Cheat Sheet for comprehensive Cisco Certified Network Associate (CCNA) - Industrial

Network Fundamentals

- **OSI Model Layers**
  - **Layer 7: Application** - User interface, protocols (HTTP, FTP)
  - **Layer 6: Presentation** - Data formatting, encryption (SSL, TLS)
  - **Layer 5: Session** - Session management (NetBIOS)
  - **Layer 4: Transport** - End-to-end communication (TCP, UDP)
  - **Layer 3: Network** - Logical addressing, routing (IP, ICMP)
  - **Layer 2: Data Link** - Physical addressing, MAC (Ethernet, ARP)
  - **Layer 1: Physical** - Physical medium, cabling (RJ45, fiber)
- **TCP/IP Model**
  - **Application** - Application, Presentation, Session (HTTP, FTP)
  - **Transport** - Transport (TCP, UDP)
  - **Internet** - Network (IP, ICMP)
  - **Network Access** - Data Link, Physical (Ethernet, ARP)

IP Addressing and Subnetting

- **IPv4 Addressing**
  - **Format**: 32 bits, dotted-decimal (e.g., 192.168.1.1)
  - **Classes**: A (1-126), B (128-191), C (192-223), D (224-239), E (240-255)
  - **Private Addresses**:

- Class A: 10.0.0.0/8
- Class B: 172.16.0.0/12
- Class C: 192.168.0.0/16

- **Subnetting**
  - **Subnet Mask**: Defines network and host portions (e.g., 255.255.255.0)

- **CIDR Notation**: /24 (255.255.255.0), /16 (255.255.0.0)
- **Subnet Calculation**:
  - **Formula**: 2^n (n = number of subnet bits)
  - **Example**: 192.168.1.0/24 -> 192.168.1.0/26 (64 subnets, 62 hosts)

Routing and Switching

- **Routing Protocols**
  - **RIP**: Distance vector, max 15 hops, 30 sec updates
  - **EIGRP**: Advanced distance vector, fast convergence, Cisco proprietary
  - **OSPF**: Link-state, hierarchical design, OSPFv2 (IPv4), OSPFv3 (IPv6)
  - **BGP**: Path vector, external routing, AS-based
- **Switching Concepts**
  - **MAC Address Table**: Learns and stores MAC addresses
  - **Switching Modes**: Store-and-forward, cut-through, fragment-free
  - **VLANs**: Virtual LANs, isolates traffic (e.g., VLAN 10, VLAN 20)
  - **Trunking**: Carries multiple VLANs over a single link (802.1Q)

Network Automation and Programmability

- **APIs and RESTCONF**
  - **RESTCONF**: RESTful API for network devices
  - **Example**: `GET /restconf/data/ietf-interfaces:interfaces`
- **Python for Networking**
  - **Libraries**: `netmiko`, `paramiko`, `ncclient`
  - **Example**:

```
from netmiko import ConnectHandler
device = {
    'device_type': 'cisco_ios',
    'host': '192.168.1.1',
    'username': 'admin',
    'password': 'cisco'
}
```

```
connection = ConnectHandler(**device)
output = connection.send_command('show ip interface brief')
print(output)
```

Security

- **Access Control Lists (ACLs)**
  - **Standard ACL**: Filters based on source IP (e.g., 1-99)
  - **Extended ACL**: Filters based on source/dest IP, protocol (e.g., 100-199)
  - **Example**:

```
access-list 1 permit 192.168.1.0 0.0.0.255
access-list 100 deny tcp any 192.168.1.0 0.0.0.255 eq 80
```

- **Firewalls and NAT**
  - **Static NAT**: 1:1 mapping (e.g., inside local to inside global)
  - **Dynamic NAT**: Many:Few mapping
  - **PAT (NAT Overload)**: Many:1 mapping (e.g., port forwarding)
  - **Example**:

```
ip nat inside source static 192.168.1.10 203.0.113.10
ip nat inside source list 1 interface GigabitEthernet0/1 overload
```

Industrial Networking

- **Industrial Protocols**
  - **Modbus**: Serial and TCP/IP, master-slave, registers
  - **OPC UA**: Platform-independent, secure, real-time data exchange
  - **DNP3**: Distributed Network Protocol, SCADA systems
- **Industrial Network Design**
  - **Redundancy**: HSR (High-availability Seamless Redundancy), PRP (Parallel Redundancy Protocol)

- **Security**: Network segmentation, VLANs, ACLs
- **Scalability**: Hierarchical design, modular architecture

Troubleshooting and Maintenance

- **Common Commands**
  - **Show Commands**:

- `show ip interface brief`
- `show running-config`
- `show ip route`
- `show vlan`

  - **Debug Commands**:

- `debug ip icmp`
- `debug eigrp packets`

  - **Troubleshooting Tools**:
    - **Ping**: `ping 192.168.1.1`
    - **Traceroute**: `traceroute 192.168.1.1`
    - **Telnet**: `telnet 192.168.1.1`
- **Backup and Restore**
  - **Backup**: `copy running-config tftp://192.168.1.2/backup.cfg`
  - **Restore**: `copy tftp://192.168.1.2/backup.cfg running-config`

Best Practices

- **Documentation**: Maintain detailed network diagrams and configuration backups
- **Regular Updates**: Apply firmware updates and patches
- **Monitoring**: Use SNMP, syslog, and network monitoring tools
- **Security**: Implement strong passwords, ACLs, and firewall rules

Example Configurations

- **Basic Router Configuration**

```
hostname R1
interface GigabitEthernet0/0
 ip address 192.168.1.1 255.255.255.0
```

```
 no shutdown
ip route 0.0.0.0 0.0.0.0 192.168.1.254
```

- **Basic Switch Configuration**

```
hostname SW1
vlan 10
 name Sales
interface range GigabitEthernet0/1 - 4
 switchport mode access
 switchport access vlan 10
```

Additional Resources

- **Cisco Documentation**: [Cisco Documentation](https://www.cisco.com/c/en/us/support/index.html)

- **Cisco Learning Network**: [Cisco Learning Network](https://learningnetwork.cisco.com/)

- **Online Labs**: [Cisco Packet Tracer](https://www.netacad.com/courses/packet-tracer)

This cheat sheet provides a comprehensive overview of essential topics for the CCNA - Industrial certification. Use it as a quick reference guide to reinforce your understanding and prepare for the exam.

By Ahmed Baheeg Khorshid

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