



Broadband access networks

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Industria

- Systems Integrator
 - for Equal Access a Multi-play
 - Design, Build, Operate
 - Physical
 - Network
 - Software
 - Marketing, Business, Processes, etc.
- International (IE, IS, DK, UK, NO, NL)
- Intl. staff (IE, IS, CS, BG, DK, UK)

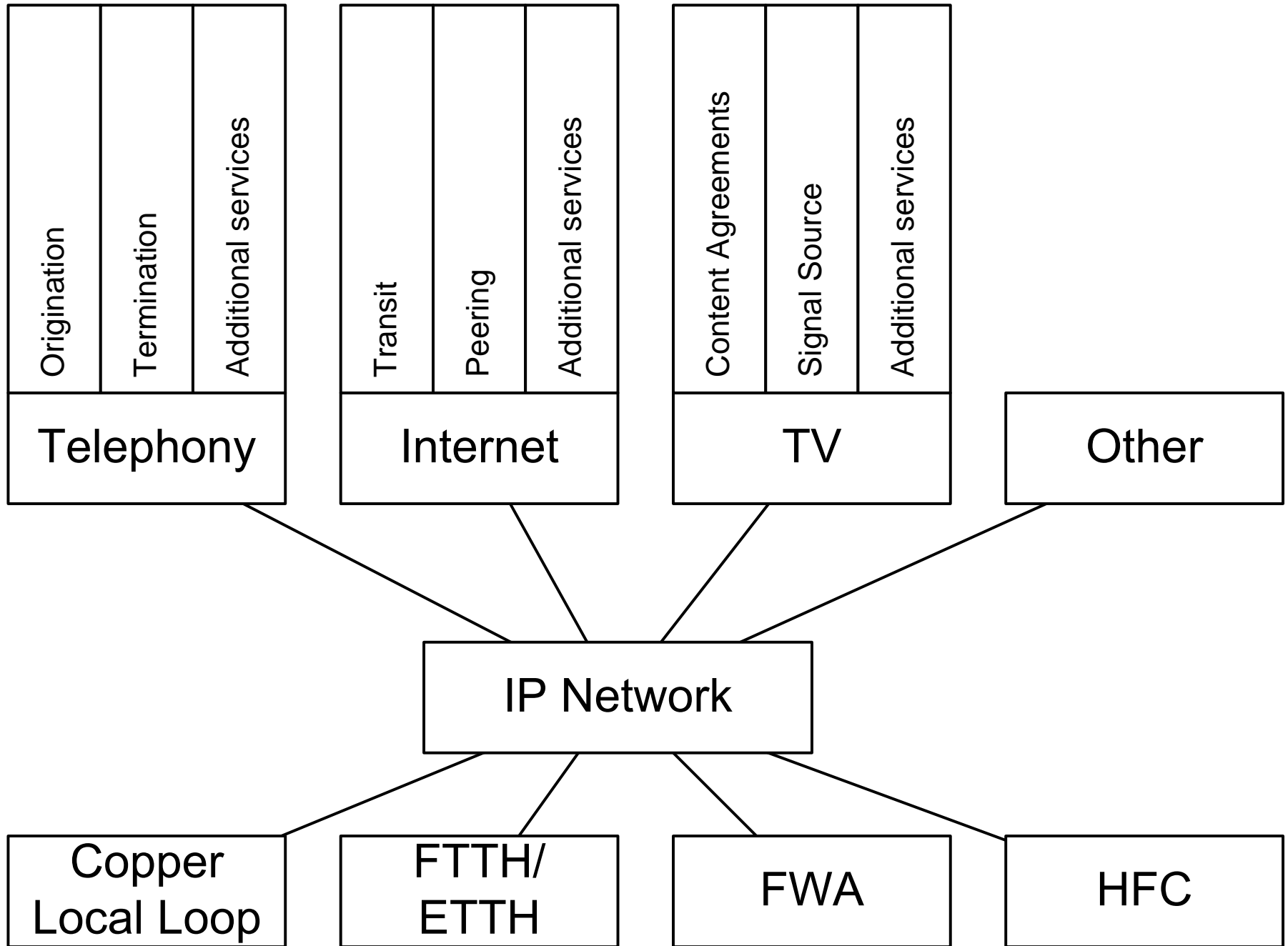
- speaking for myself



Agenda

- Intro
- Equal access
- Technologies
- Channenges
- Wrap-up

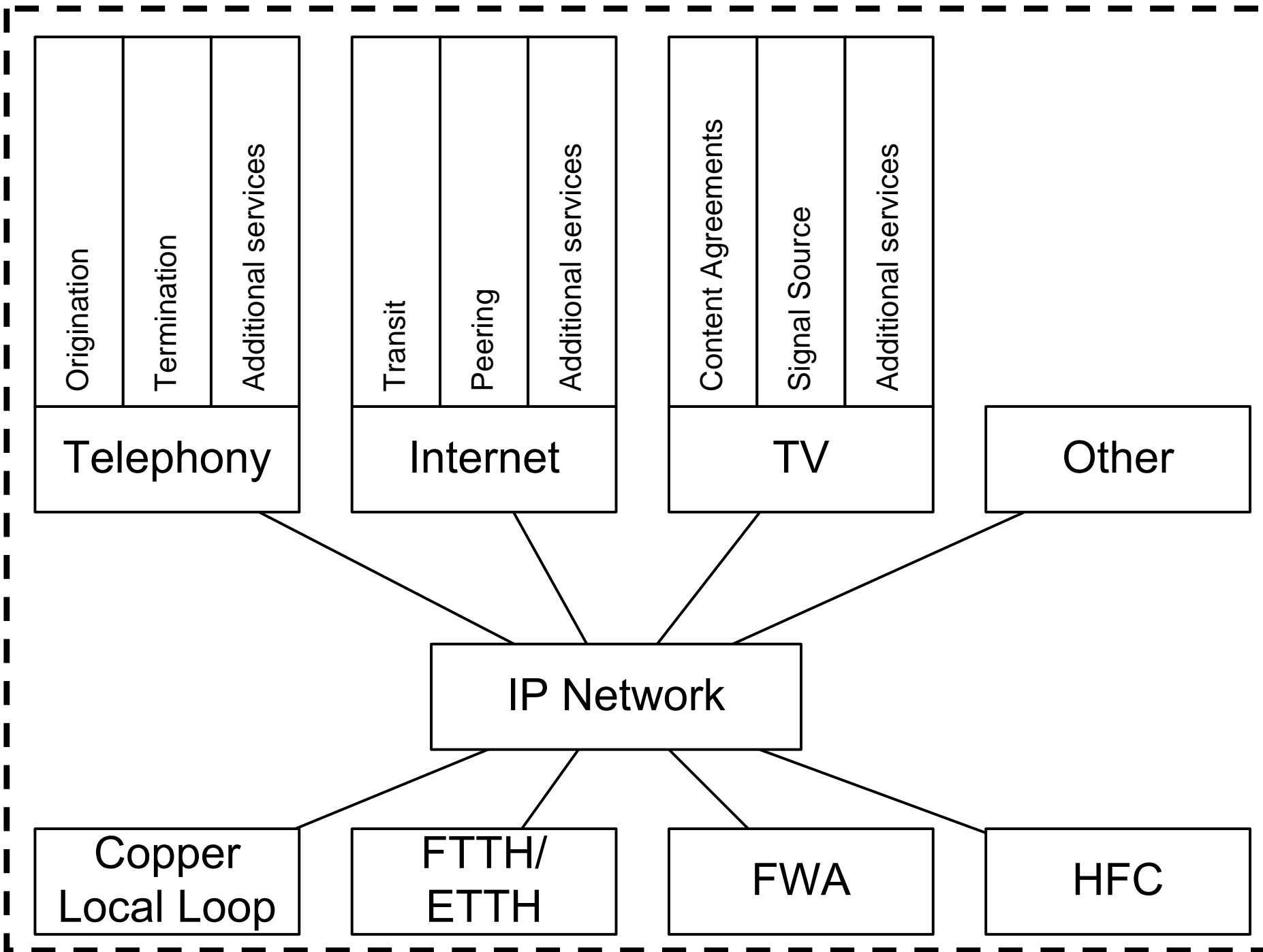
- Beer at 9

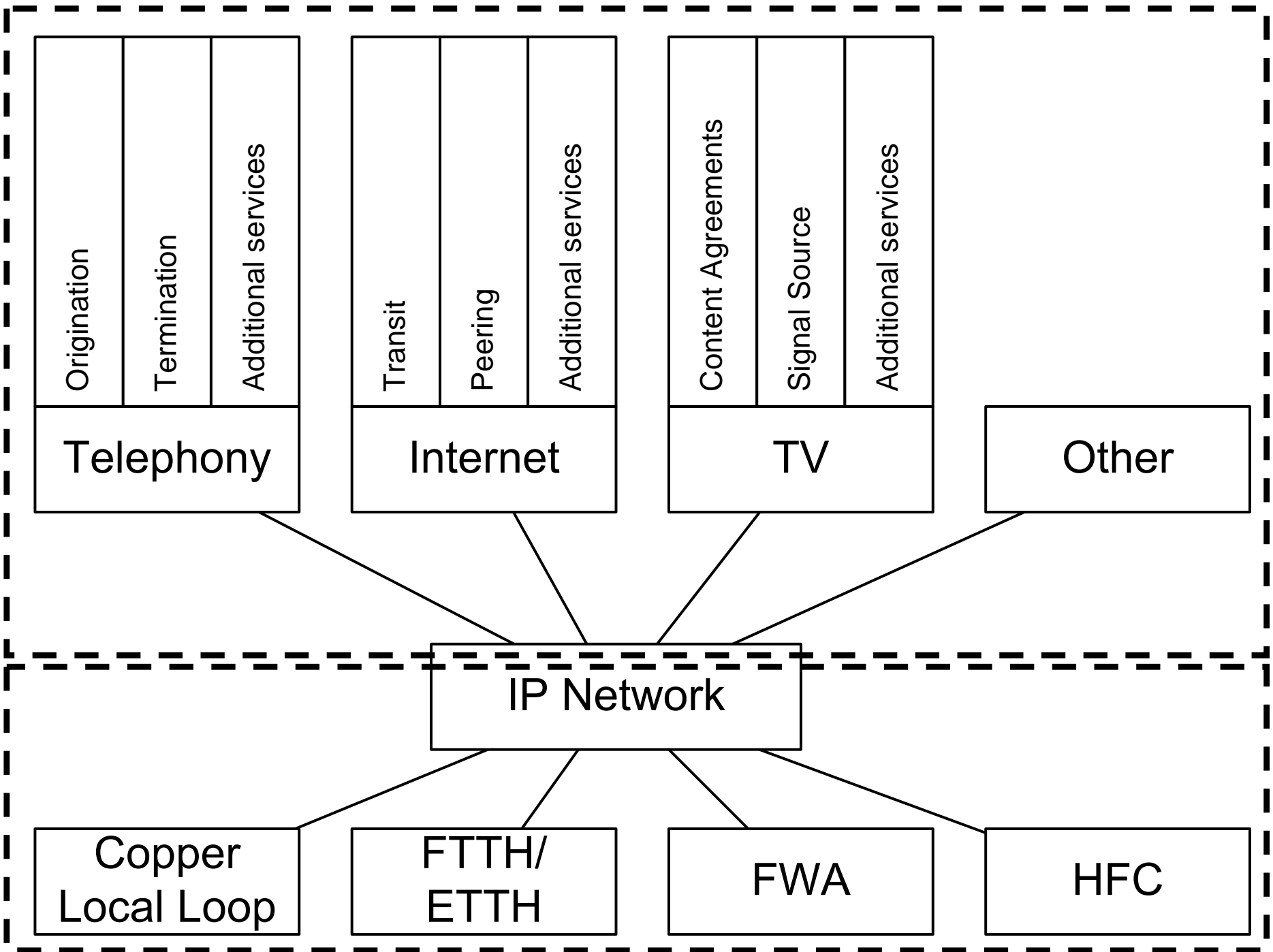


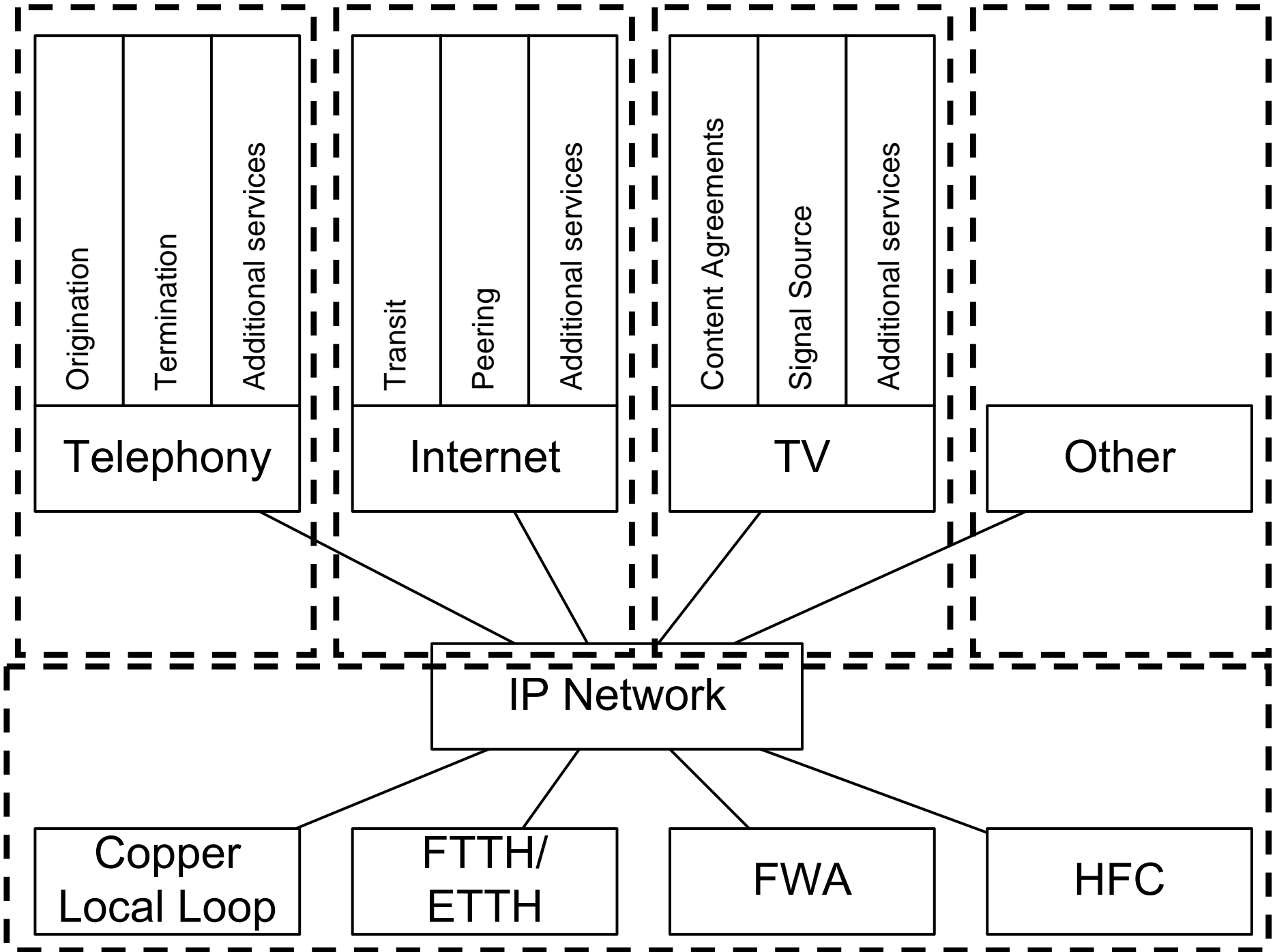


Equal Access

- Separation of network and services









Equal Access

- Separation of network and services
- Revenue share business model
- Choice for the customer
- Maximized penetration and therefore profit
- Minimized overall expense

- Fierce competition for market share between service providers



Equal Access

- Works best in Nordic countries and Benelux
- Main players
 - utilities
 - municipalities
 - property developers
- Companies exploiting state-built infrastructure should not be allowed to operate in any different model
- Strong and clueful government and regulatory support required



Q&A

Equal Access



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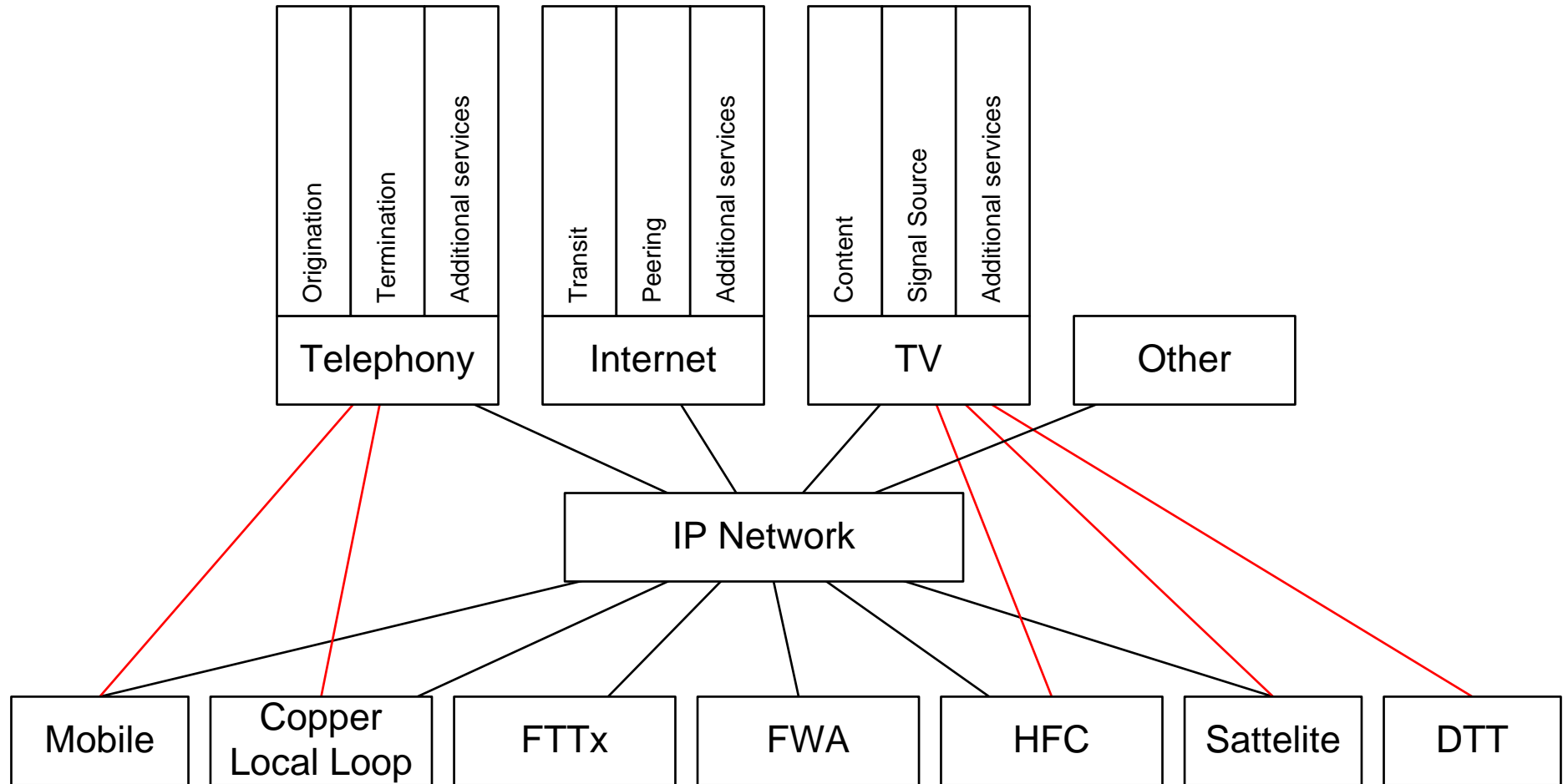


Technologies

- Complete picture?

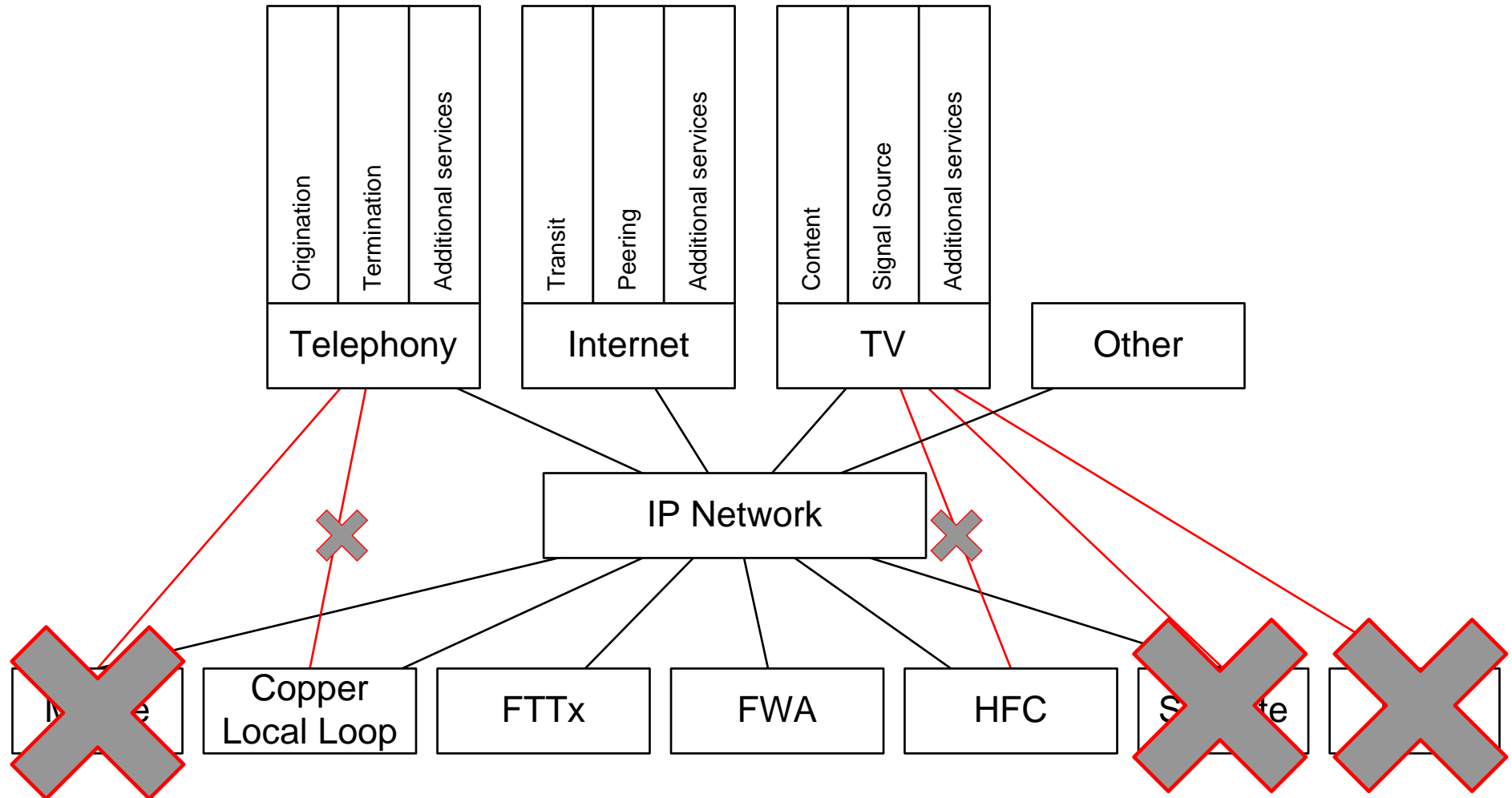
Technologies

- Complete picture?



Technologies

- Complete picture?



Technologies

- Copper Local Loop
 - ADSL2+
 - 100BASE-TX
 - 100BASE-FX (3 flavors)
 - EPON
- FWA
 - 802.11 WLAN
 - Proprietary FWA
 - 802.16 WMAN
 - DOCSIS 2.0
- HFC




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Technology Classification

	Shared media	Dedicated media
Friendly media	EPON	100BASE-TX 100BASE-FX
Unfriendly media	802.16 WMAN DOCSIS 2.0	ADSL2+

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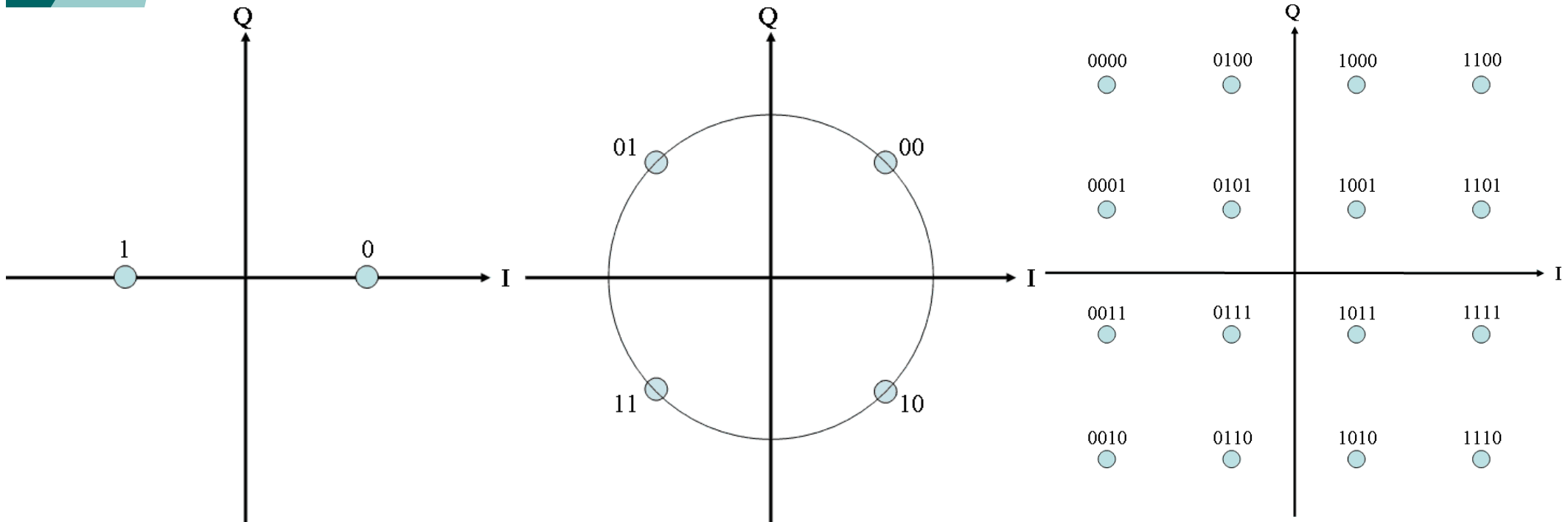
Unfriendly vs. Friendly medium

- Medium not designed for data
- Elaborate modulation needed
- Data correction codes needed

- Medium designed for data
- Baseband encoding, pure and simple
- Sync code only

Modulation 1/2

- BPSK, QPSK, 16QAM, 64QAM, 256QAM



- 1, 2, 4, 6, 8 bits per second per Hz respectively
- Used in all unfriendly medium technologies

Modulation 2/2

- Modulation
 - OFDM a.k.a. DMT
 - used in WMAN and ADSL2
 - effective utilization of spectrum
- Convolutional and FEC codes
 - process gain
 - effective utilization of spectrum
 - Viterbi, Turbo codes, Reed-Solomon
 - used in all unfriendly medium technologies

Shared vs. Dedicated

- Shared bandwidth and medium
- Multi-access method required
- Dedicated bandwidth and medium
- No multi-access method required

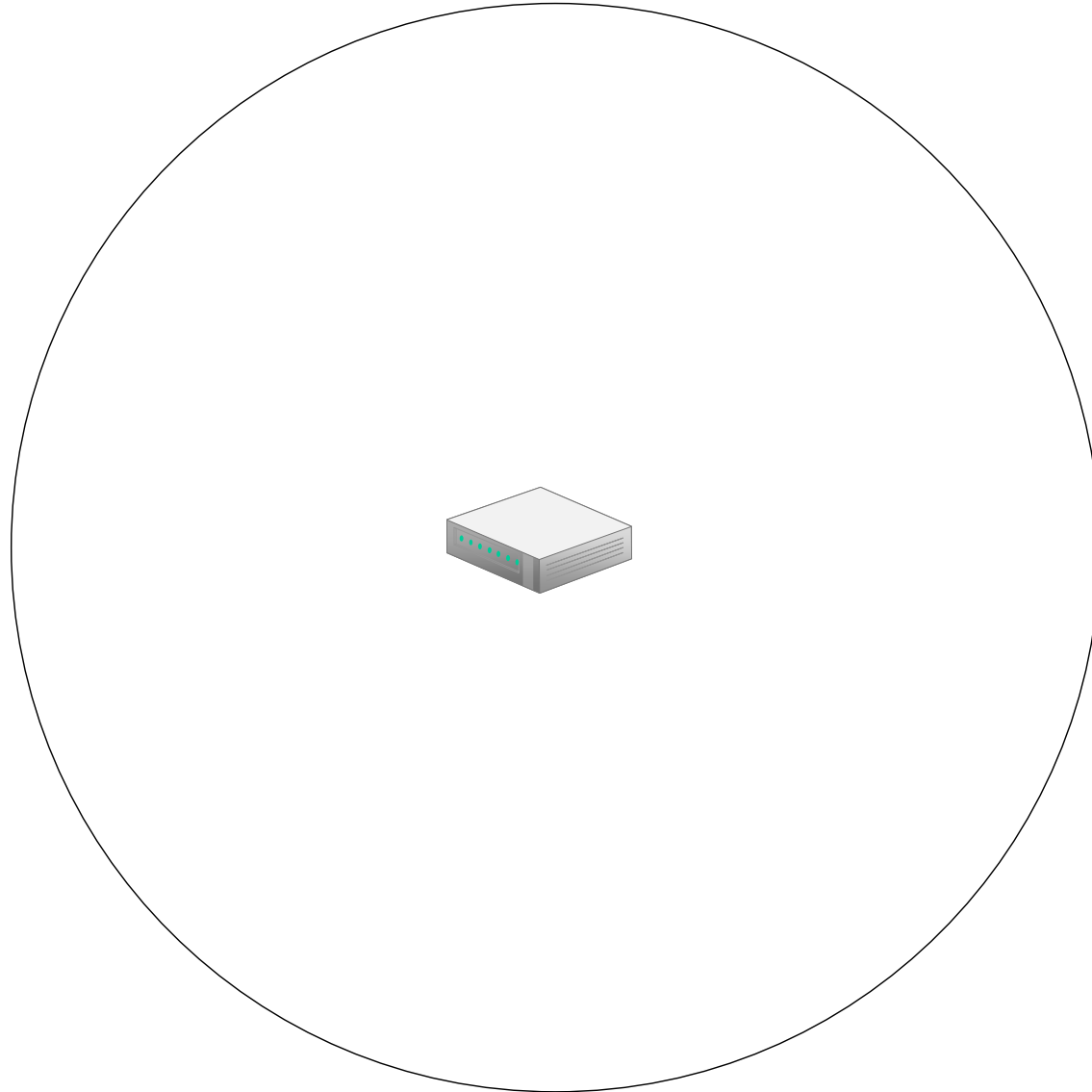
Multi-access methods

- TDMA
 - DOCSIS2.0
 - 802.16 WMAN
 - EPON
- FDMA
 - 802.16 WMAN
- Both are centrally controlled. No free decisions by end-stations

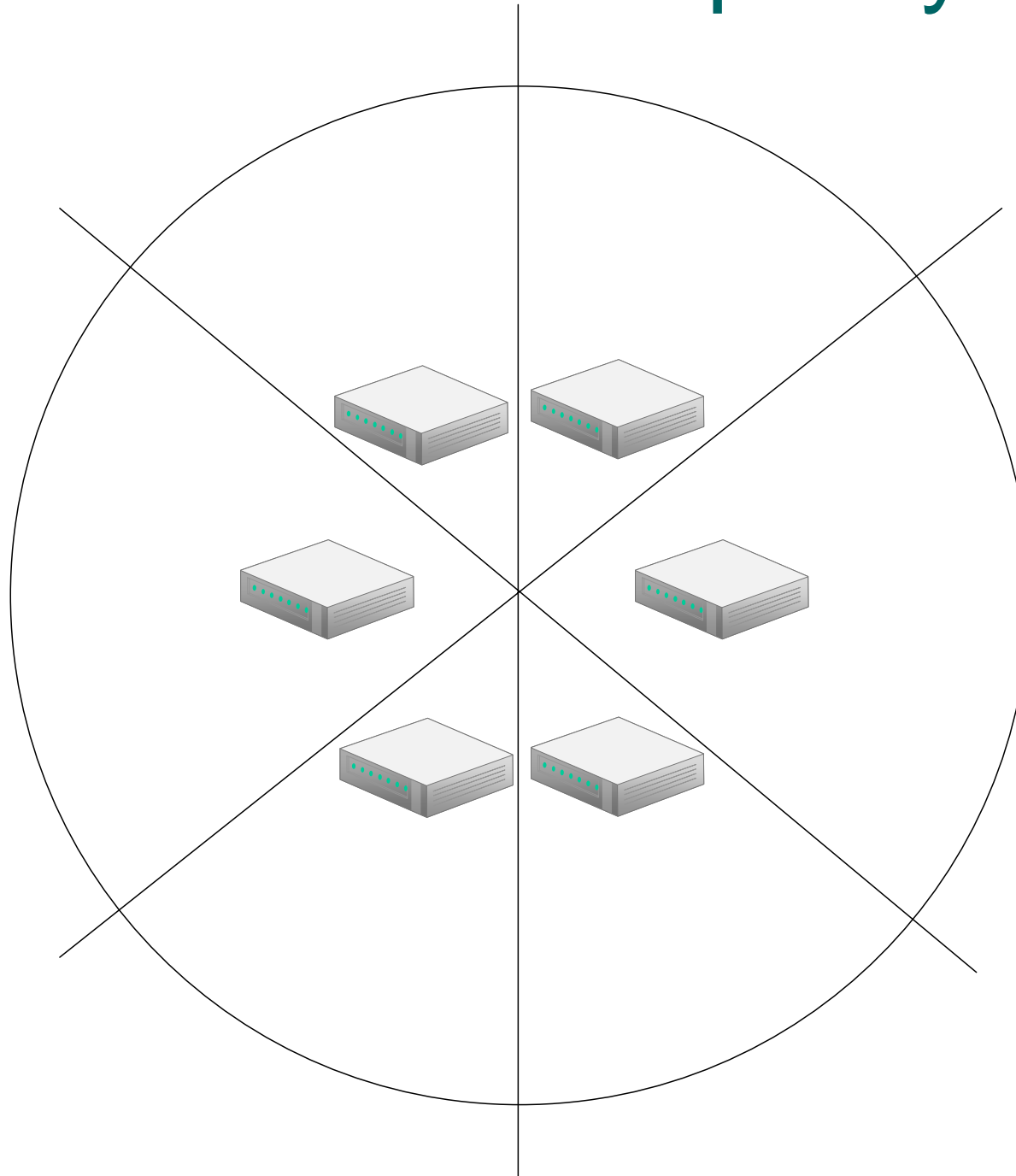
Duplexing methods

- When the head endpoint is involved these are called
 - TDD
 - 802.16 WMAN
 - FDD
 - DOCSIS2.0
 - 802.16 WMAN
 - ADSL2+
 - WDD (Wavelength division duplex)
 - EPON

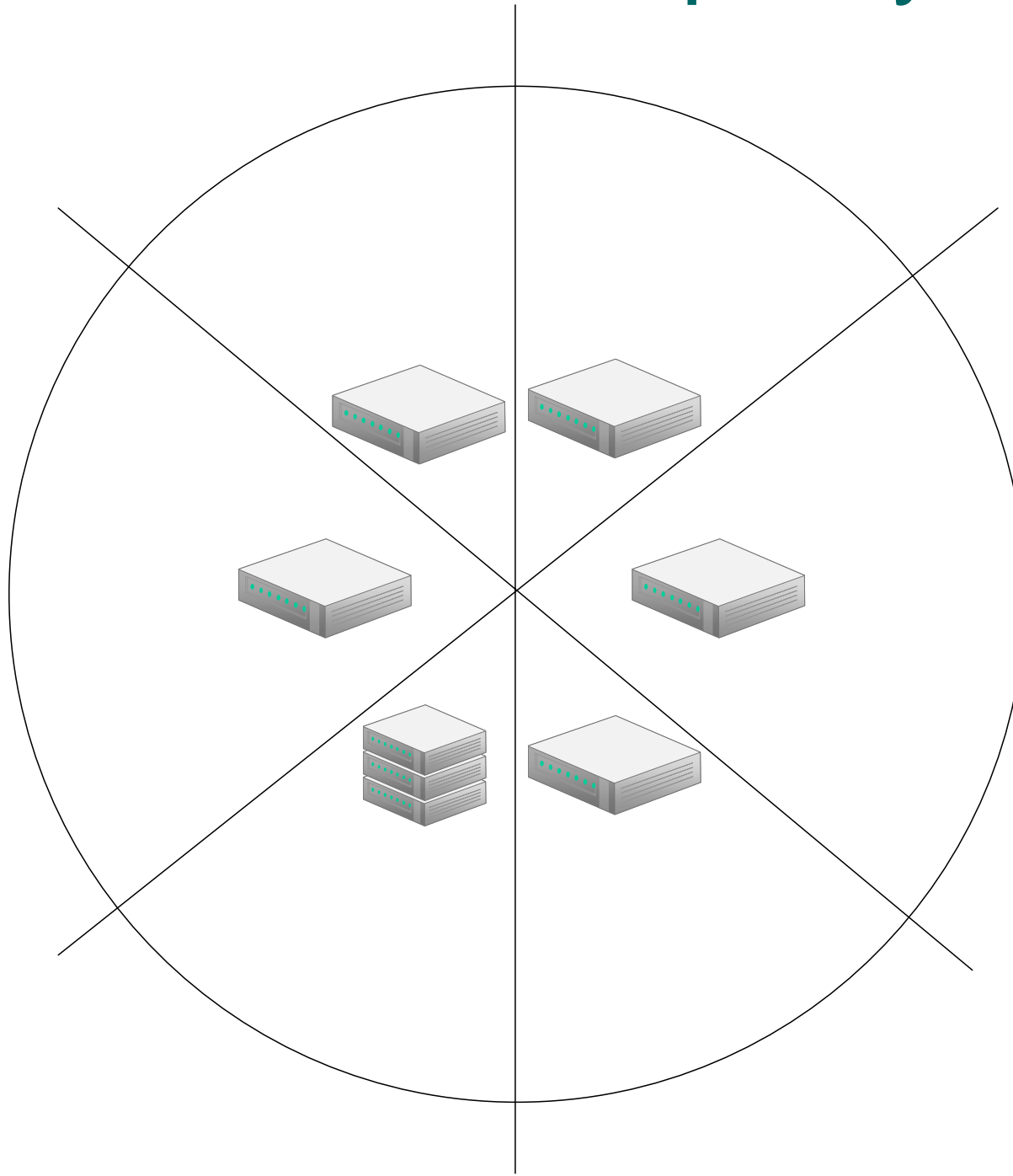
Shared media capacity



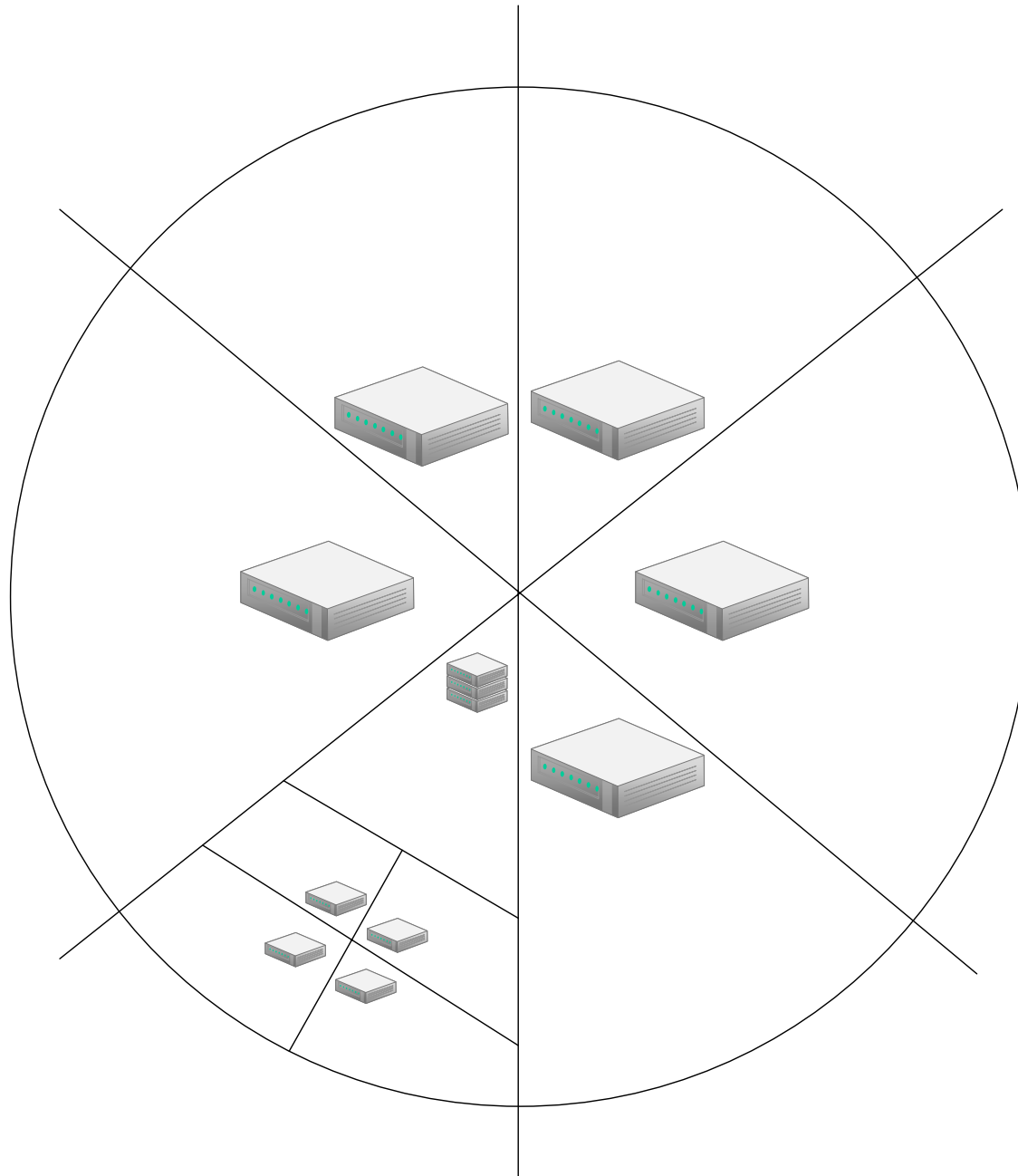
Shared media capacity



Shared media capacity



Shared media capacity



Conclusion

	100BASE-TX, 100BASE-FX	ADSL2+	EPON	802.16 WLAN	DOCSIS2.0
Shared/Dedicated	dedicated	dedicated	shared	shared	shared
Bandwidth	100 Mbps	up to 30/3.5 Mbps down/up	1Gbps	up to 75 Mbps per sector	up to 51/30 Mbps down/up per sector
- Multi-access method	n/a	n/a	TDMA	TDMA/FDMA	TDMA
- MA for Base Station	n/a, WDD	FDD	WDD	TDD/FDD	FDD
Friendly/Unfriendly	friendly	unfriendly	friendly	unfriendly	unfriendly
- Modulation	baseband	OFDM / QAM	baseband	OFDM / QAM	PSK, QAM
- FEC	no	yes	no	yes	yes



Q&A

Physical technologies



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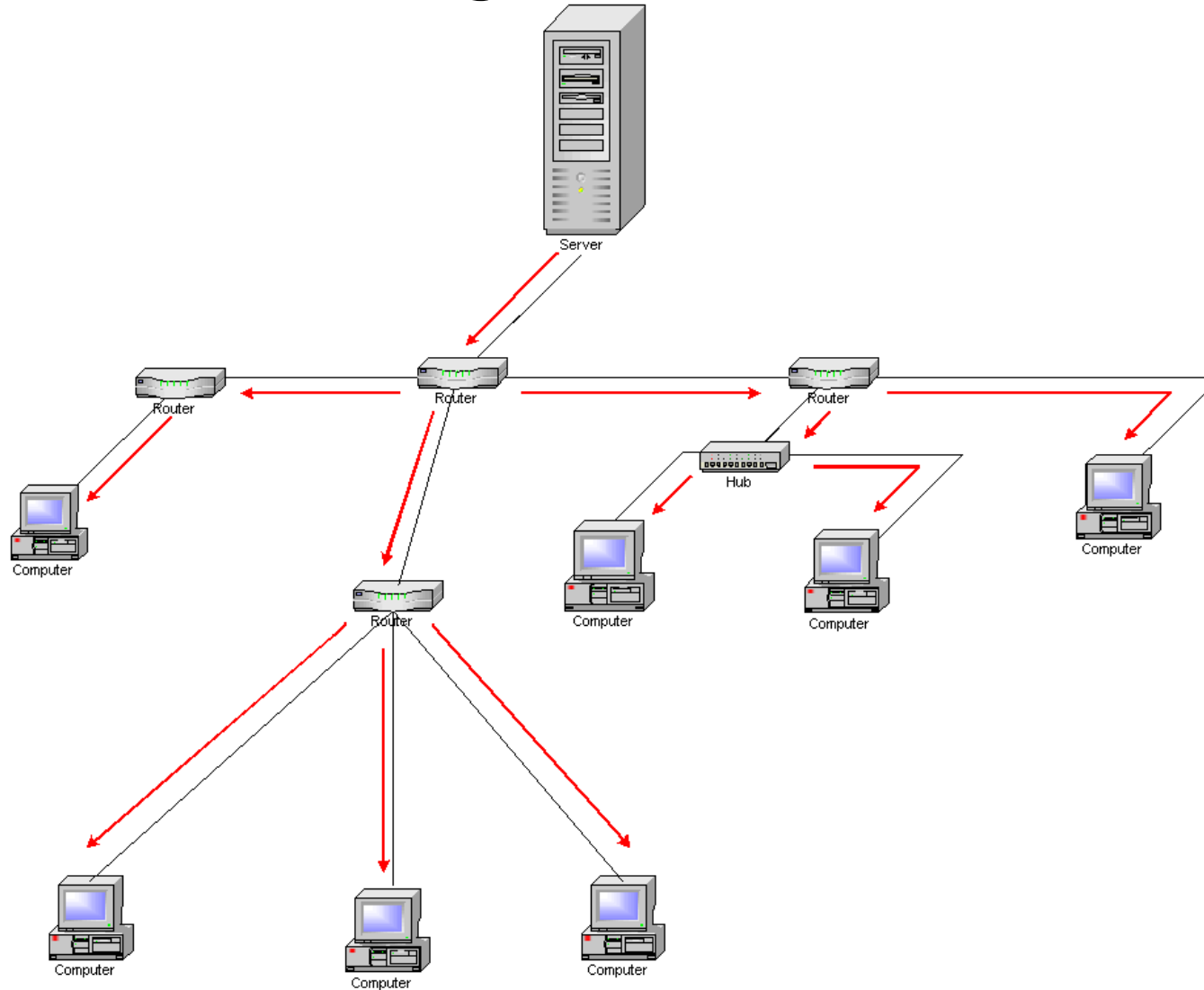


Policy enforcement point

- Needs to be physically controlled by the SP
- Large-scale DOCSIS deployments have shown that enforcing policy at the CPE is a bad idea
- Provisioning for PEs and CPEs is key to success

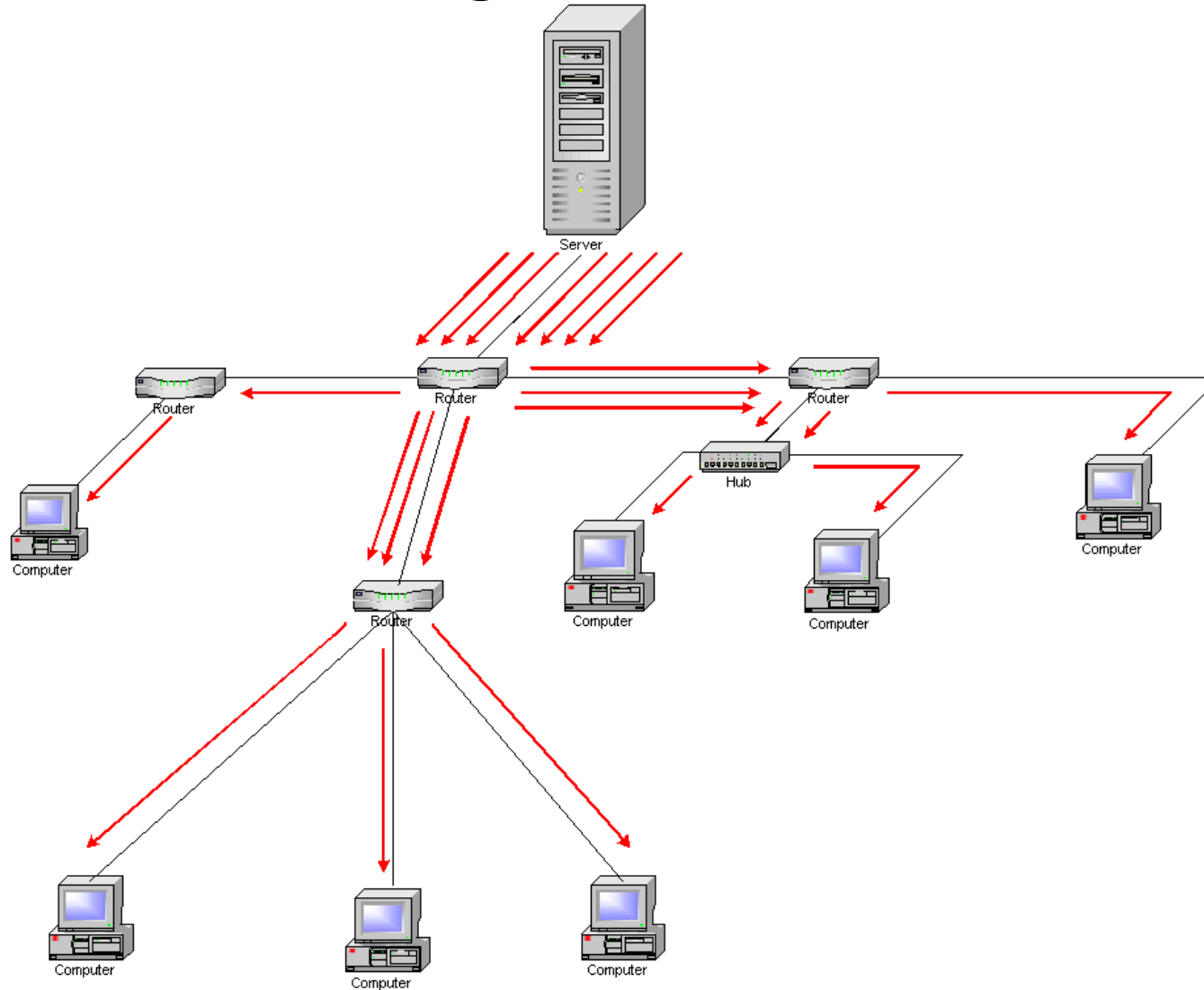
Multicasting

- Multicasting basics...



Multicasting

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- It is so important



Q&A

Network technologies



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Challenges for EANs

- Simplifying procedures to keep OPEX low – provisioning, support
- Visibility for the service providers
- Network owner getting involved in services
- Education

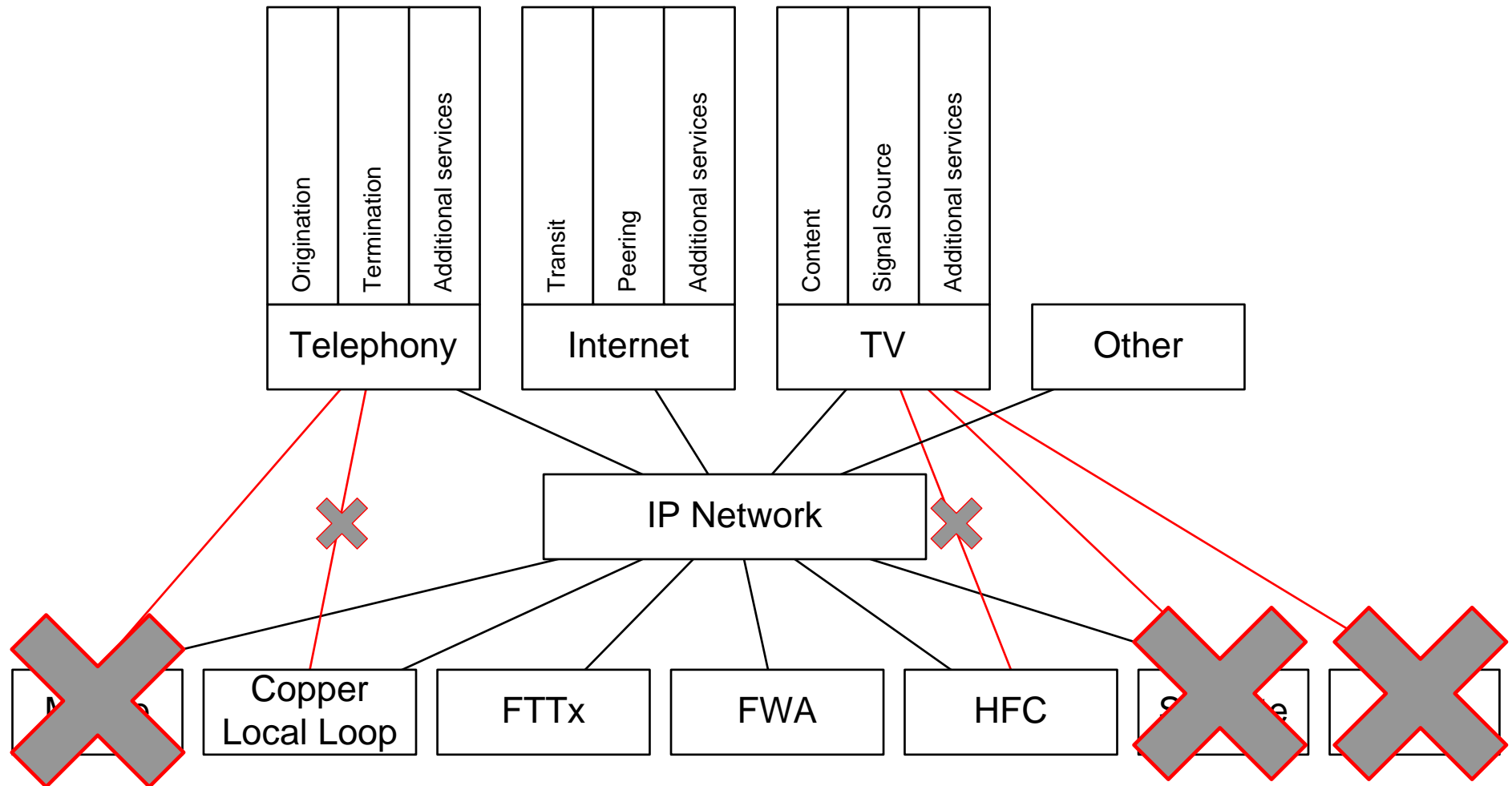


Challenges

- Low broadband penetration – education
- Network in the home
- Maturity and features of products
- Legacy
- Getting engineers for services headends

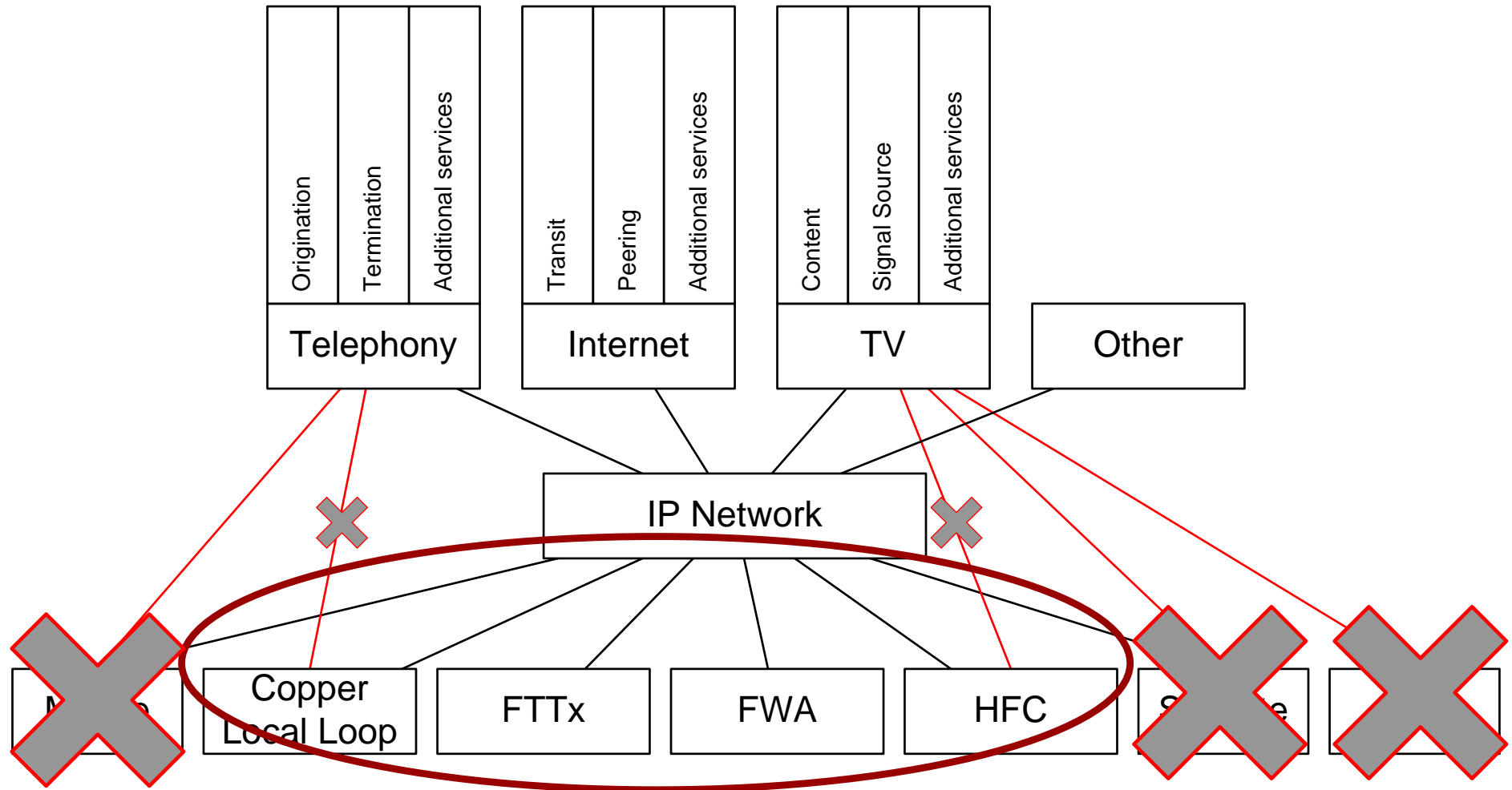
Wrap-up

- We covered ...



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