



Software Defined Networking

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In this course, you will learn about software defined networking and how it is changing the way communications networks are managed, maintained, and secured.

Module 1: History of SDN

- Discuss the timeline of SDN from the 1980s to present
- Gain awareness about the ideas and principles behind SDN
- Recognize architectural themes in computer networking where SDN originated.

The Four Chapters of SDN History

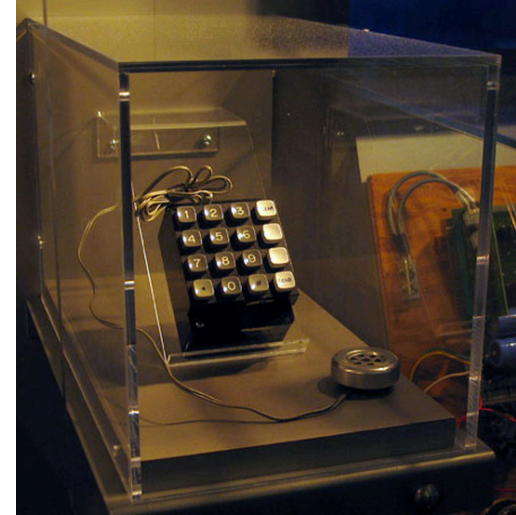
- ⦿ Evolution of supporting technologies
- ⦿ Control-data plane separation
- ⦿ Developing control channels for specific data planes
- ⦿ Convergence of control channels and data planes

Evolution of Supporting Technologies (Three Lessons)

- ⦿ **Central network control:** Dates back (at least) to AT&T's network control point (1980s)
- ⦿ **Programmability in networks:** Active networks (1990s)
- ⦿ **Network virtualization:** Switchlets, XEN, VINI (1990s)

Early Days: Control and Data Together

- In-band signaling
 - Data and control sent over same channel
 - Certain frequencies (e.g., 2600 Hz) could reset phone trunk lines, route calls
- Resulting network was brittle, insecure, etc.



Network Control Point

The network control point (NCP) was introduced in 1981 and is intended to support a wide range of SPC network applications. The first of these is an improved version of 800 Service and Mechanized Calling Card Service. A wide variety of other applications are currently being considered.

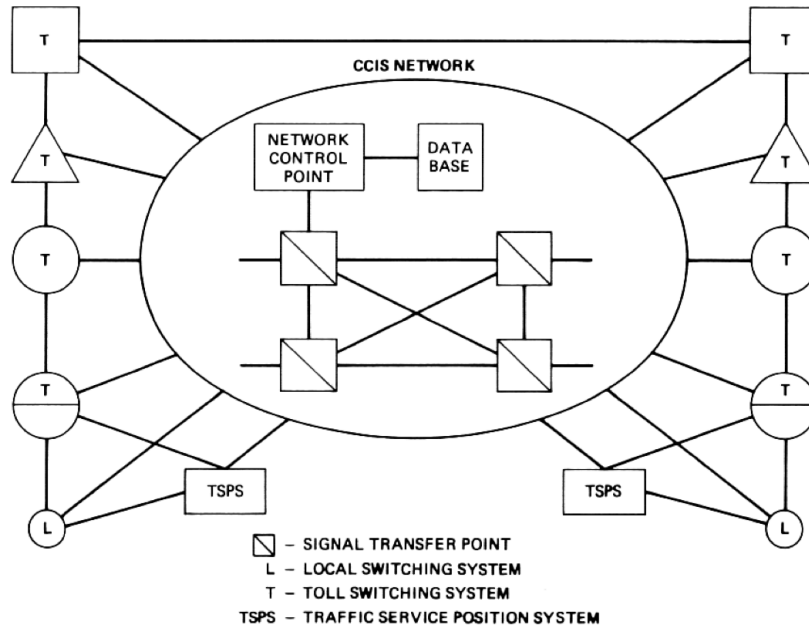


Fig. 1—Stored Program Controlled Network—switching hierarchy.

- Telephone network
- Signaling at NCP
- Benefits
 - Services on demand
 - Rapid introduction of new services

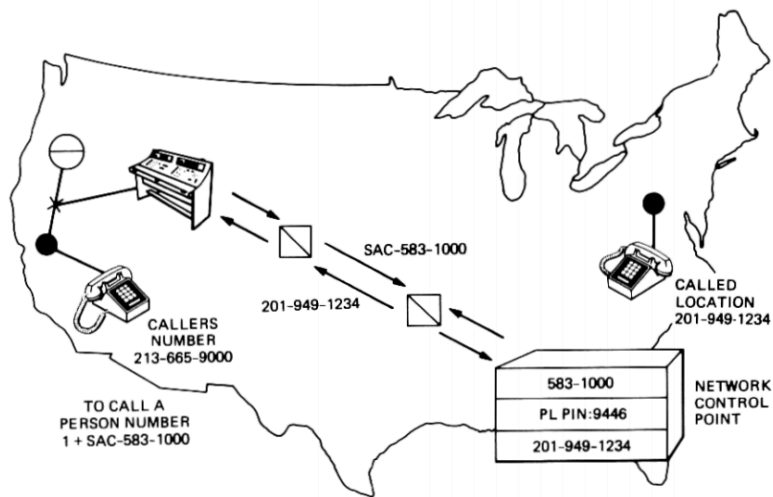
Benefits of the NCP in the AT&T Network

- Elimination of in-band signaling reduces expenditures
 - Shorter circuit holding time
 - Ability to determine busy/idle status before requesting a circuit
- Rapid introduction of new services
 - “In the area of new services that can be supported...possibilities are limited only by imagination.

Apps from Composing Basic Primitives

- ⦿ Collect N digits
- ⦿ Send a message to the NCP
- ⦿ Make a billing record
- ⦿ ...

Envisioned Service: Person Locator



- User registers location with NCP database
- NCP routes call to the current location/number
- NCPs currently used to route 800 calls

Benefits of Central Control

- ⦿ Network-wide vantage point
 - Can directly observe (rather than infer) network-wide behavior
- ⦿ Independent evolution of infrastructure, data, and services
 - Services and resource allocation decisions can be made based on customer data, network load, etc.

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