Troubleshooting Methods

Advanced Troubleshooting of IP Networks

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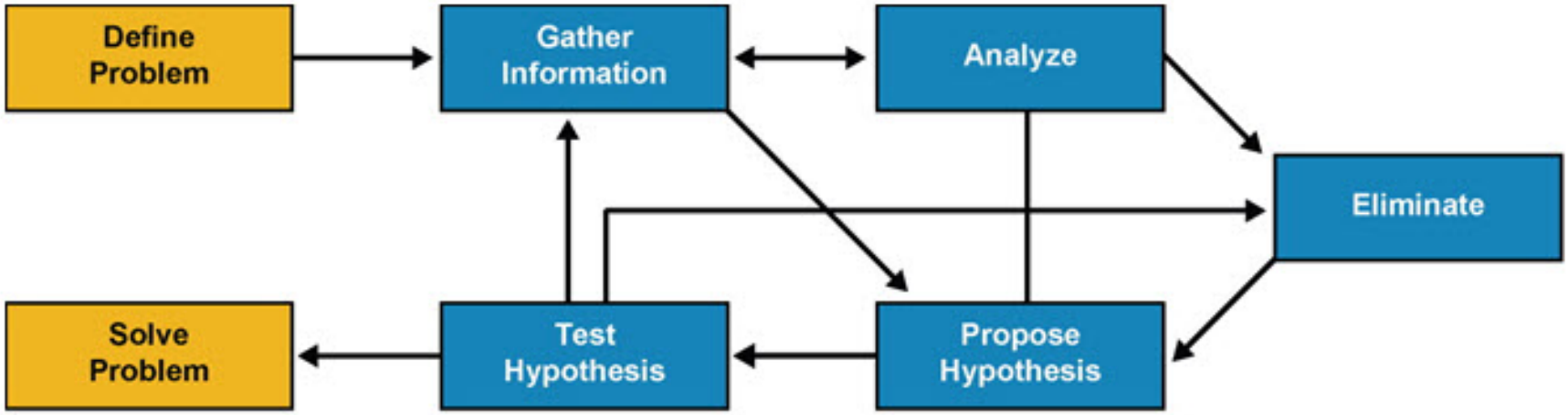
Mind Wide Open™

Objectives

- Troubleshooting Methodologies
- Structured Troubleshooting Approaches
- Routing Issues

Troubleshooting Methodologies

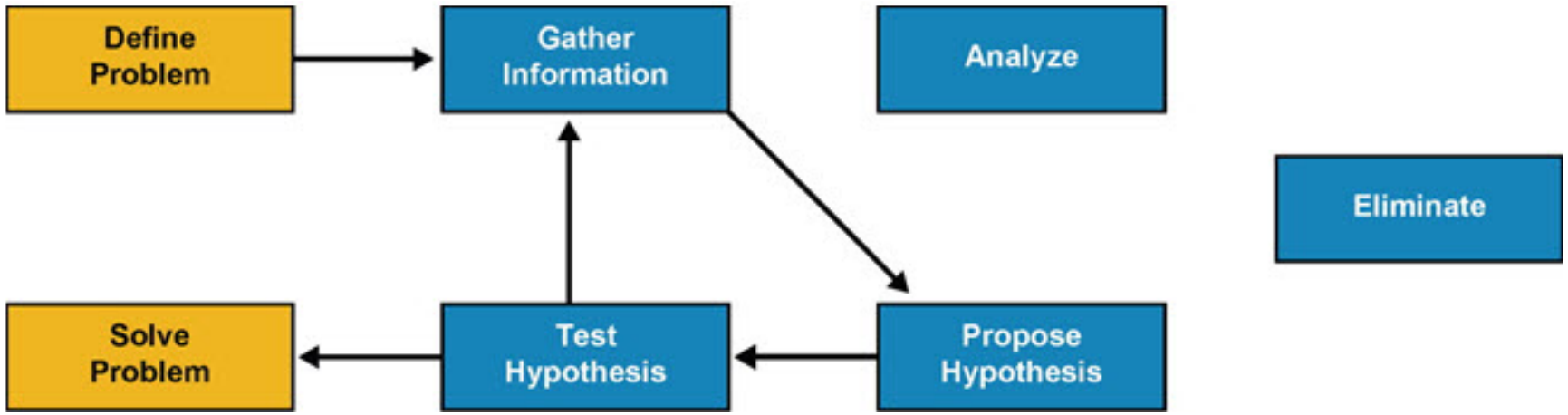
- Several different troubleshooting methodologies
- Structured troubleshooting approach is recommended to use
  - Time efficient
  - Easy to pick up where you left of or hand over to someone else without loosing any effort or results



Flow chart of a structured troubleshooting approach

Troubleshooting Methodologies

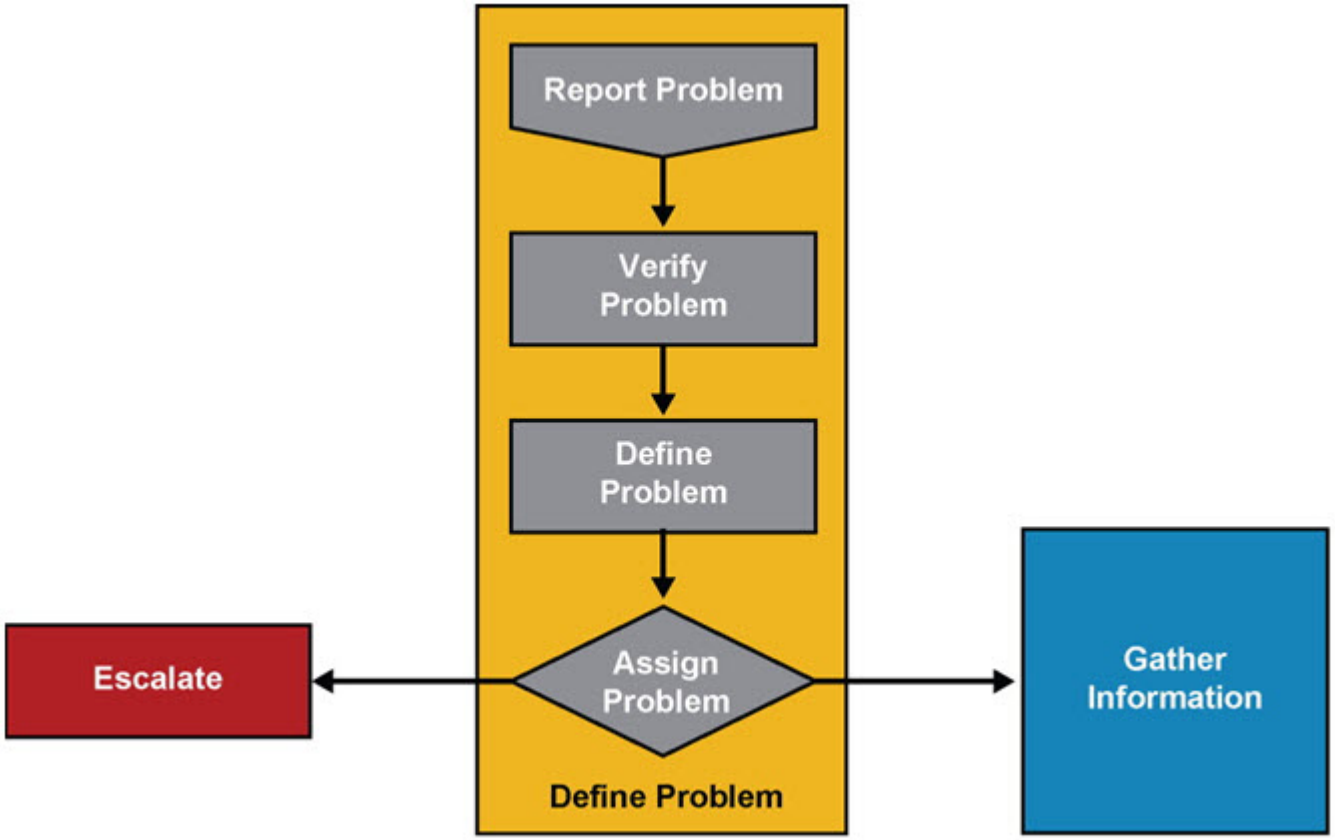
Shoot from the hip vs. structured troubleshooting method



The Troubleshooting Process

- Defining the problem
- Gathering information
- Analyzing the information
- Eliminating possible problem causes
- Formulating a hypothesis about the likely cause of the problem
- Testing that hypothesis
- Solving the problem

The Troubleshooting Process – Verify and Define the Problem



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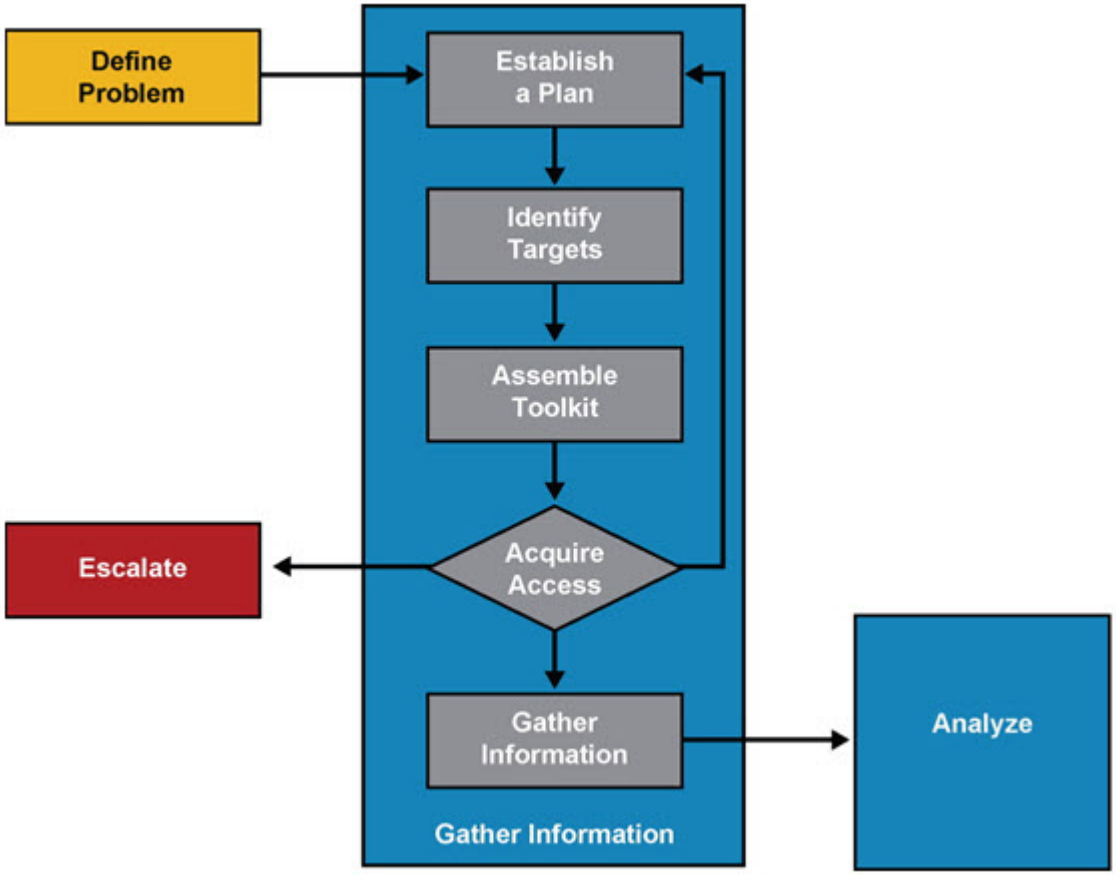
The Troubleshooting Process – Gather Information



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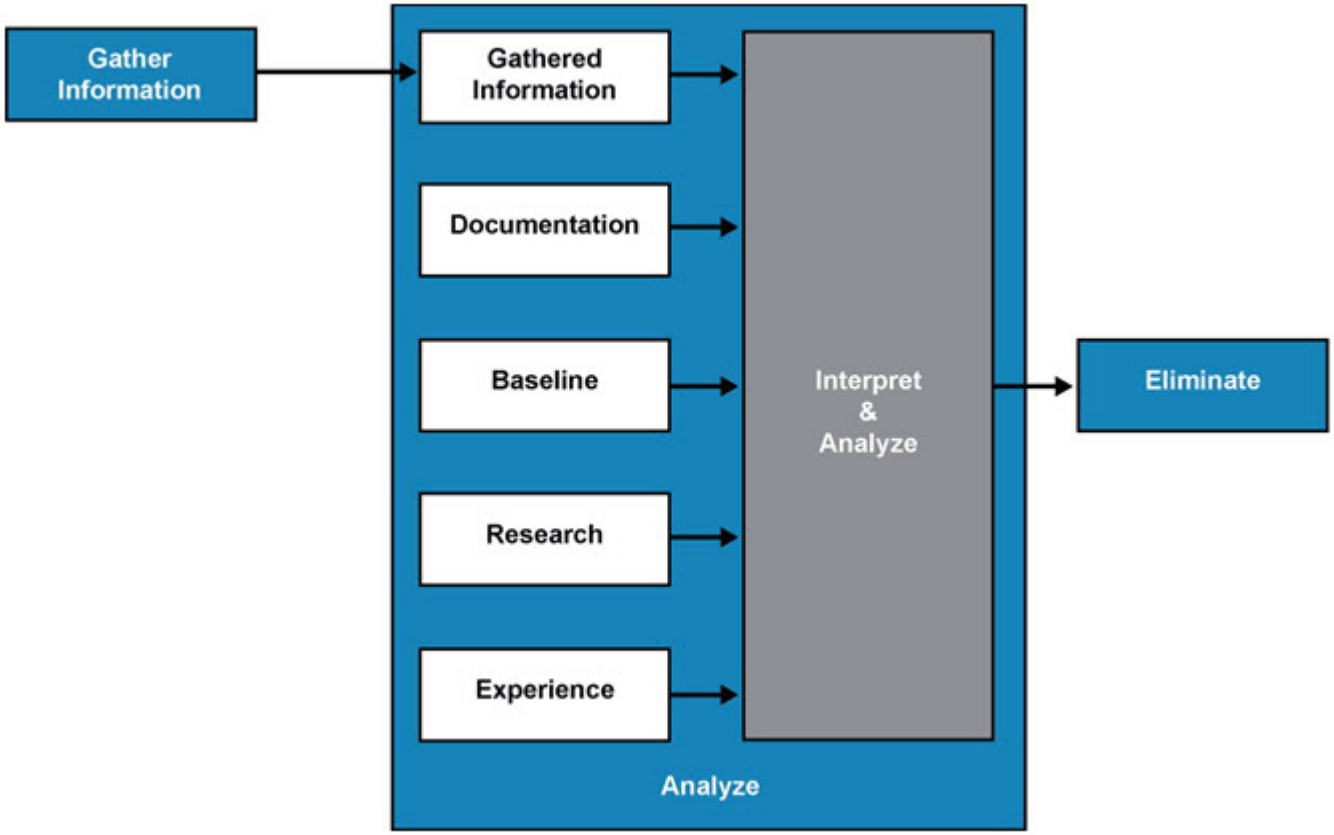
The Troubleshooting Process – Analyze



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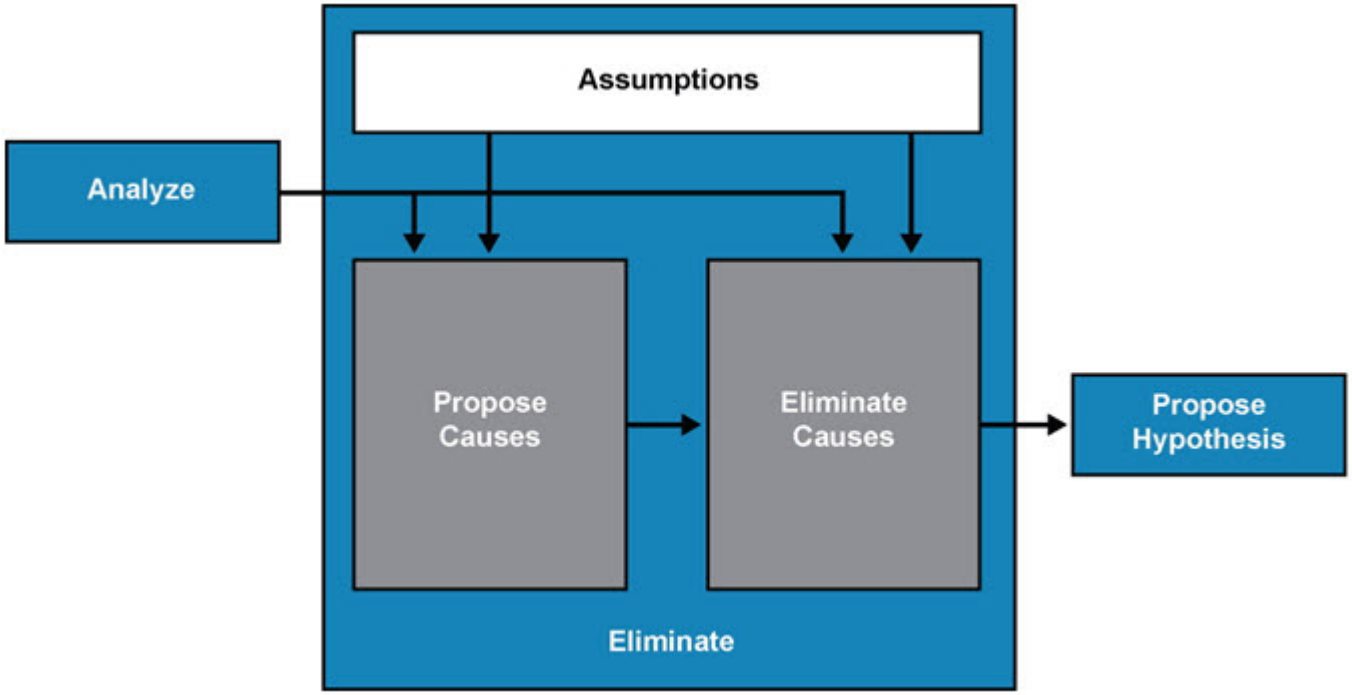
The Troubleshooting Process – Eliminate



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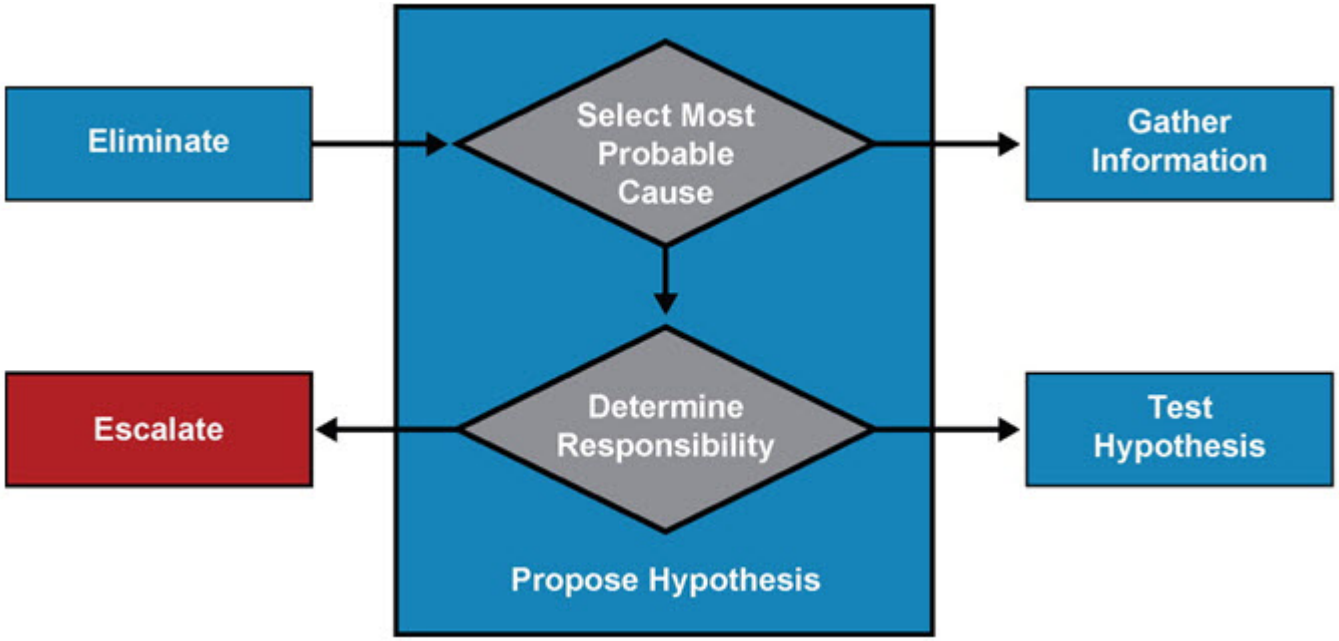
The Troubleshooting Process – Propose Hypothesis



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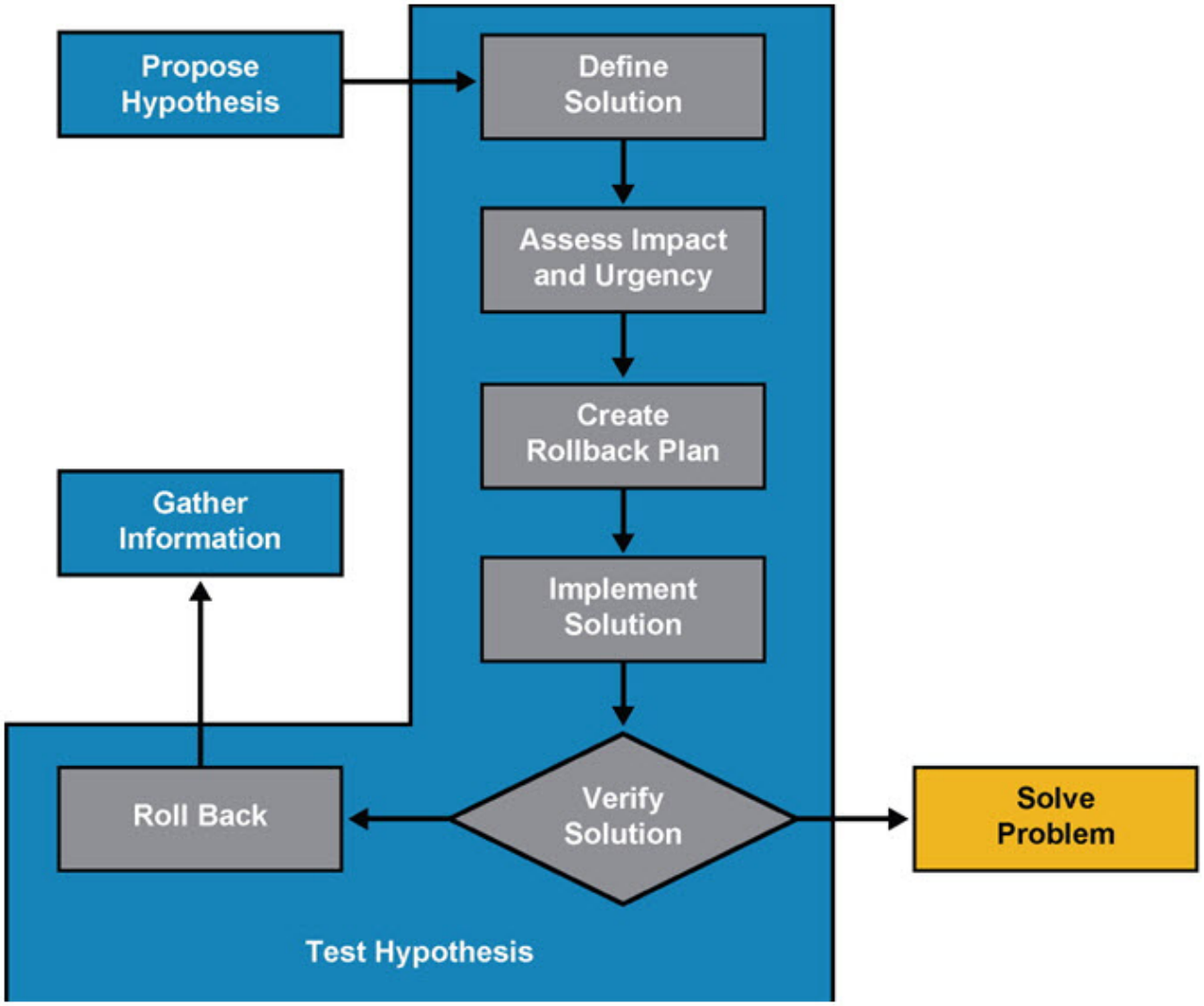
The Troubleshooting Process – Test Hypothesis



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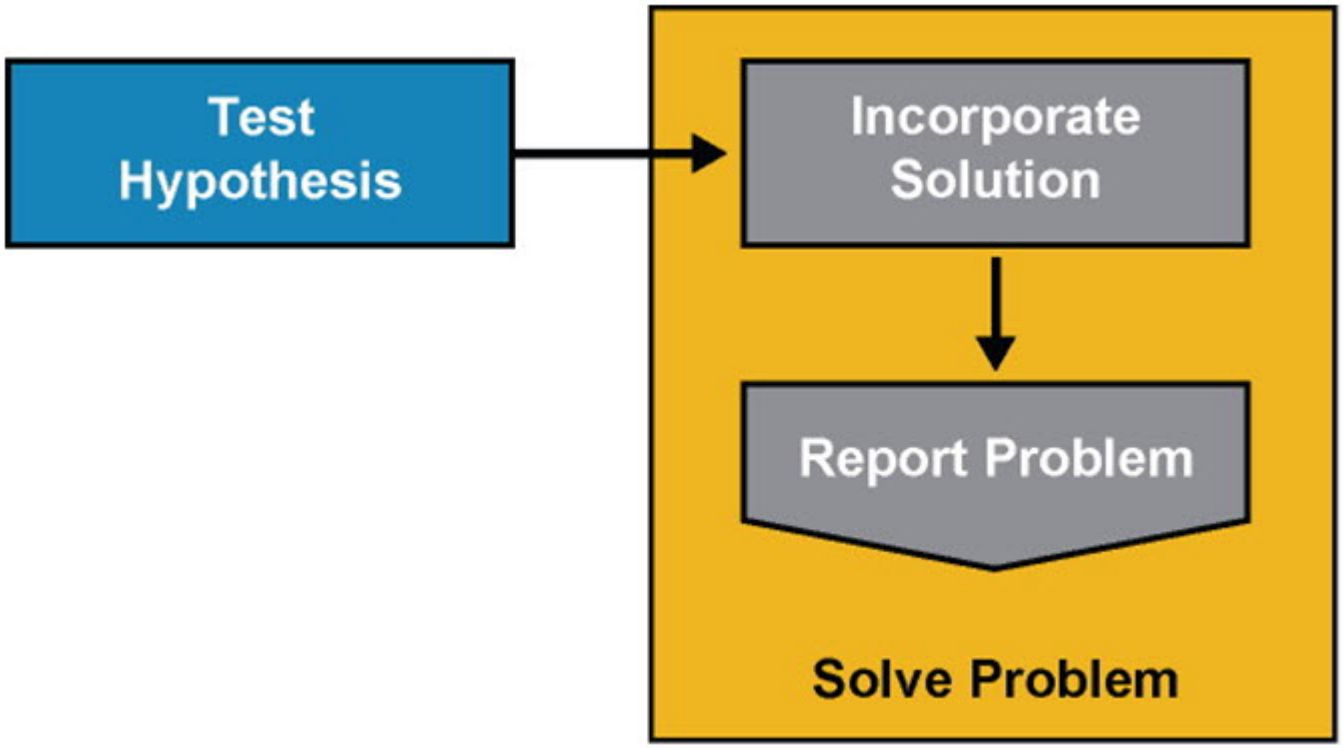
The Troubleshooting Process – Solve Problem

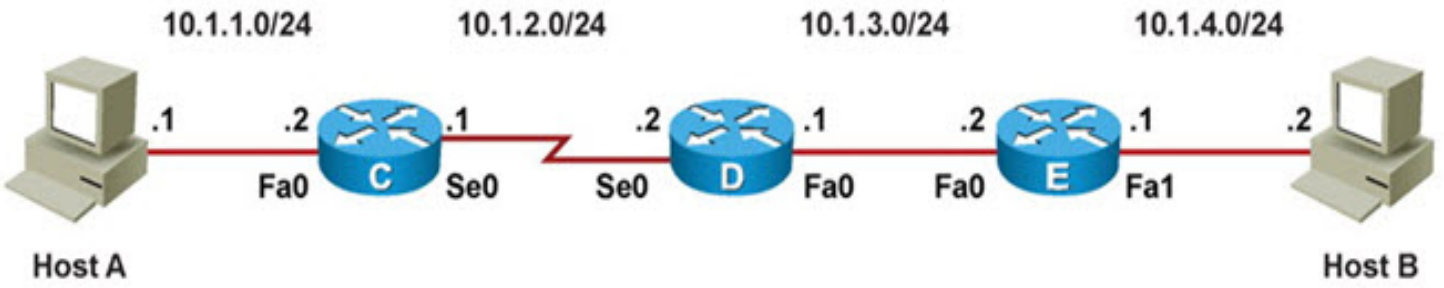


Troubleshooting Approaches

- A structured troubleshooting method is used as a guideline through a troubleshooting process
- Commonly used troubleshooting approaches are:
  - Top-down
  - Bottom-up
  - Divide and conquer
  - Follow-the-path
  - Spot the differences
  - Move the problem

Network Layer Connectivity

- Good understanding of which processes that are involved in routing a packet from a source, through multiple routers, to the final destination
- Which decisions does each of the devices make?
- What information do they need?
- What actions do they perform?



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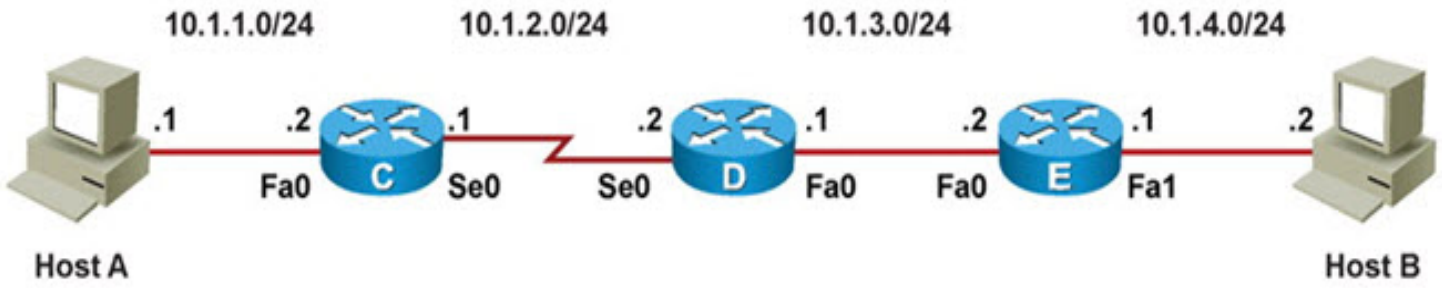

Packet exchange process between Host A and Host B:

Packet Position	Source IP Address	Destination IP Address	Source MAC Address	Destination MAC Address
Host A to Rtr C	10.1.1.1	10.1.4.2	Host A MAC	Rtr C Fa0 MAC
Rtr C to Rtr D	10.1.1.1	10.1.4.2	N/A	N/A
Rtr D to Rtr E	10.1.1.1	10.1.4.2	Rtr D Fa0 MAC	Rtr E Fa0 MAC
Rtr E to Host B	10.1.1.1	10.1.4.2	Rtr E Fa1 MAC	Host B MAC

Network Layer Connectivity

If network layer connectivity is missing:

- Track the path of the packet from router to router
- Verify availability of a matching route in the routing table
- Verify Layer 3 to Layer 2 address mapping for the next hop
- For two-way communication, track the packets in both directions

Using IOS Commands to Verify Routing Functions

To display the content of the IP routing table use the following commands:

- **`show ip route`** *`ip-address`*:
  - Displays the best route that matches the address and all associated control plane details.
- **`show ip route`** *`network mask`*:
  - Searches for exact match for the network and mask specified and displays the entry if found.
  - Note that if the only route that matches the *`ip-address`* argument is the default route, the router will respond with

    `%Network not in table`
- **`show ip route`** *`network mask`* **`longer-prefixes`**:
  - Displays prefixes in the routing table that fall within the prefix specified by the network and mask parameters.

Using IOS Commands to Verify Routing Functions – Cont.

To display the CEF Forwarding Information Base (FIB) table use the following commands:

- **`show ip cef`** *`ip-address`*:
  - Searches the FIB instead of the routing table.
  - Displays only the information that is necessary to forward packet (no routing protocol related information).
- **`show ip cef`** *`network mask`*:
  - Displays information from the FIB instead of the routing table (RIB).
- **`show ip cef exact-route`** *`source destination`*:
  - Displays the exact adjacency used to forward a packet with source and destination IP addresses.
  - Useful when the routing table and FIB contain two or more equal routes for a particular prefix.

Using IOS Commands to Verify Routing Functions – Cont.

To verify the Layer 3 to Layer 2 mappings use the following commands:

- **`show ip arp`**:
  - Used to verify the dynamic IP address to Ethernet MAC address mappings that were resolved by ARP. (Use the **`clear ip arp`** and **`clear arp-cache`** commands to refresh the ARP cache).
- **`show adjacency detail`**:
  - Displays the full frame header that will be used to encapsulate the packet as well as packet and byte counters for all traffic that was forwarded using a particular adjacency entry. Verify Layer 3 to Layer 2 mappings for the data link protocol used on the egress interface.