What is IOS?

- Internetwork Operating System
- A derivative of BSD UNIX
Router Components RAM

RAM

- Temporary storage of config files
- All content is lost on power-down
- Large to hold large routing tables

Stores

- Routing tables (remember: usually built dynamically)
- ARP cache (again, built dynamically and ephemeral)
- Packet buffers
- Packet hold queues
Router Components NVRAM

NVRAM
- Non-volatile RAM
- Not especially fast
- Content is NOT LOST on power cycle.
- Usually less than 100 Kbytes

Stores
- Exclusively used to store configuration scripts that are parsed on power-up.
Router Components FLASH

FLASH

- EEPROM (Electronically Erasable Programmable Read-Only Memory)
- Retained on power-down.
- May be off-board in the form of flashcards.

Stores

- IOS versions. Allows for upgrading Operating System without replacing chip.
- Multiple versions of IOS may be stored at once (GREAT for testing install of a new version!)
Router Components ROM

ROM

- Read-Only Memory.
- Generally installed in factory and never touched again!

Stores

- POST (power-on self test)
- Bootstrap program that calls IOS.
- Bare-bones version of an IOS. If IOS load routine fails, it defaults back to this version, giving limited functionality.
Boot Procedure

POST
Bootstrap
Mini IOS

ROM

TFTP?

FLASH

IOS

NVRAM

Configuration

Configuration Loaded IOS

RAM

Route tables..

ARP..

Built during runtime
IOS Interface

- IOS commands are very “assembly-like”. They are often counter-intuitive.
- Since these configurations are stored as text scripts, you can look up lots of examples on Cisco’s website.
- This is somewhat alleviated with inline help. The “?” character will become your best friend.
In-line Help

- Typing the “?” character either after a command or at some point during a word brings up configuration parameters:

For instance, typing:

```
“ac?” <RETURN>
```

*Will ask the IOS what commands begin with “ac”, it will respond with:*

```
“access-enable access-template”
```

This also works to find command modifiers or subsets:

```
“show ip ?”
```

*Asks the IOS what is available for the “show ip” command:*

```
“interface route …”
```

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Shortcuts

- Just like most *NIX’s, IOS has a wide array of shortcut keys to expedite configuration.

<table>
<thead>
<tr>
<th>Command</th>
<th>Issued At</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delete</td>
<td>Anywhere</td>
<td>Removes one char to the right of cursor</td>
</tr>
<tr>
<td>Backspace</td>
<td>Anywhere</td>
<td>Removes one char to the left of cursor</td>
</tr>
<tr>
<td>TAB</td>
<td>Anywhere</td>
<td>Finishes a partial command.</td>
</tr>
<tr>
<td>Ctrl-A</td>
<td>Anywhere</td>
<td>Moves the cursor to beginning of current line.</td>
</tr>
<tr>
<td>Ctrl-E</td>
<td>Anywhere</td>
<td>Moves cursor to end of current line.</td>
</tr>
<tr>
<td>Ctrl-R</td>
<td>Anywhere</td>
<td>Redisplays a line.</td>
</tr>
<tr>
<td>Ctrl-U</td>
<td>Anywhere</td>
<td>Erases a line.</td>
</tr>
<tr>
<td>Ctrl-W</td>
<td>Anywhere</td>
<td>Erases previous word.</td>
</tr>
<tr>
<td>Ctrl-Z</td>
<td>Configuration Mode</td>
<td>Ends configuration mode and returns to EXEC</td>
</tr>
<tr>
<td>Up Arrow</td>
<td>Anywhere</td>
<td>Scroll forward through former commands.</td>
</tr>
<tr>
<td>Down Arrow</td>
<td>Anywhere</td>
<td>Scroll backward through former commands.</td>
</tr>
</tbody>
</table>

- The most useful is the TAB key, which as you may know, completes a word.