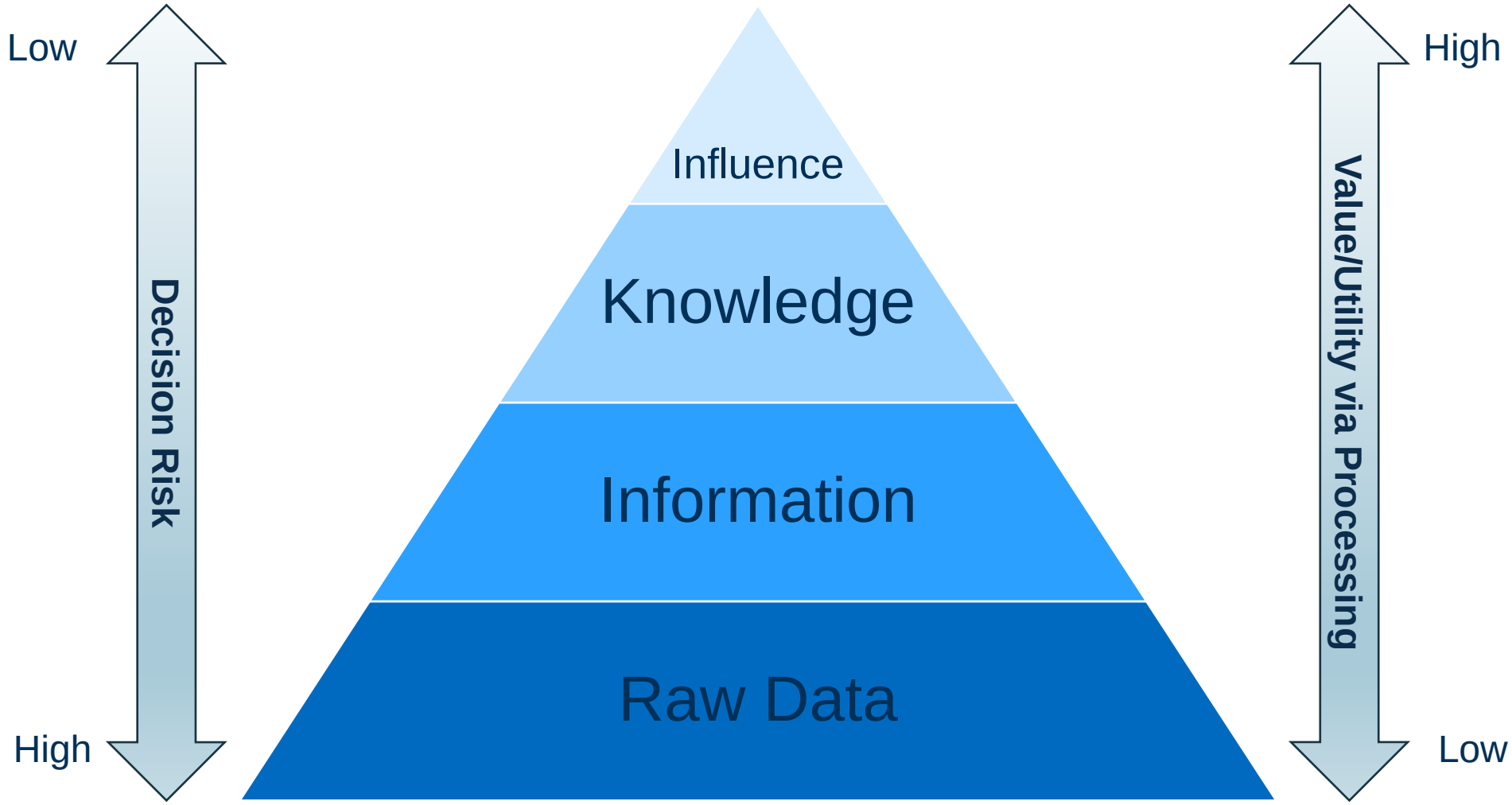

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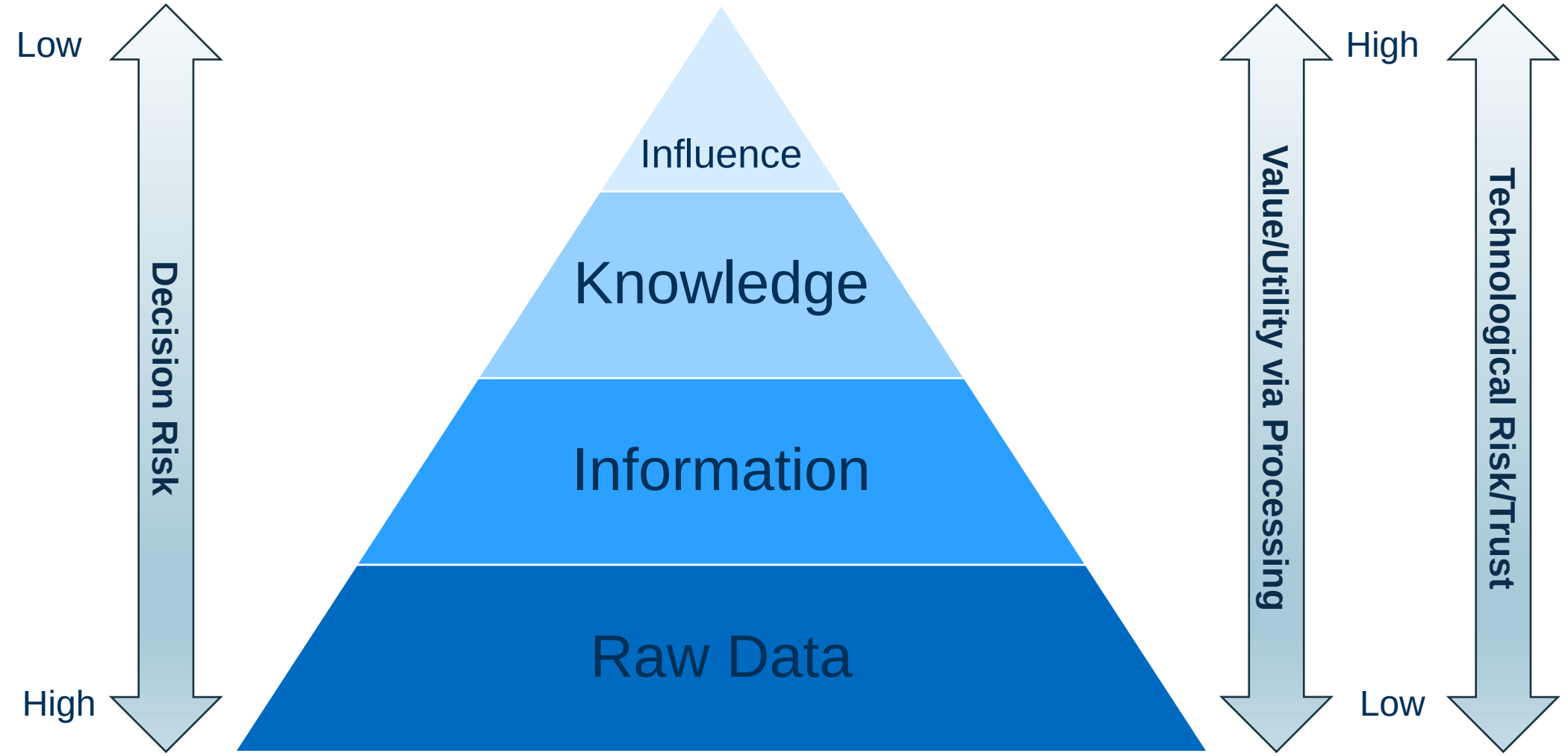

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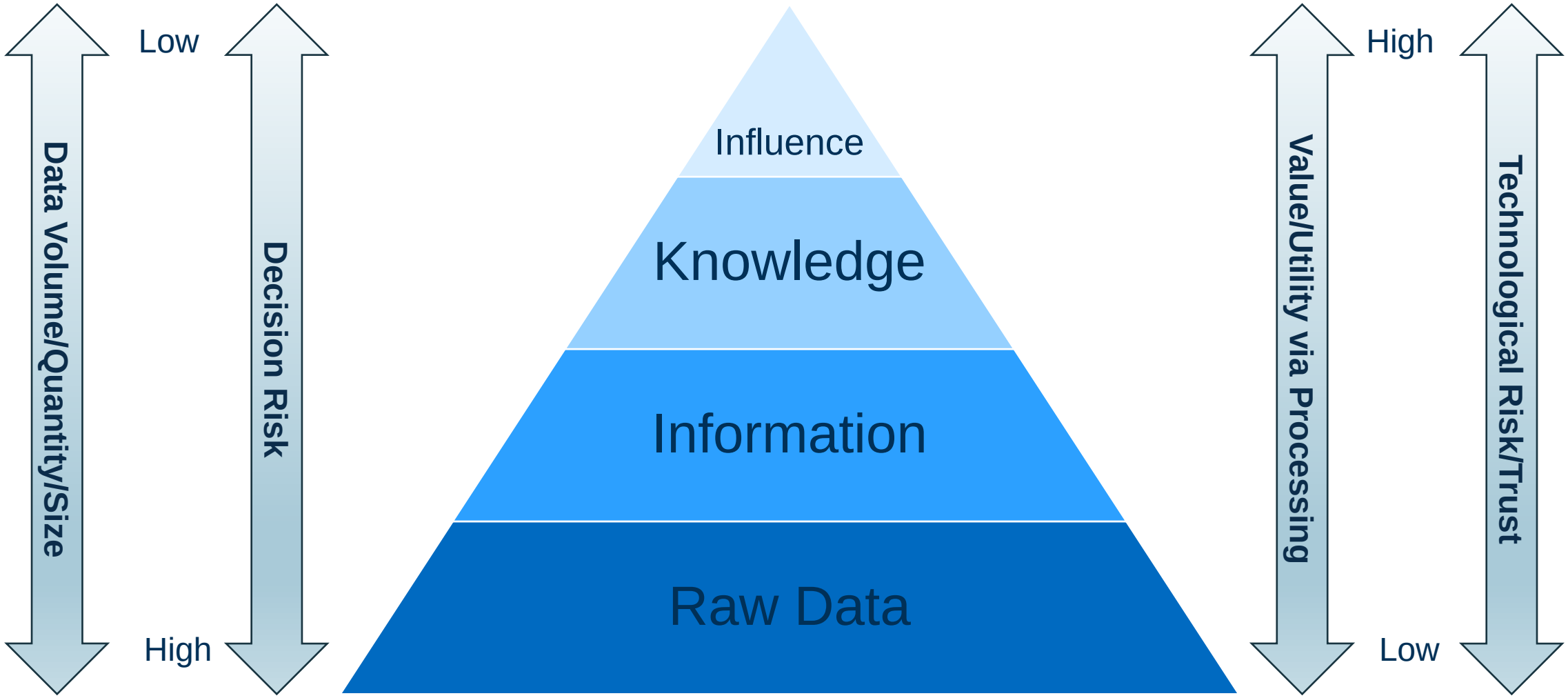

Technology and Organizational Ambition

From Fast to Faster to Fastest

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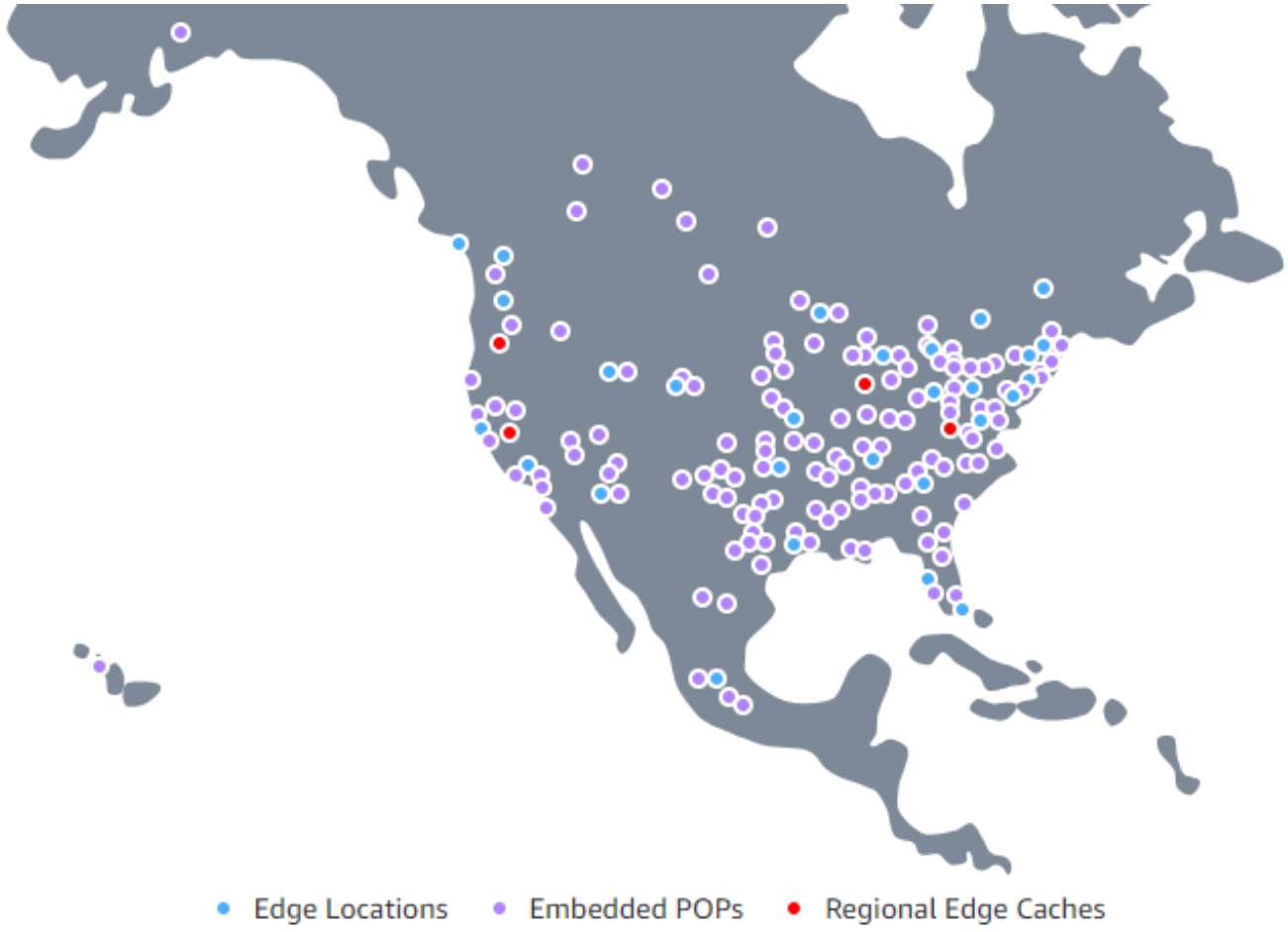
The Need for Speed!!!

- A Packet can circle the globe in 200MS and that's not fast enough
    - At Speed of light – no latency – 13 Milliseconds
    - Internet traffic travels 15-40X slower than Speed of Light

- Primary Causes of Latency:
    - Distance
    - Protocols/Handshakes
    - Routing/Switching
    - Land lines are not line-of-sight
    - Data Size
    - Code Bloat
    - Encryption
    - Network Congestion

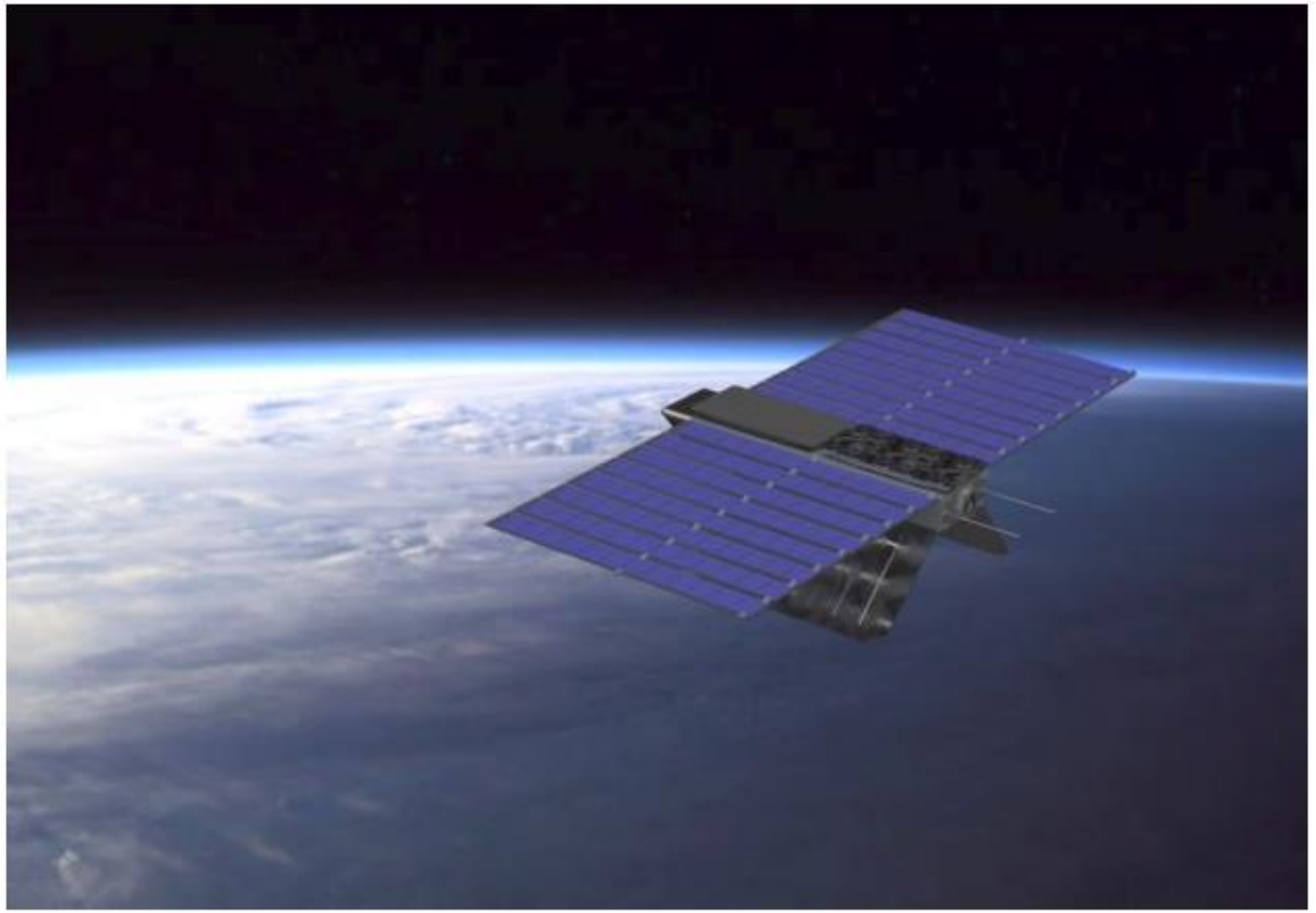
Amazon Region and Edge Locations in North America



Space-based Data Centers – Ultimate in Edge Computing

- Lumen Orbit
- Axiom
- Others

"For when instant is not fast enough"



An artist's conception shows Lumen Orbit's satellite in space. (Lumen Orbit Illustration)

Wireless/Microwave Options – Line-of-Sight

- Speed of Light Internet
    - https://www.usenix.org/conference/nsdi22/presentation/bhattacherjee

- Latency Arbitrage – McKay Brothers LOS network between Chicago and New York

Skills Convergence

Networking, Cloud and Security

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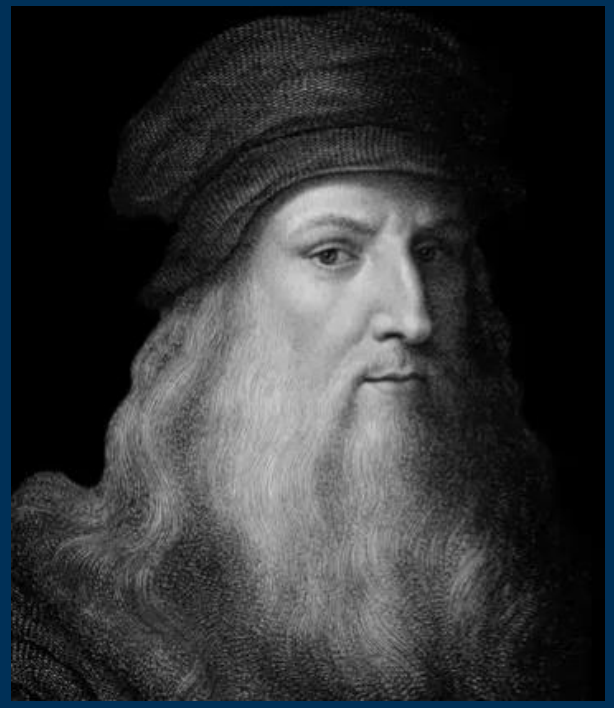

"Study the Art of Science, study the Science of Art. Develop your senses, especially learn how to see, realize that everything connects to everything else"

- Leonardo da Vinci
(www.leonardodavincisinventions.com)

How to Support Collaboration and Influence

1. Minimize the amount of Data that must Travel
   - Networking and Edge Computing

2. Minimize the Distance that the Data must Travel
   - Regional Centers (Cloud) and Fog Networks

3. Minimize the # of Devices that the Data must Traverse
   - Network Engineering

4. Maximize the capability of the Channel that the Data must Traverse
   - Network Engineering

Security is Implied!!!!

Skills Breakdown for Collaboration Technologies

Cloud Skills	Network Engineering Skills	Cyber Security Skills
Amazon Web Services	Firewall	Vulnerability
Computer Science	Network Switches	Cyber Security
Microsoft Azure	Wide Area Networks	Python (Programming Language)
Automation	Computer Science	Amazon Web Services
Python (Programming Language)	Local Area Networks	Automation
DevOps	Network Routing	Security Controls
Terraform	Network Infrastructure	Scripting
Infrastructure as Code (IaC)	Virtual Private Networks (VPN)	Firewall
Cloud Infrastructure	Networking Hardware	Linux
Kubernetes	Network Security	Incident Response
Agile Methodology	Network Performance Management	Security Information And Event Management (SIEM)
Scripting	TCP/IP	Microsoft Azure
Linux	Routing Protocols	Security Engineering
Scalability	Multiprotocol Label Switching	Auditing
CI/CD	Network Planning And Design	Operating Systems
Cloud Services	Network Troubleshooting	Application Security
Cloud Computing	Network Monitoring	Authentications
Ansible	Operating Systems	Windows PowerShell
Docker (Software)	Virtual Local Area Network (VLAN)	Network Security
Cloud Computing Architecture	Juniper Network Technologies	Identity And Access Management
Public Cloud	Network Architecture	IT Security
Infrastructure As A Service (IaaS)	Dynamic Host Configuration Protocol (DHCP)	Vulnerability Assessments
Windows PowerShell	Network Quality Of Service (QoS)	Risk Analysis
Software Development	Project Management	Information Systems
Solution Architecture	Automation	Vulnerability Management
AWS CloudFormation	Telecommunications	Cloud Security
Jenkins	Python (Programming Language)	Penetration Testing
Google Cloud Platform (GCP)	Microsoft Azure	Cyber Threat Intelligence
Platform As A Service (PaaS)	Wireless Networks	Risk Management
Java (Programming Language)	Complex Networks	Active Directory
Operating Systems	Internet Protocol Security (IP SEC)	Splunk
Cloud Technologies	Scripting	Project Management
Systems Engineering	Microsoft Visio	Endpoint Security
Git (Version Control System)	(SD-WAN)	IT Security Architecture
Bash (Scripting Language)	Network Protocols	Disaster Recovery
Software As A Service (SaaS)	Network Management	Authorization (Computing)
System Administration	Amazon Web Services	Triage
Microservices	Data Centers	On Prem
SQL (Programming Language)	SolarWinds	Unix
Containerization	Cisco Networking	CI/CD
Software Engineering	Disaster Recovery	Configuration Management
Disaster Recovery	Aruba (Network Management Software)	Java (Programming Language)
Cloud-Native Computing	Cisco Routers	Systems Development Life Cycle
Application Programming Interface (API)	Information Systems	Intrusion Detection And Prevention
Continuous Integration	Network Administration	Vulnerability Scanning
Virtualization	Linux	Mitigation
DevSecOps	IT Capacity Management	Endpoint Detection And Response
Amazon S3	Cisco Meraki	Directory Service
Firewall	Technical Support	HIPPA
Cloud Security	Systems Engineering	TCP/IP

Top 50 Skills for Cloud, NetEng and Security

- Cloud – 30 Duplicates
- Networking – 18 Duplicates
- Security – 25 Duplicates

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Notable Unique Skills

Cloud Computing

- Cloud Services
- **Orchestration**
- Containerization
- IaaS, PaaS

Networking

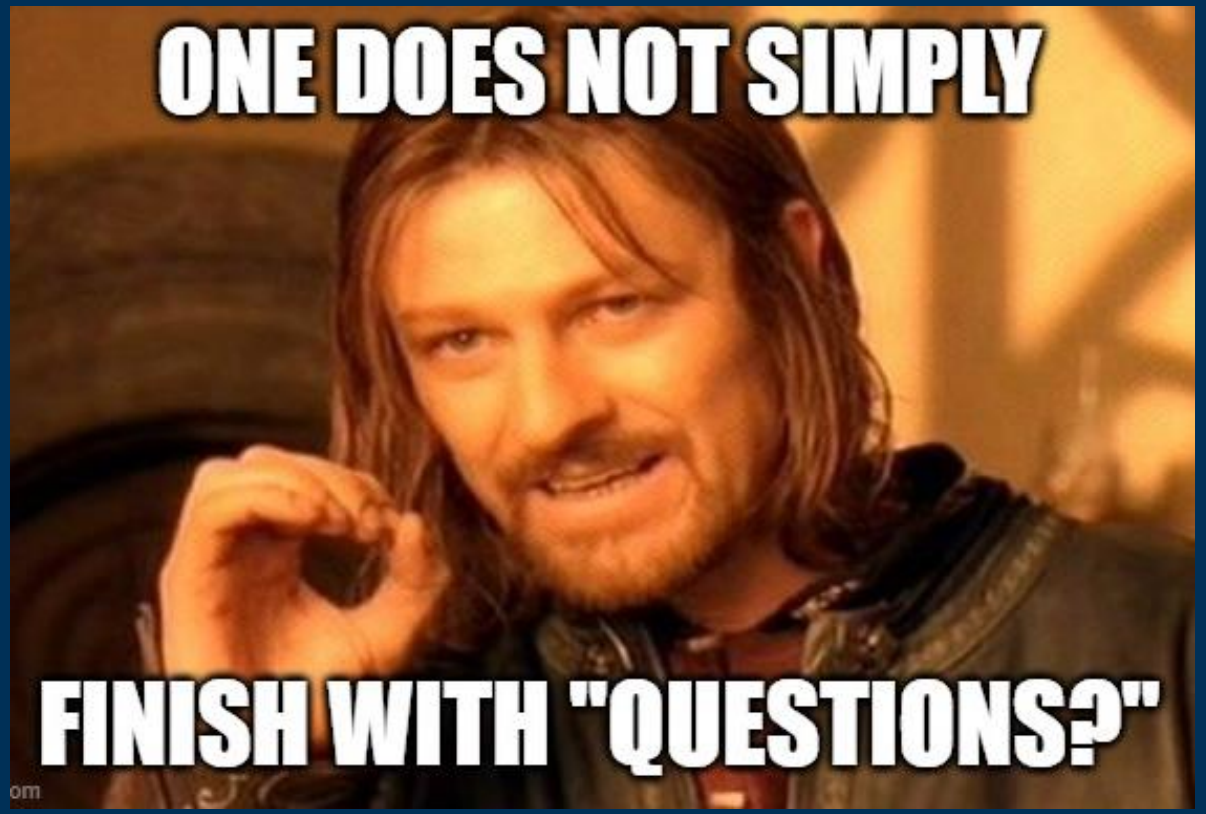
- Network Architecture
- Hardware
- **Routing/Switching**
- Troubleshooting
- Telecomm/Wireless
- QOS

Cyber Security

- SIEM
- Vulnerability Assessment
- **Pen Testing**
- Risk Analysis
- Splunk
- Cryptography

The Big Finish

Networking, Cloud and Security



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Organizations will always REQUIRE

Fast(er), Reliable and Secure

inputs to influence decisions.

To deliver on this promise, IT professionals MUST be fluent in Networking, Cloud and Security Technologies…and related best practices

Thank you!

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