5--USING MULTIPLE ROUTERS TO PROTECT AGAINST "IoT" INSECURITY

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SUMMARY

- "Internet of Things" (IoT) devices come with a proprietary Internet access methodology that is controlled by their manufacturers. Having IoT devices share the same router as a computer or tablet is not recommended. We recommend a 3 router solution for connecting "IoT" devices your home or small business network.

TOPICS

- Basic Advice About Routers
- Basic Assumptions
- Two Router Configuration
- Three Router Configuration
- Activate "Access Point" Isolation on More Expensive Routers

BASIC ADVICE ABOUT ROUTERS

- One of the best descriptions of securing local networks for insecure "Internet of Things" devices can be found at https://shkspr.mobi/blog/2016/03/designing-a-home-network-for-hostile-devices/

BASIC ADVICE ABOUT ROUTERS (continued)

- See also https://www.trendmicro.com/vinfo/us/security/news/internet-of-things/protect-home-network-securing-router

BASIC ADVICE ABOUT ROUTERS (continued)

- See also: https://www.ic3.gov/Media/Y2018/PSA180802 and https://www.fbi.gov/contact-us/field-offices/portland/news/press-releases/tech-tuesday-internet-of-things-iot

BASIC ADVICE ABOUT ROUTERS (continued)

- We agree with the general concept of using a "guest Wi-Fi network" inside an existing router but having multiple virtual routers inside a single router is usually a lot more susceptible to malware relative to having separate routers with uniquely different usernames and passwords and manufacturers.

BASIC ASSUMPTIONS

- Assumption One:
  We are using "dumb routers" that generate and assign "private IP addresses" for their local network-attached computers and devices.
- Assumption Two:
  These "dumb routers" do not communicate and coordinate with each other.

MULTIPLE ROUTER CONFIGURATION

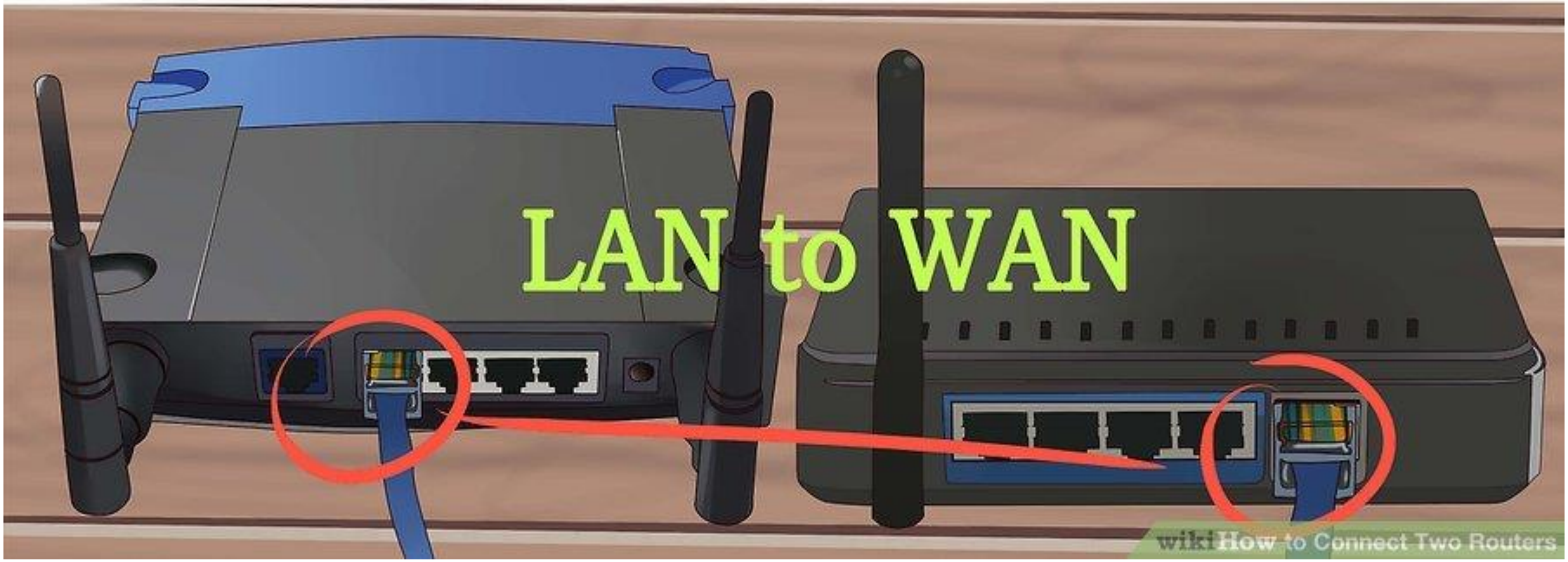
- In the large networks of governments, large businesses, and educational institutions, multiple tree-like levels of routers (both actual and virtual) have been the normal mode of operation for about 60 years

MULTIPLE ROUTER CONFIGURATION (continued)

- Reference for the multiple router concept: https://www.pcper.com/reviews/General-Tech/Steve-Gibsons-Three-Router-Solution-IOT-Insecurity

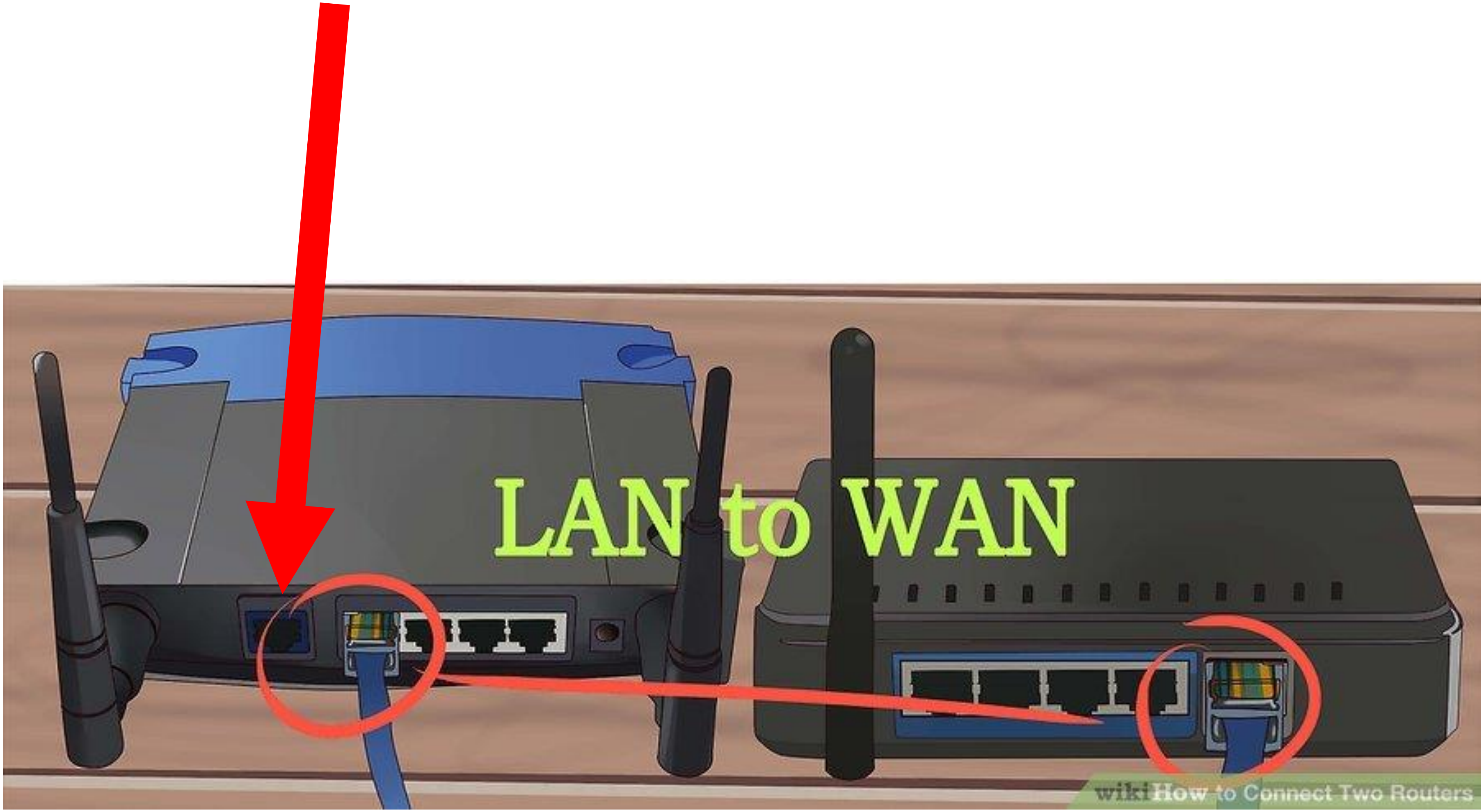
MULTIPLE ROUTER CONFIGURATION (continued)

- "Border router" on the left
  and
  "IOT router" on the right:


LAN to WAN
wikiHow to Connect Two Routers

MULTIPLE ROUTER CONFIGURATION (continued)

- If the "border router" is not part of a "broadband modem", then the WAN jack or Internet jack connect here: ("WAN" stands for "Wide Area Network"):


LAN to WAN
wikiHow to Connect Two Routers

MULTIPLE ROUTER CONFIGURATION (continued)

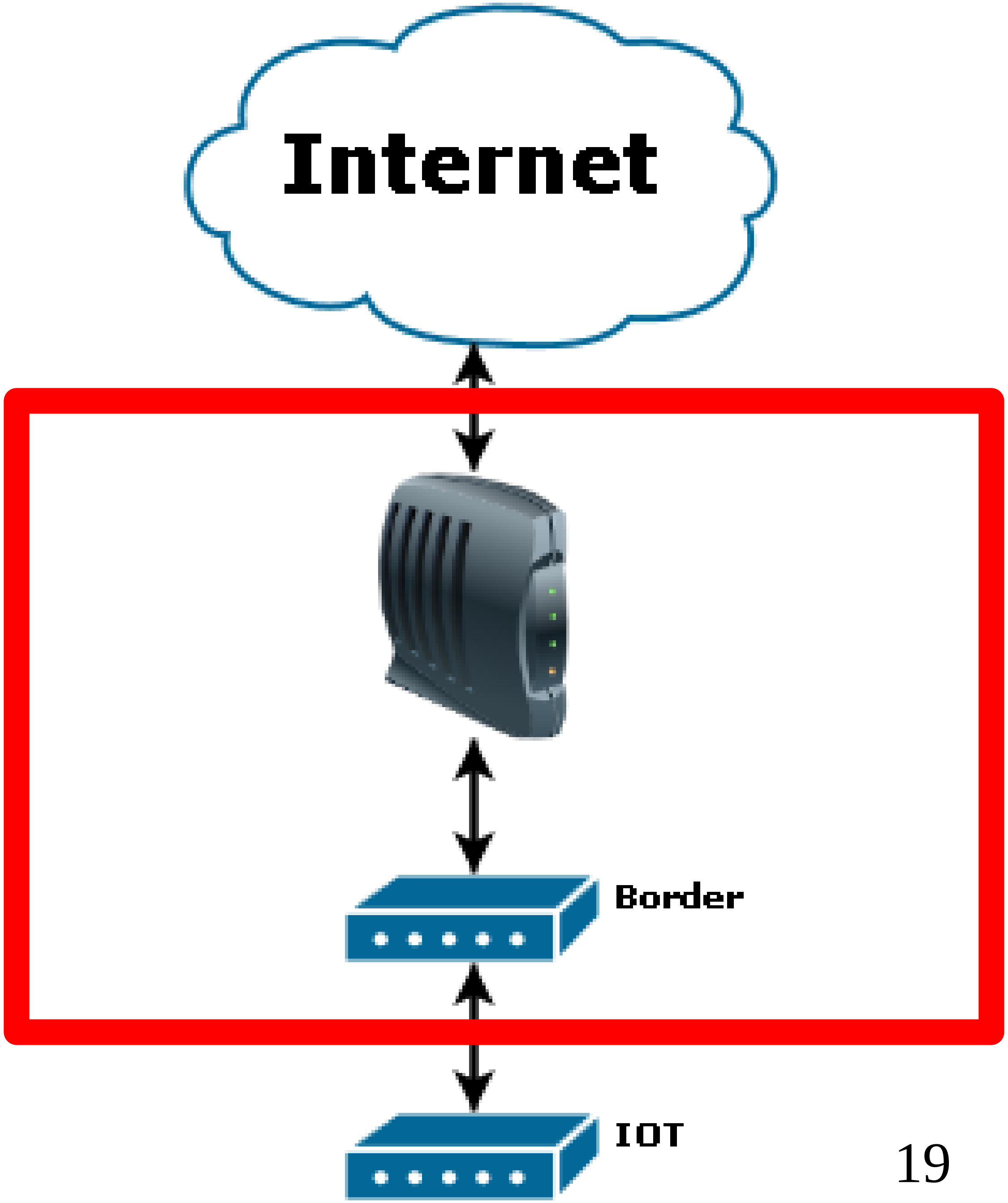
- Reference for the previous two illustrations: https://www.wikihow.com/Connect-Two-Routers

MULTIPLE ROUTER CONFIGURATION (continued)

- "LAN to WAN" means that one of the "LAN" jacks of the (left) "border router" is connected to the the "WAN" jack of the (right) "IOT router":

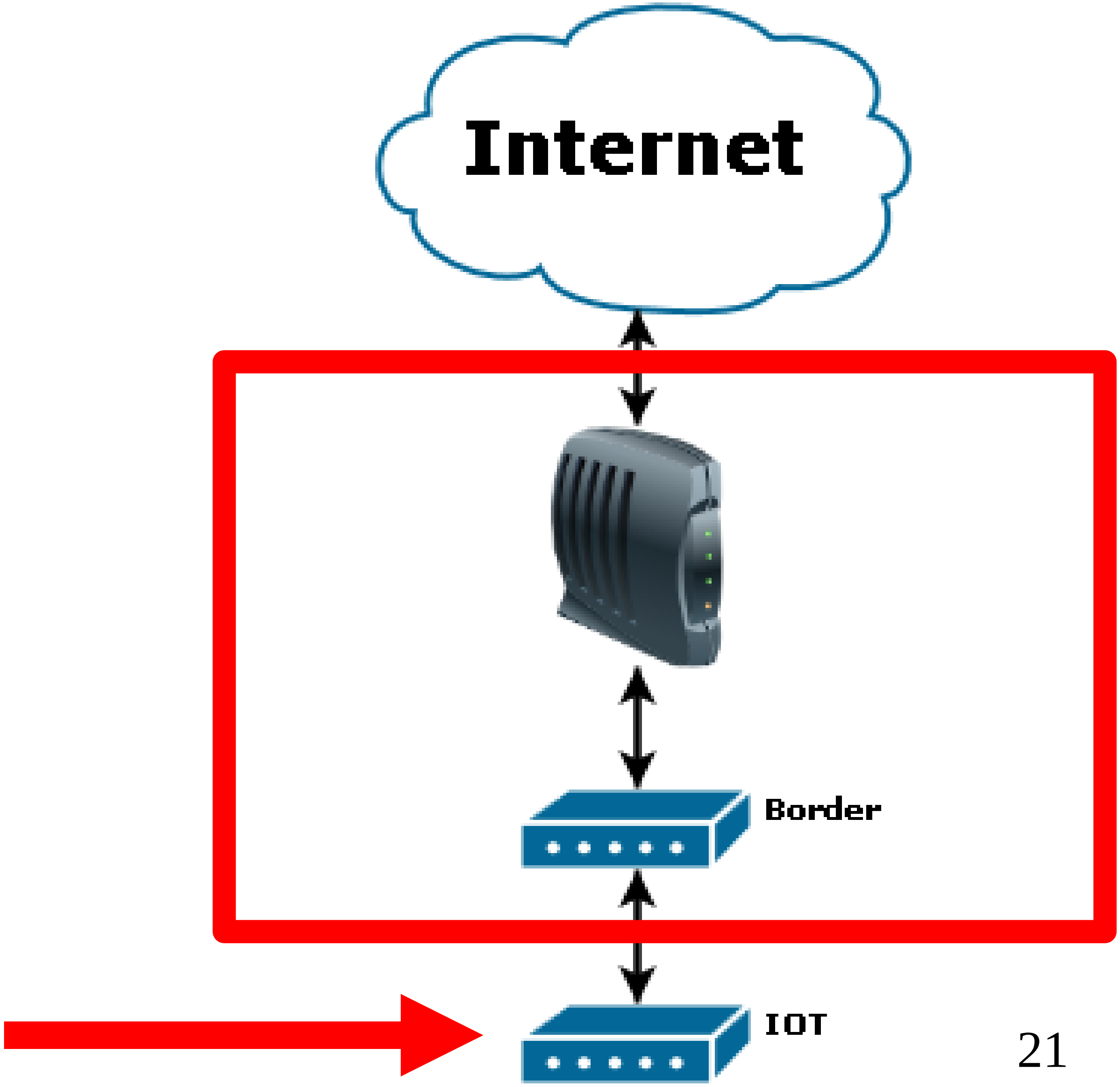
MULTIPLE ROUTER CONFIGURATION (continued)

- For most of us, the broadband modem that we rent from our "Internet Services Provider" actually has both a broadband modem and a "border router" inside it:


Internet
Border
IOT

MULTIPLE ROUTER CONFIGURATION (continued)

- Therefore, for most of us, adding one additional router brings us to the "two router" configuration:


Internet
Border
IOT

MULTIPLE ROUTER CONFIGURATION (continued)

- The article at https://www.pcper.com/reviews/General-Tech/Steve-Gibsons-Three-Router-Solution-IOT-Insecurity criticizes the two-router configuration as follows:

MULTIPLE ROUTER CONFIGURATION (continued)

- <Start of quote:>
  In this arrangement, only IOT/Smart devices are connected to the internal (or IOT-purposed) router. The idea was to isolate insecure or poorly implemented devices from the more valuable personal local data devices such as a NAS with important files and or backups.

MULTIPLE ROUTER CONFIGURATION (continued)

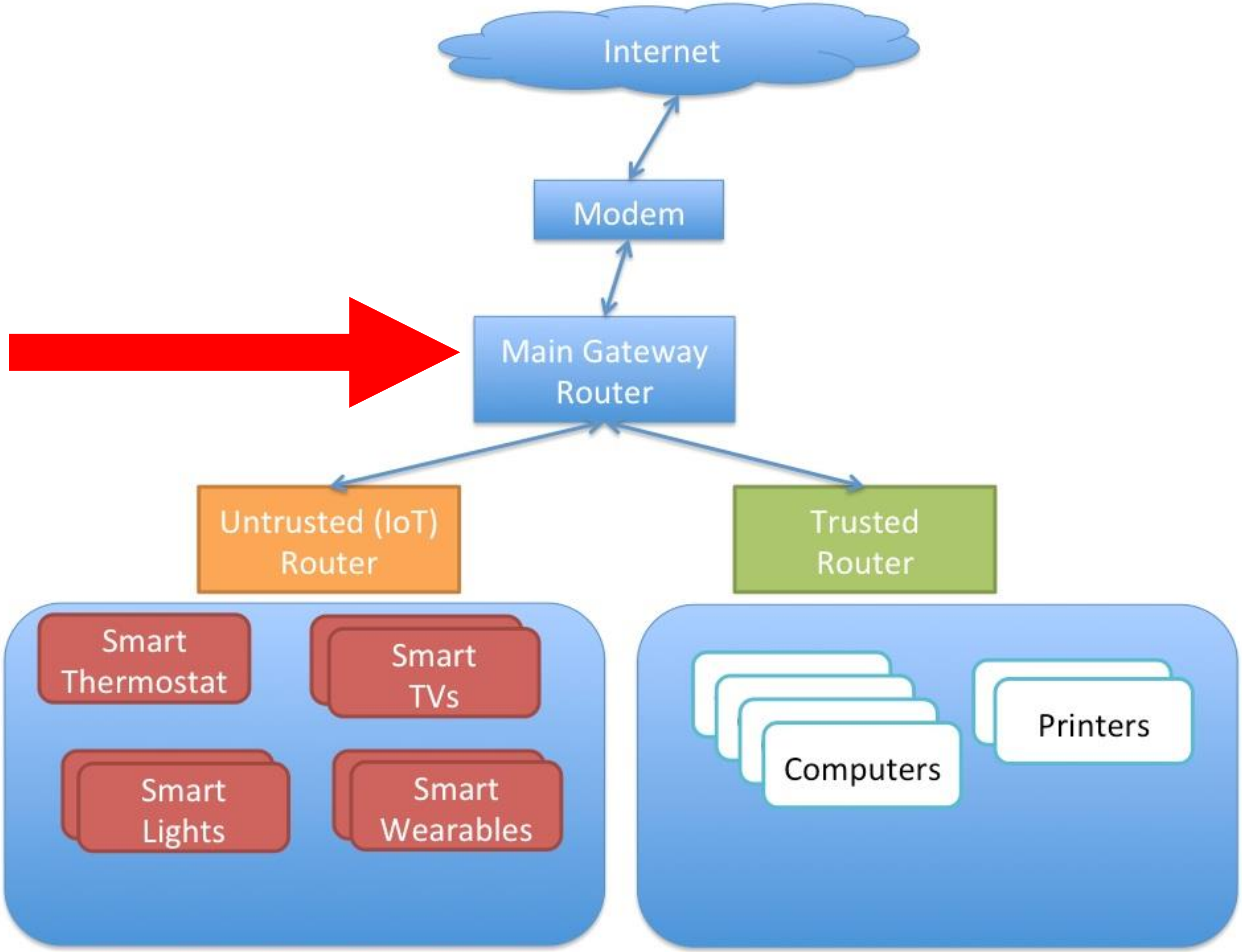
- Unfortunately this clever arrangement leaves any device directly connected to the “border” router open to attack by infected devices running on the internal/IOT router. Said devices could perform a simple trace-route and identify that an intermediate network exists between it and the public Internet.

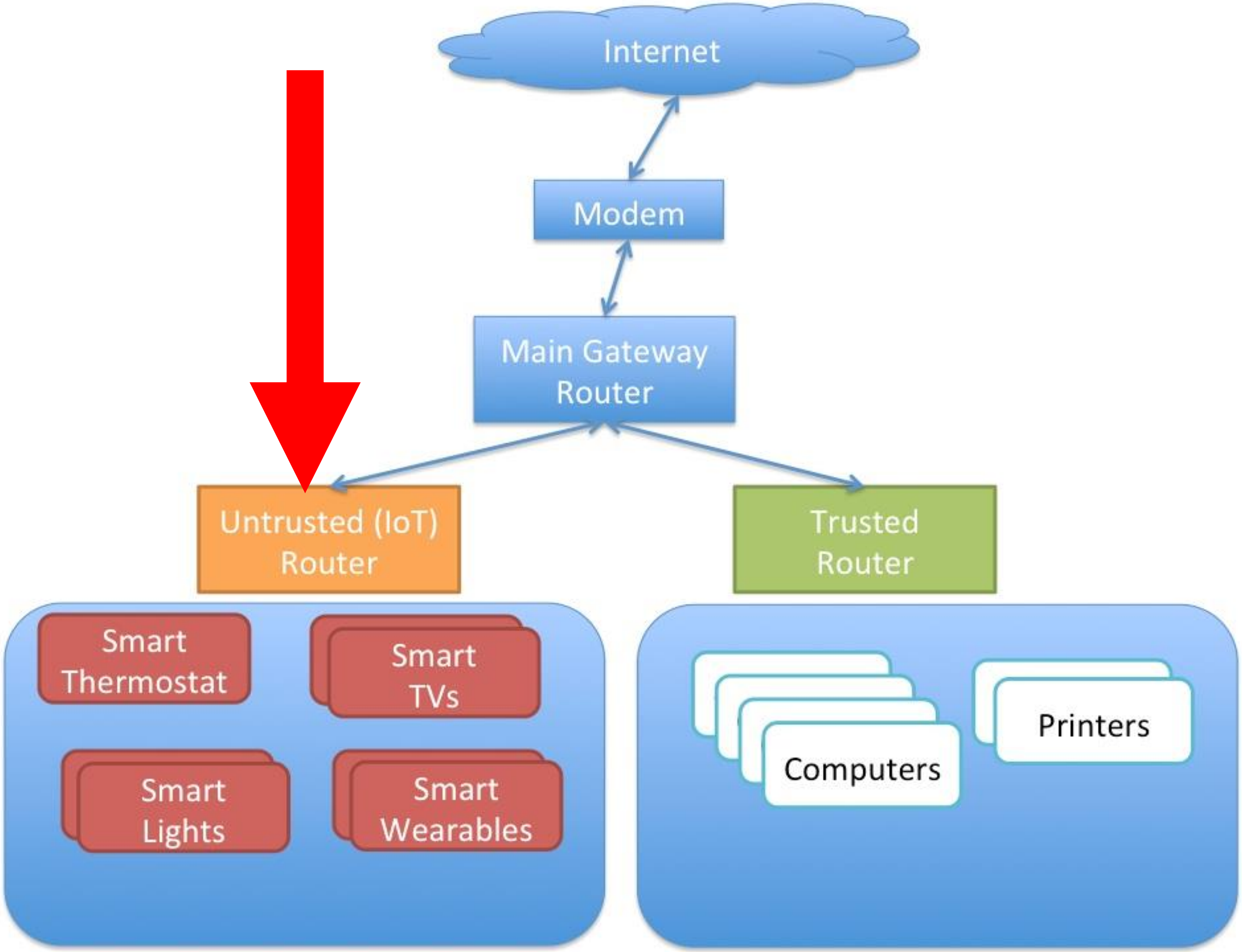
MULTIPLE ROUTER CONFIGURATION (continued)

- Any device running under the border router with known (or worse - unknown!) vulnerabilities can be immediately exploited.
  <End of quote>

THREE+ ROUTER CONFIGURATION

- Untrusted IoT Router:


Internet
Modem
Main Gateway Router
Untrusted (IoT) Router
Trusted Router
Smart Thermostat
Smart TVs
Smart Lights
Smart Wearables
Computers
Printers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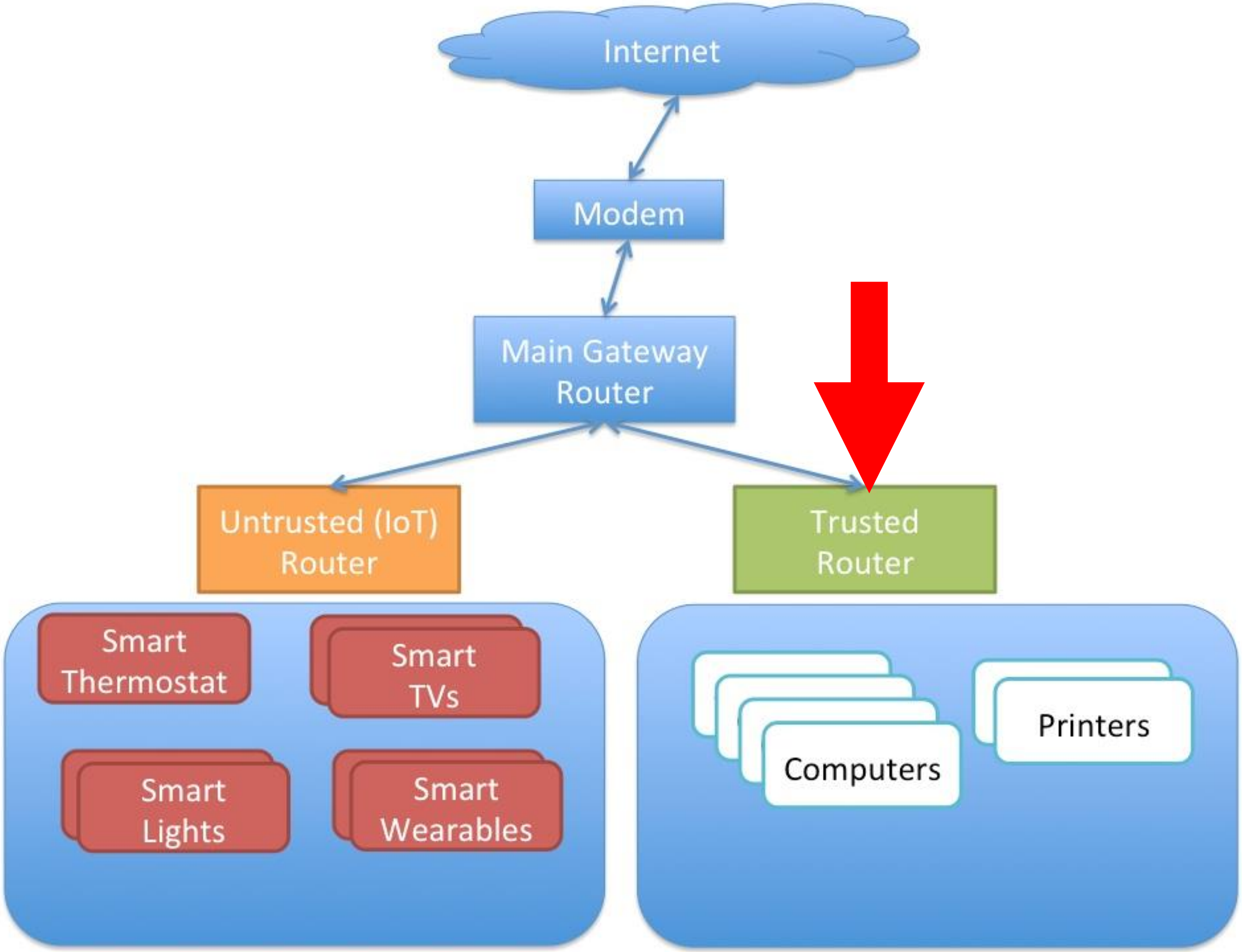
Main Gateway Router
Untrusted (IoT) Router
Trusted Router
Smart Thermostat
Smart TVs
Smart Lights
Smart Wearables
Computers
Printers

BASIC THREE+ ROUTER CONCEPT (continued)

- Trusted Router:


Internet
Modem
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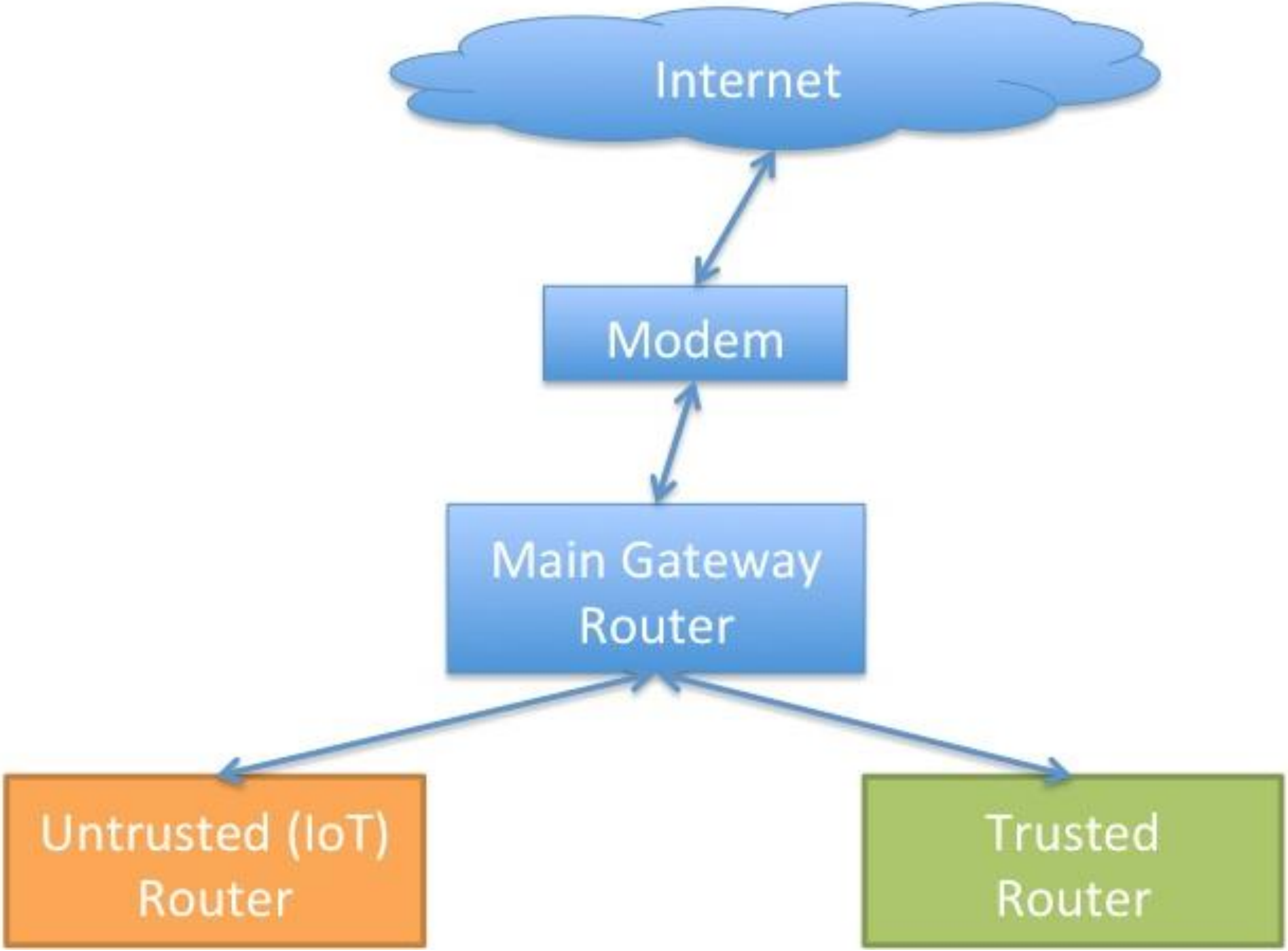
Printers

BASIC THREE+ ROUTER CONCEPT (continued)

- Basic Concept:
  Internet providers modem or router connects to
  Main Gateway Router
  which has a LAN side that connects to Untrusted (IoT) Router
  and
  to Trusted router



Internet
Modem
Main Gateway Router
Untrusted (IoT) Router
Trusted Router

BASIC THREE+ ROUTER CONCEPT (continued)

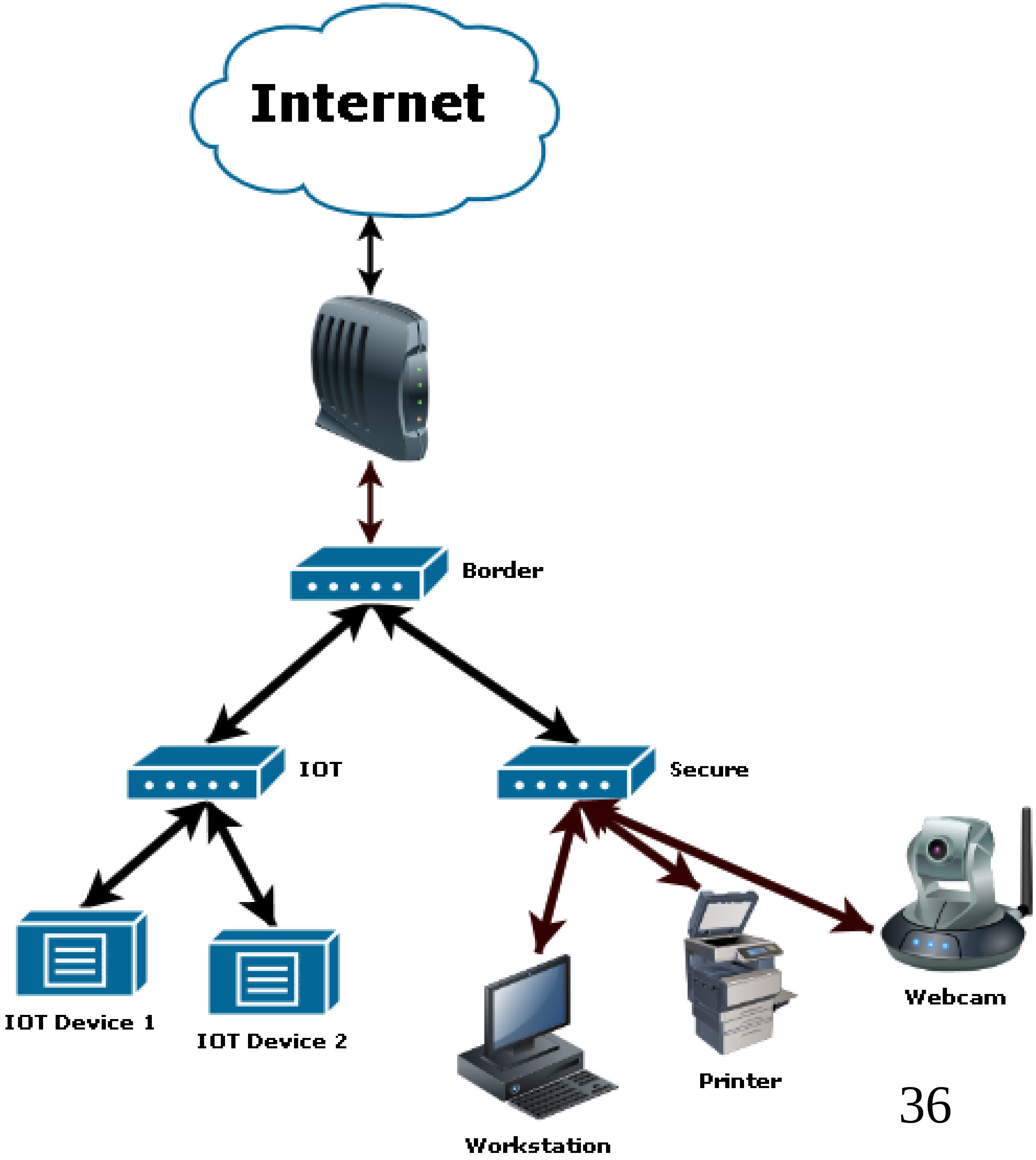
- Also known as "3 dumb routers" as coined by Steve Gibson because the routers that are purchased for homes and small business are much dumber than that ones that larger businesses and organizations use, which, for a home or small business network, may be a good thing.

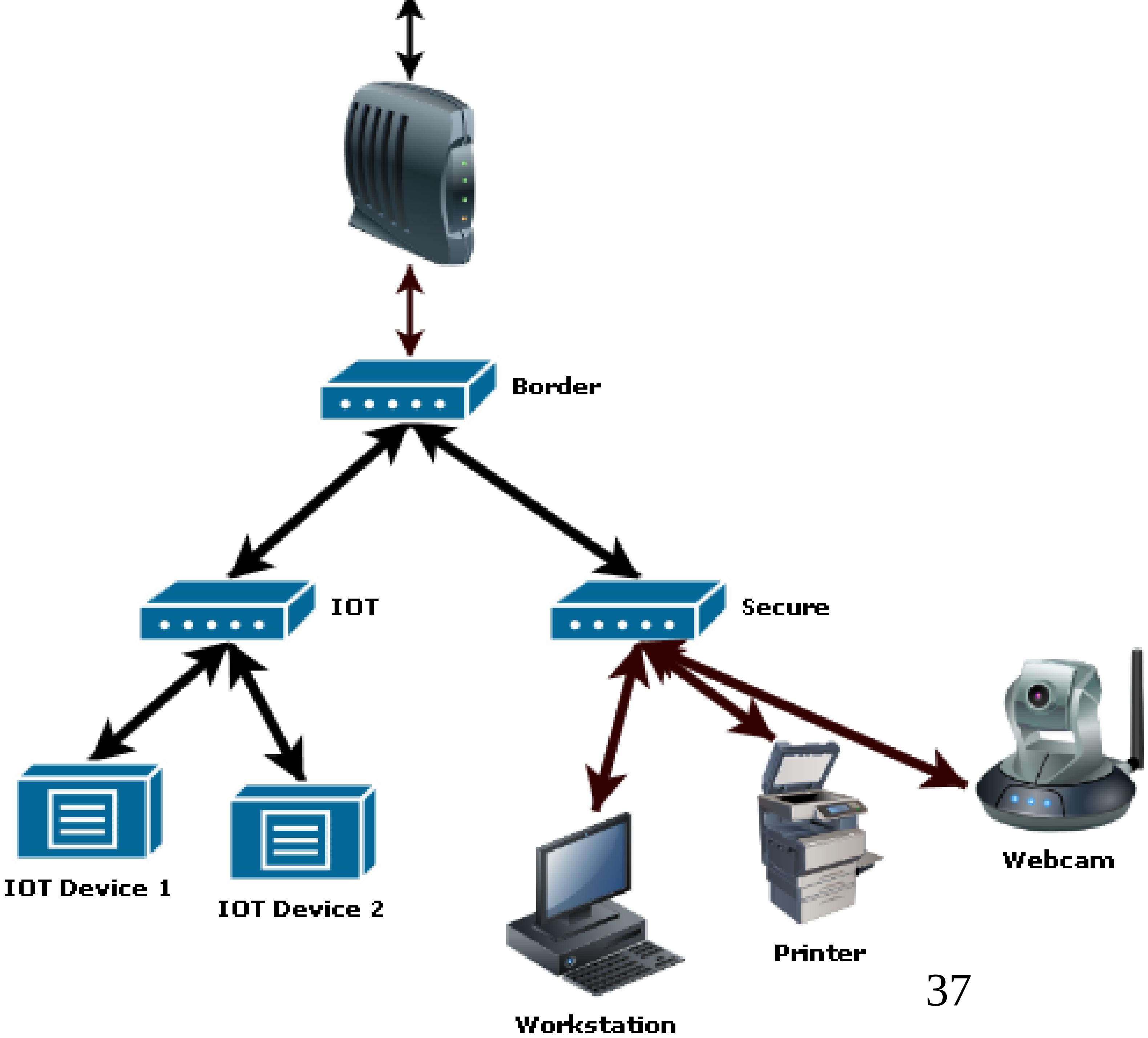
A MORE PROFESSIONAL DESCRIPTION OF THE THREE+ ROUTER CONCEPT

- A more professional description of the 3 router concept along with a more critical view of the details can be found at https://www.pcper.com/reviews/General-Tech/Steve-Gibsons-Three-Router-Solution-IOT-Insecurity

A MORE PROFESSIONAL DESCRIPTION OF THE THREE+ ROUTER CONCEPT (continued)

- "Main Gateway Router" is usually called "Border Router" by computer and network professionals.
- "Untrusted Router" is now usually called "IoT Router" since "Untrusted.." has a bad connotation.


Internet
Border
IOT
Secure
IOT Device 1
IOT Device 2
Workstation
Printer
Webcam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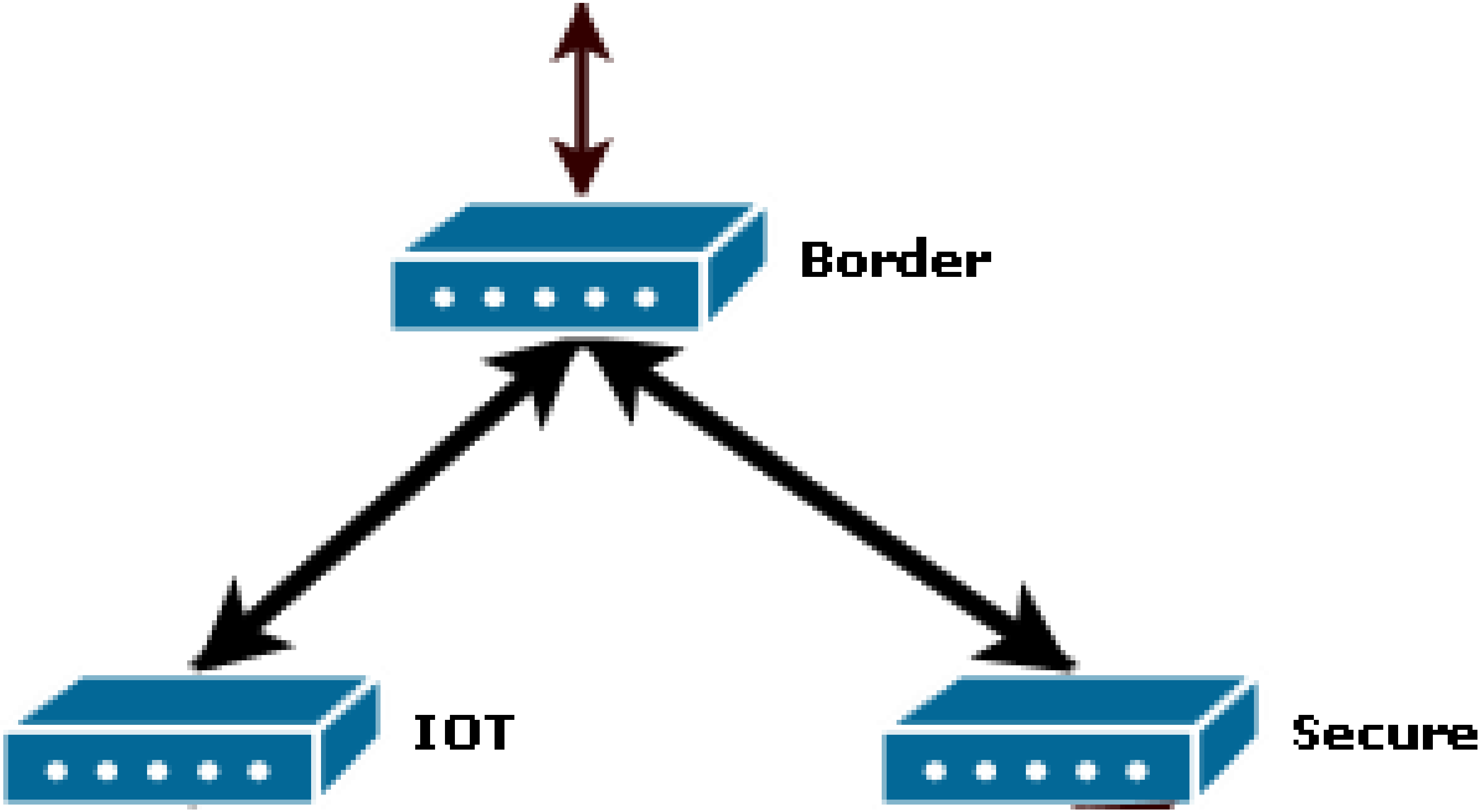
Border
IOT
Secure

A MORE PROFESSIONAL DESCRIPTION OF THE THREE ROUTER CONCEPT (continued)

- For most of us, the "border router" is part of the broadband modem that is provided by our broadband "Internet Service Provider"

ACTIVATE "ACCESS POINT ISOLATION" ON MORE EXPENSIVE ROUTERS

- On more expensive routers, you might be able to activate "wireless isolation" so that each Wi-Fi-connected "Internet of Things" device is isolated from each other and from wired computers on the local network.

ACTIVATE "WIRELESS ISOLATION" ON MORE EXPENSIVE ROUTERS (continued)

- "wireless isolation"

  = "AP isolation"

  = "Access Point isolation"

  = "client isolation"

  = "station isolation"

  = "wireless client isolation"

ACTIVATE "WIRELESS ISOLATION" ON MORE EXPENSIVE ROUTERS (continued)

- "Wireless isolation" means that each Wi-Fi-connected "Internet of Things" device cannot access shared files on any other Wi-Fi-connected or Ethernet-connected device that is connected to the router.

ACTIVATE "WIRELESS ISOLATION" ON MORE EXPENSIVE ROUTERS (continued)

- When you activate "access point isolation", you end up with a separate virtual router for each individual "Internet of Things" device, as described at https://dazeend.org/2017/03/segregating-iot-devices-on-an-isolated-network/

ACTIVATE "WIRELESS ISOLATION" ON MORE EXPENSIVE ROUTERS (continued)

- However, "wireless isolation" is implemented differently in different models of routers, as described at https://jervis.ws/implementing-security-zones-with-home-routers-for-the-iot-early-years/
as follows:

ACTIVATE "WIRELESS ISOLATION" ON MORE EXPENSIVE ROUTERS (continued)

- <Start of quote:>
  Some routers provide ‘Wireless isolation’ which is designed to block inter-device access on the same wireless network. In some cases this blocks access to wired devices and all other wireless devices,

ACTIVATE "WIRELESS ISOLATION" ON MORE EXPENSIVE ROUTERS (continued)

- in others access to wired devices is ALLOWED however access to other wireless devices is blocked. If you wish to utilise wireless isolation on a wireless network,

ACTIVATE "WIRELESS ISOLATION" ON MORE EXPENSIVE ROUTERS (continued)

- check the manufacture's manual and perform some tests to ensure you’re familiar with the implementation.
  <End of quote>

ACTIVATE "WIRELESS ISOLATION" ON MORE EXPENSIVE ROUTERS (continued)

- In other words, "wireless isolation" is useful as a way to isolate "Internet of Things" devices from other computers in some models of routers and worthless in other models of routers.