Copper Networks, Evolution to Fiber and IP Transition
Overview of Existing Network and the Evolution to Fiber

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Purpose & Agenda

Provide an overview of the components of the Telecom network and the evolution from copper to fiber

- Copper Access and the Evolution of the AT&T Network
- Complexity of the Copper Network
- Copper Network Challenges
- The Evolution to Fiber
- Why Fiber?
- Industry Trends for POTS in the state of CA
- Summary
What happened in the last 20 years...

1980s

1990s

Now
Copper Access and the Evolution of the Network

1990 → Early 2000s
Up to 12 Mbps

Late 2000s → 2010
Up to 100 Mbps + HD video
Complexity of Copper Network

Hundreds of thousands of copper pairs terminated at the MDF
Main Distribution Frame (MDF)

Thousands of copper pairs in feeder cables and copper cross connects

Hundreds of thousands of copper pairs terminated at the MDF
Copper Network Challenges

- Less robust service options, including lower broadband speeds
- Can’t meet customer demand for new services, which require much higher bandwidth and broadband speed
- New technologies and cheaper components makes fiber more feasible
- Copper theft
- Very difficult to provision and maintain copper infrastructure
The Evolution to Fiber

- **1990s → Early 2000s**: Up to 12Mbps
  - Copper pairs → Copper Cables → Cross Box

- **Late 2000s → 2010**: Up to 100Mbps + HD Video
  - Copper pairs → Copper Cables → Cross Box

- **2010+**: Up to 1000Mbps UHD Video
  - Fiber cables → Passive splitter → DSL Access Mux

- **Central office**
  - DSL Access Mux
  - Fiber Distribution Frame

- **Metro IP Network**

- **Internet**

- **Voice Network**

- **GPON Access Mux**

- **Passive splitter**
Why Fiber?

- Capacity of 2400 pair copper telephone cable:
  - 1 call per copper pair

- Capacity of a single fiber:
  - > 1,562,500 calls

- Size and weight
  - To transmit equivalent information 1 mile
    - Single fiber cable = 28 lbs
    - Equivalent capacity copper cable = 33 tons
Industry Trends for POTS in the State of CA

Statewide Change in Housing Units and ILEC Residential Lines
California, December 1999 - December 2017

% Change in Housing Units (HUs) and Lines

% Housing Units (HUs) with ILEC Residential Service

Data Source:
- ILEC Res Lines from FCC Voice Telephone Services Reports
- Housing Units are linear plots of values from 1990, 2000, 2010 Census plus ACS 2011 thru 2015 1 Yr Estimates
- Data for 2016 and 2017 are estimates using linear trending
Summary

- Evolution to fiber in many areas is required to keep up with customer demands for more robust service options, especially much higher speed broadband service.
- This evolution started decades ago within the network core and over time has been pushed further out, however will continue to coexist with the copper infrastructure.
- Fiber infrastructure supports the vast majority of services offered over copper today – including Residential Basic Service as defined by the CPUC; the CPUC’s Basic Service definition is technology-neutral.
- AT&T basic service provided over fiber supports analog devices (e.g., medical monitoring devices, alarm systems, etc.).
- AT&T uses existing customer notification processes to let customers know when facilities transitions take place. This may require a no-cost optical interface device upgrade at the customer’s premise; underlying fiber facility upgrades have no effect on Residential Basic Service elements or pricing.
- Battery backup options are available for VoIP and basic service provided over fiber + cell phones to call 911 in case of power outage.
- Regulatory environment in CA should stimulate and encourage carriers to deploy fiber and next generation services so as to meet customer demands; otherwise, customers of the state will be left behind.