Putting IPv6 to work

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Rocky Mountain IPv6 Task Force

RMv6TF

IPv6 – an Enabler for Virtualizing the Home

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History of SDN/NFV

- SDN started in the data center
- NFV followed later

Google Data Center

History of SDN/NFV

- Enterprises followed next

GrantLabs
Data Center

History of SDN/NFV

- The home is the next major area

The Home is not the Data Center

- The home is the anti-data center
- Uber distributed model
- Each home is a distinct location
- Each home is a separate access link
- Redundancy doesn't apply

Virtualizing the home is difficult!

Problems with the Home

- No (competent) administrator
- No planning or engineering
  - Routers bought instead of Range Extenders
  - 2 firewalls, 2 NATs, multiple wireless radios (on the same channel)

Problems with the Home

- Very price sensitive
  - Old technology lives almost forever
- Architecture is not like a office
  - Often multi-level or split level
- ISP access, many times, is at one corner of the home

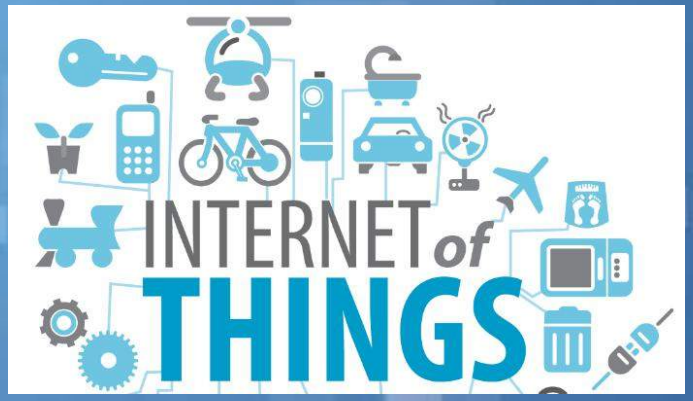
Home Complexity is Increasing!

Mu-MIMO Router

iPad Air 2

Samsung Galaxy S6

iControl Security



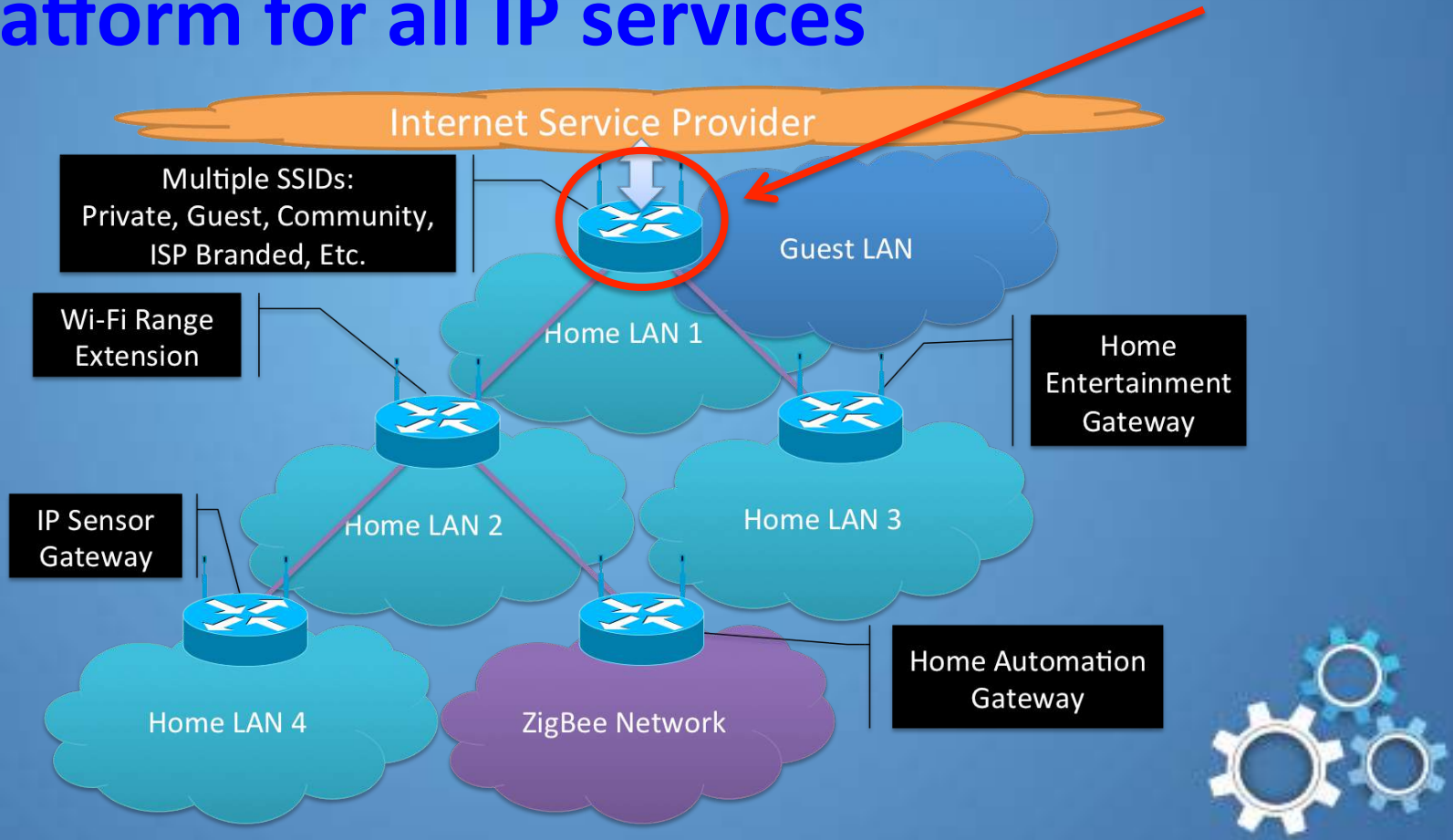
IoT

Home Complexity is Increasing!

- 1 in 3 Comcast subscribers have IPv6 to their cable modems
- Multiple SSIDs
  - Private, Guest, Office VPN, Kid's, Public
- Smart Grid, Home automation, Content sharing, Multi-homing, Heterogeneous link layer technologies …

Home Complexity is Increasing!

- **Failure causes service calls**
- **Platform for all IP services**



Home Complexity is Increasing!

- Multiple routers in the home ….
- Explicit – people buy a second router
- Implicit – Roku, Nest, iControl, X1, …

How can IPv6 and Virtualization solve the home complexity problem?

Extending IPv6 into the Home

IPv6, including Prefix Sub-Delegation can be distributed in the home using:

- HIPnet, developed by CableLabs and available to anyone.
- Homenet, an IETF draft that will use a routing protocol.

HIPnet - IPv6 into the Home

The prototype code doesn't include all the features of HIPnet. Includes:

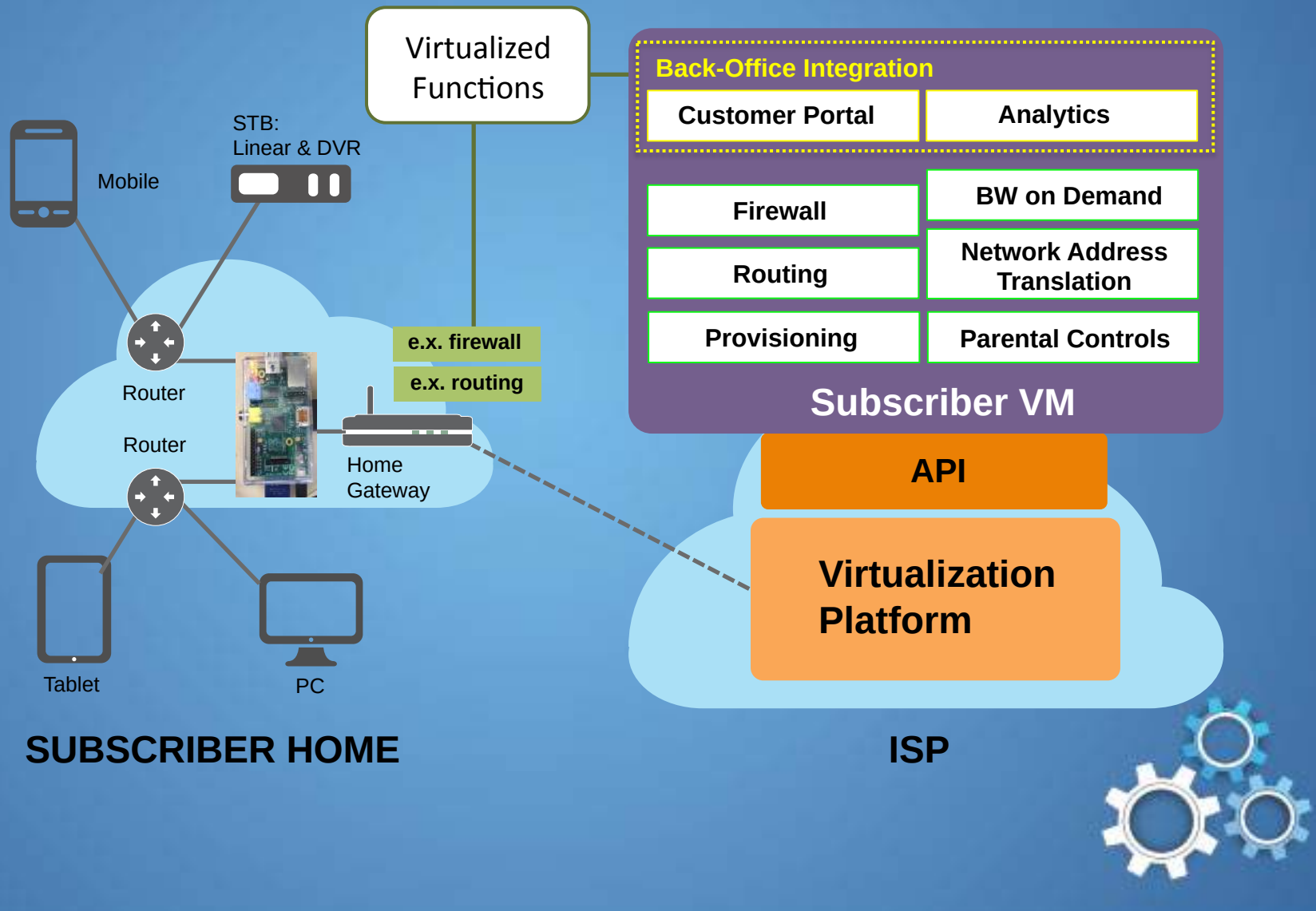
- Accepts IA_NA for Operator interface
- Uses IP_PD for prefix delegation in a 'serial[1] mode.
- Dynamically assigns Prefix Delegation from /52 to /64, inclusive
- Detects CER using prefix comparison

HIPnet - IPv6 into the Home

- Enables CER firewall and Disables firewall on IRs
- Uses Link-ID to map IPv4 subnets to each router
- Changes DHCPv4 pool to Link-ID assigned values
- Supports hot swapping cable/router box

https://github.com/cablelabs/HIPnet

A Virtualized Home Architecture



Telemetry and Topologies

Service Providers want telemetry from the home – why?

- Faster time to market
- Provide new and enhanced services
- Capex & Opex reduction

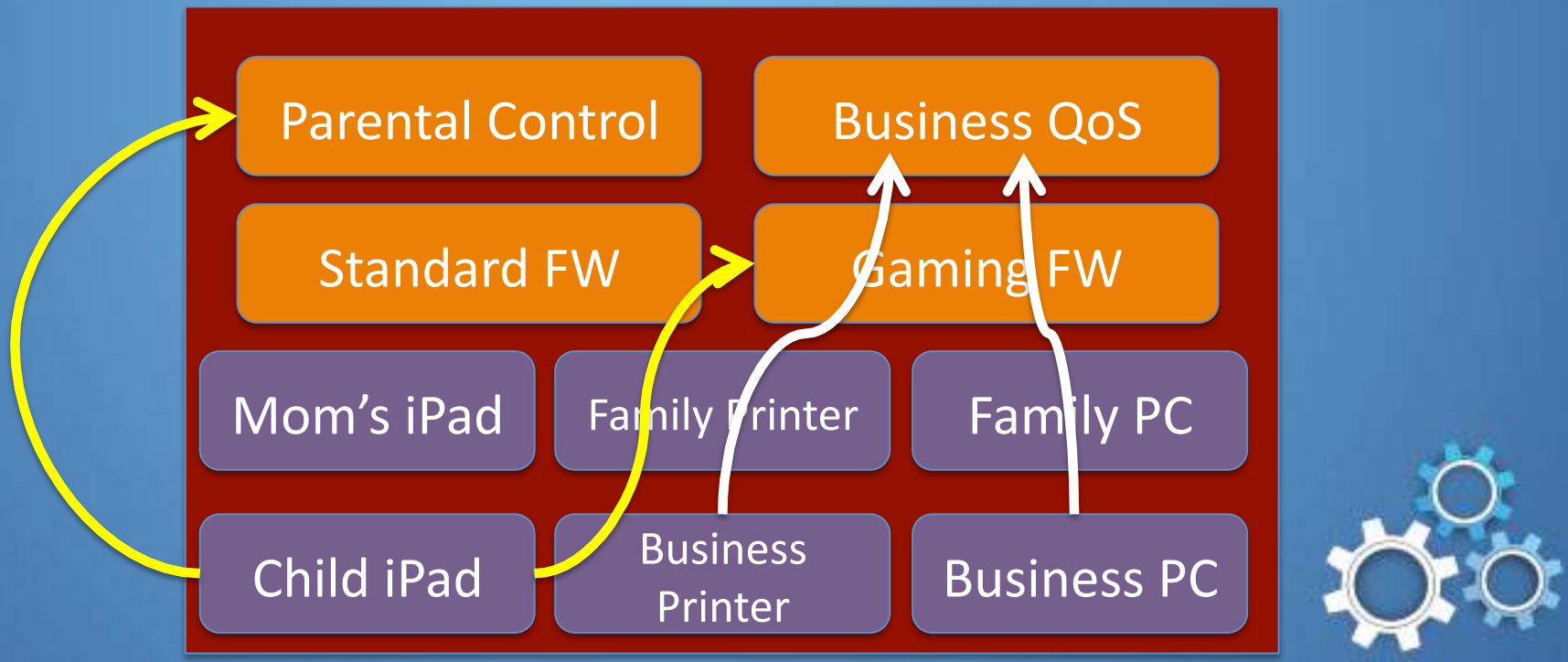
Telemetry and Topologies

Broadband providers want to enable new services based on telemetry

- Subscriber, location, time, device & application
- Mapping can only happen if a device can be identified.
- Devices are discovered; UPnP, etc.

ISP Service Portal

A portal, groups known devices to a service (policy) group by the subscriber

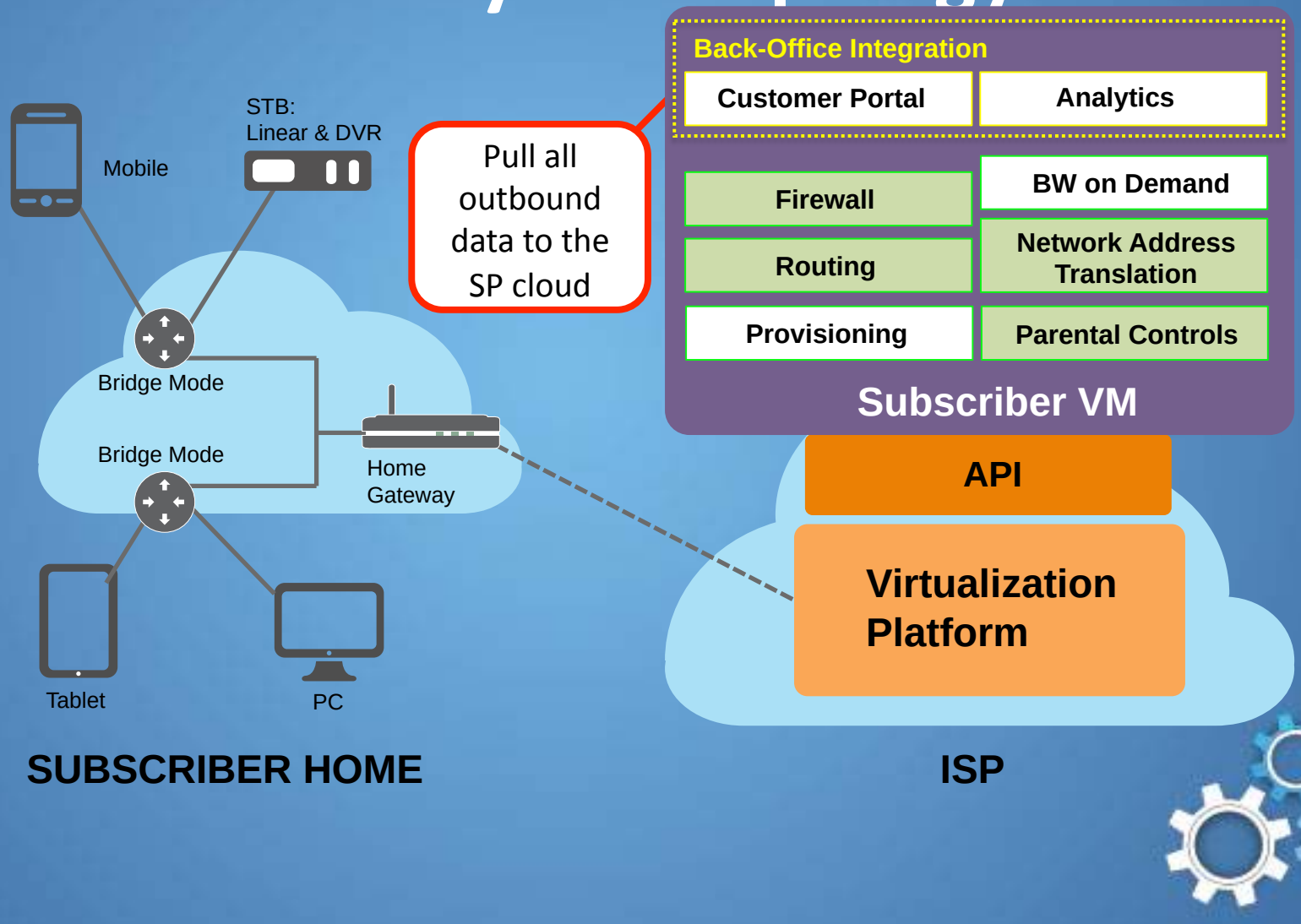


Telemetry and Topologies

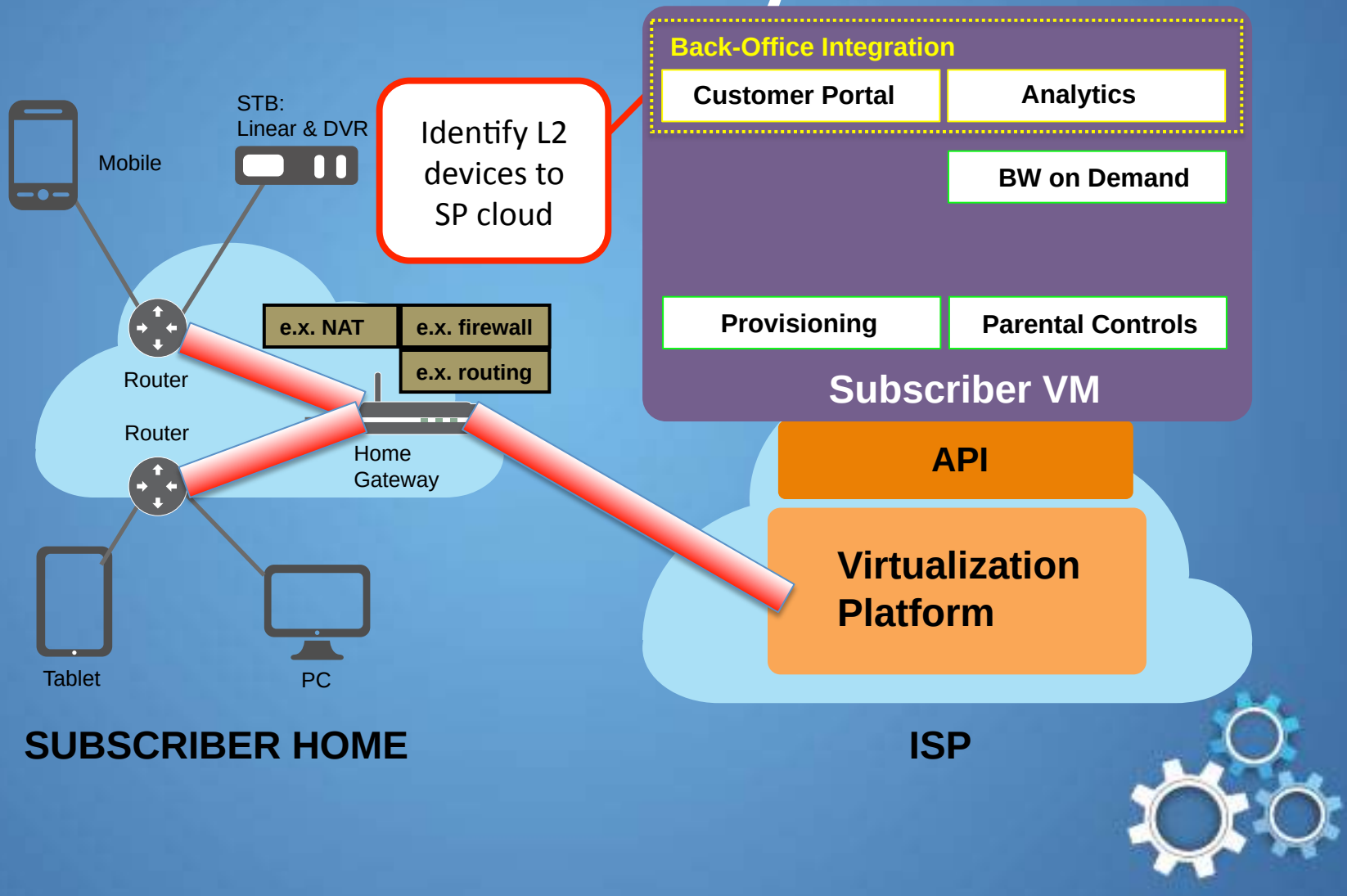
Multiple routers obfuscate rich layer-2 data used to identify devices.

- Two realistic approaches:
  - Place all routers in bridge mode
  - Use a L2 overlay on a L3 network

Telemetry and Topologies
Flat Layer-2 Topology



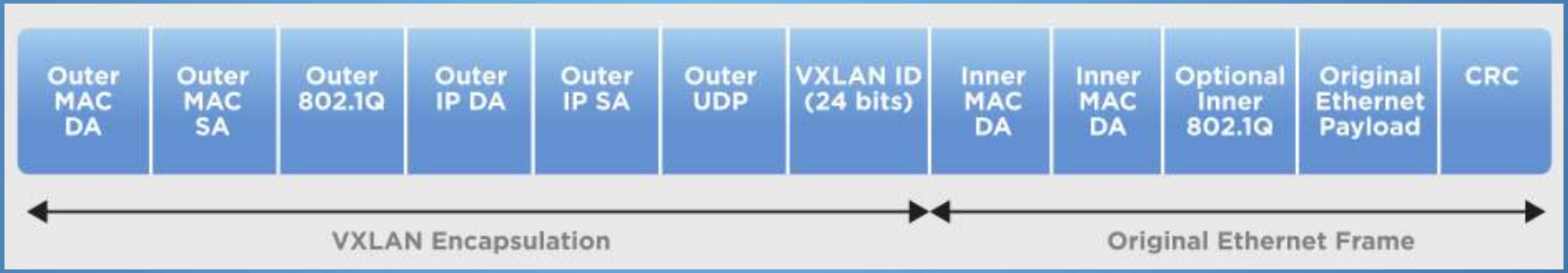
Telemetry and Topologies
L2 Overlay



Tunnel Topology

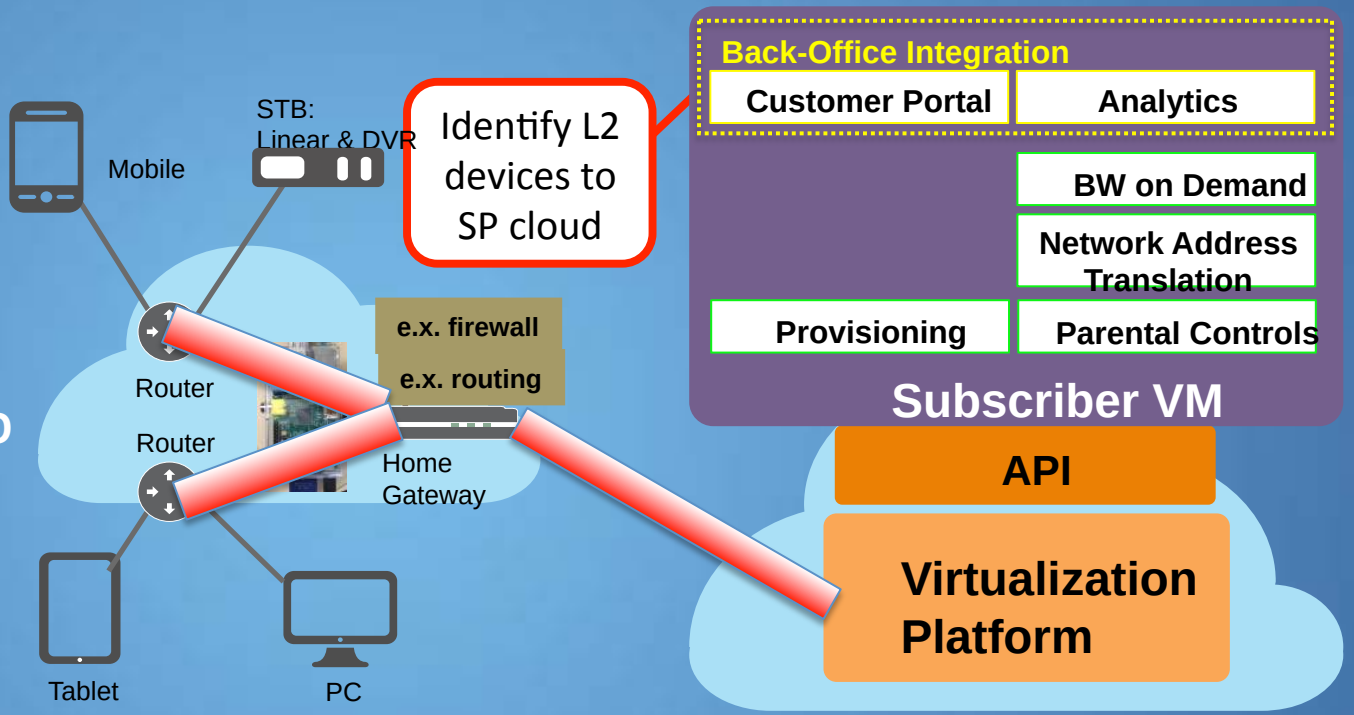
VXLAN is an IETF draft of an overlay

- IPv6 Friendly
- Contains 16-million identifiers



Telemetry and Topologies
L2 Overlay

1 Find Edge Router
2 Get ER LAN address
3 Create DHCP option
4 Pass ER address
5 Create tunnels inside
6 Create tunnel to MSO



Summary

The world is changing…

- IPv6 is critical to our future.
- Only virtualization can enable the speed of new services and time to market needed.
- The potential synergy between these two technologies is huge.

Questions?

Discussion?