PSTN Data Presentation

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PSTN Economic Regulation (US)

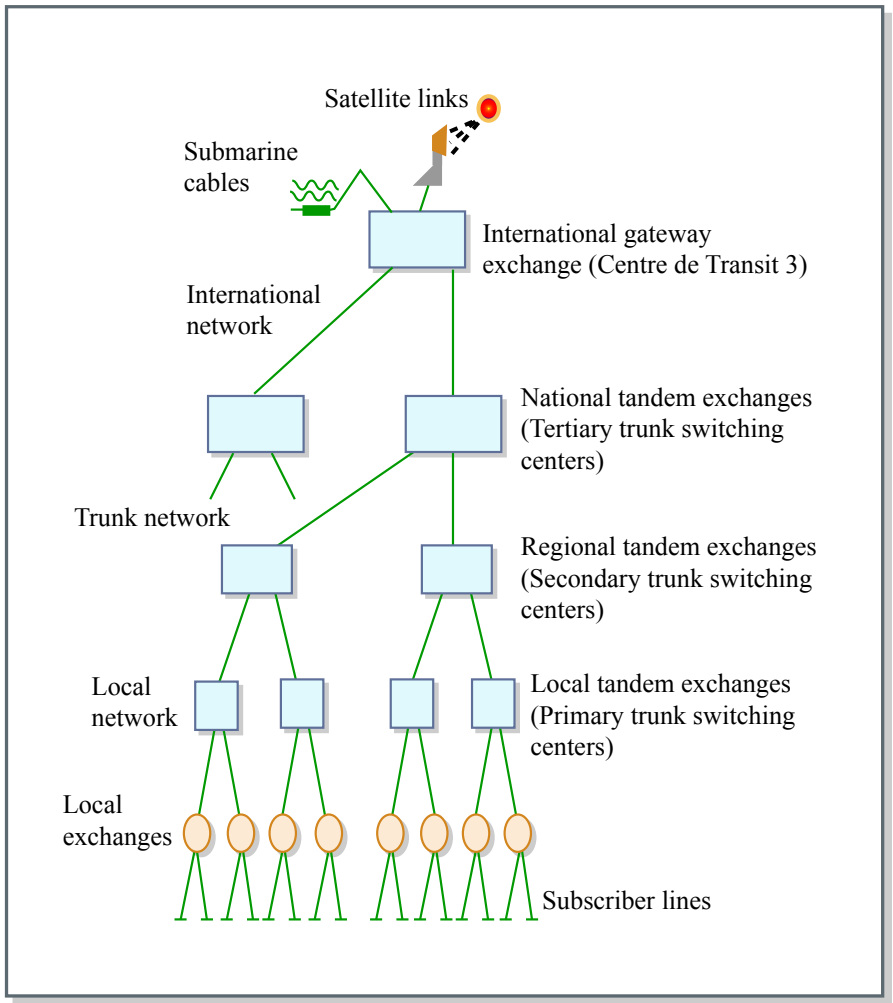
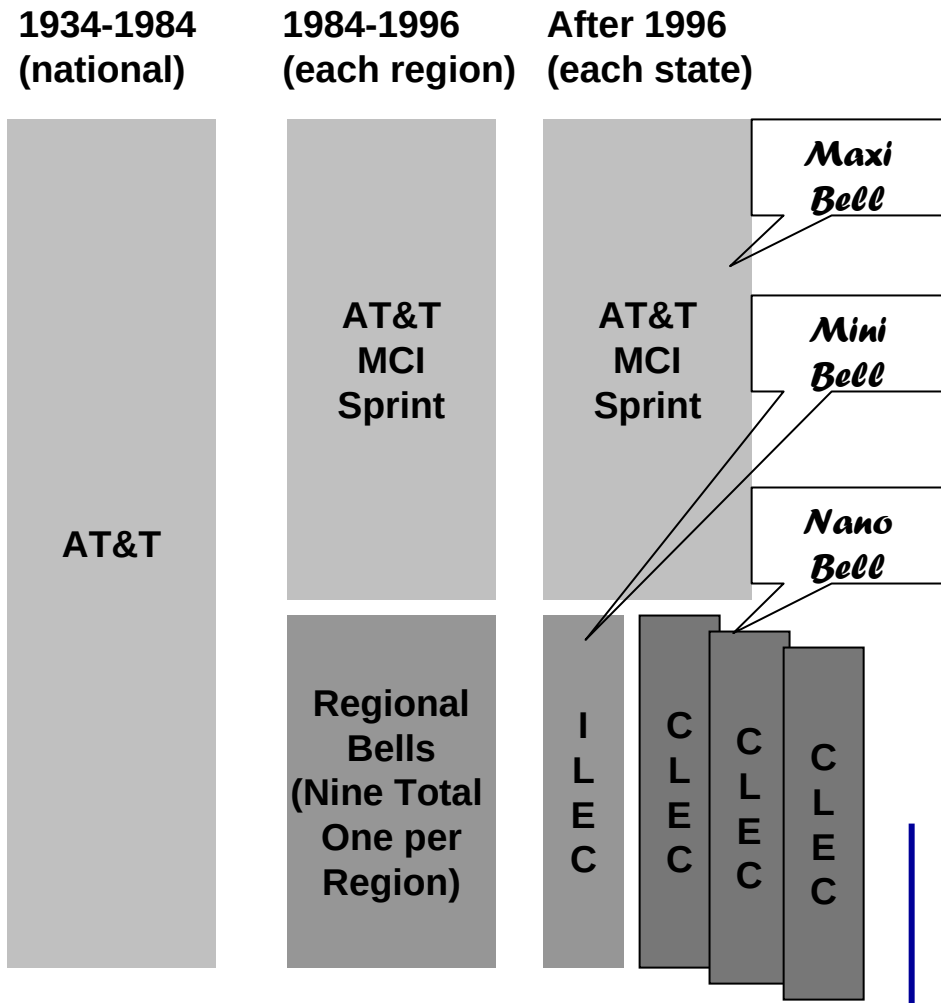
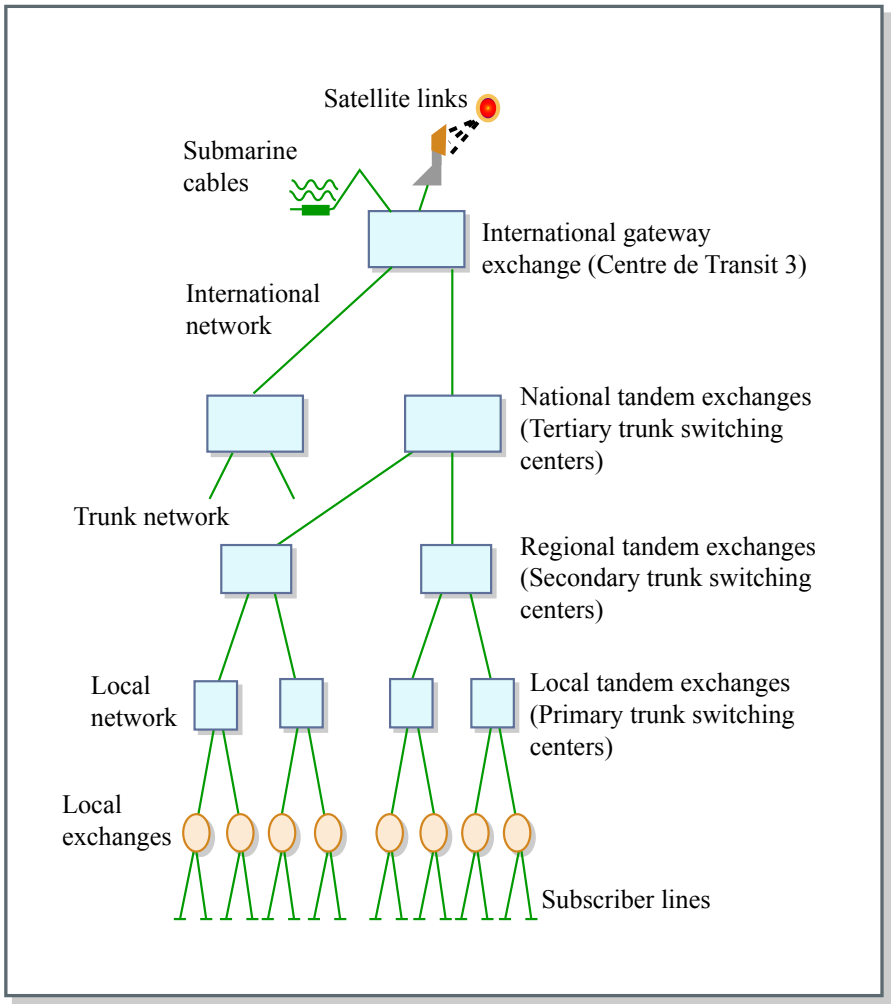


Figure by MIT OCW.

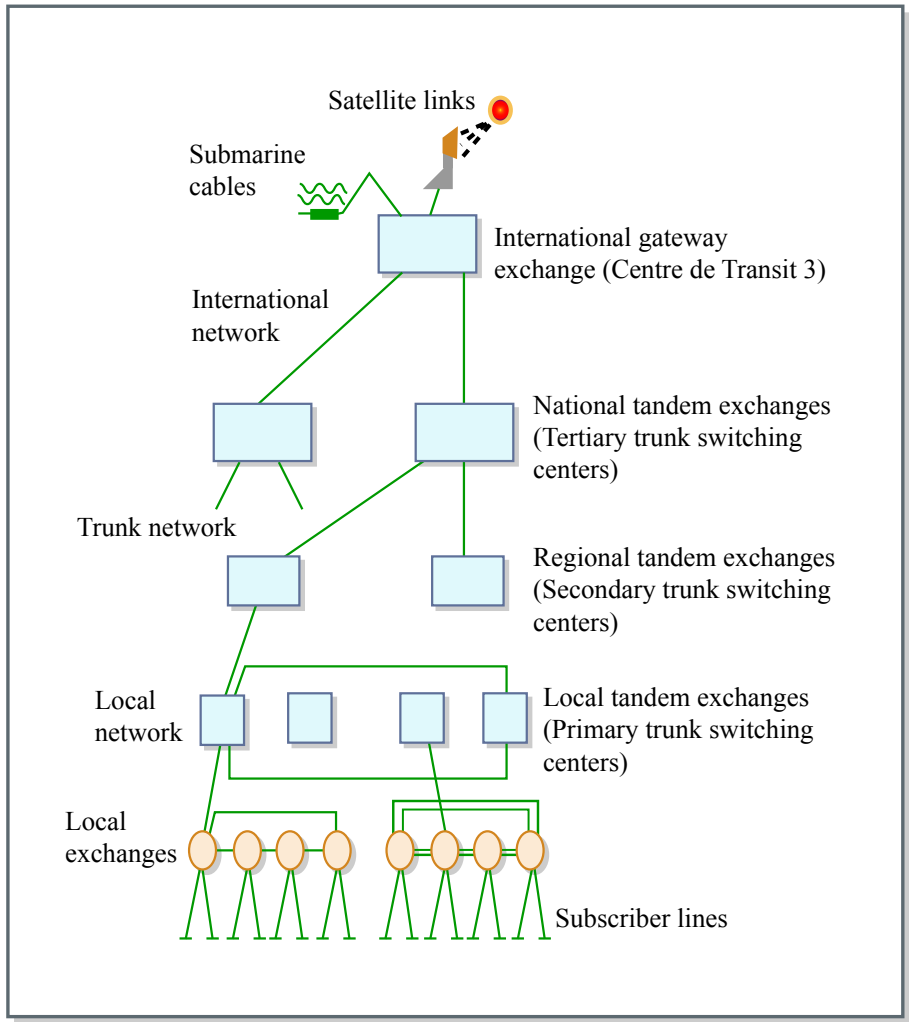


Our analysis focuses on an ILEC and a CLEC for a single state

Technology – Copper to Fiber



Copper Figure by MIT OCW



Fiber Figure by MIT OCW

Fiber has statistical aggregation similar to old PSTN, but with better SN ratio.
Fiber rings have specific robustness features.

Data Collection and Challenges

- **Maxi Bell and Other Sensitive Data**
  (*we cannot get this data*)
  - Call Routing Information – efficient Interstate and Intrastate call routing provides competitive advantage
  - Class 1, 2 and 3 switches -- national security concerns, blurring boundaries between regional and long-distance
  - Customer base – Competitive and privacy concerns
- **Mini Bell (*we have data*)**
  - Tandem (Class 4) and the sub-tending CO (Class 5) switches
- **Nano Bell (*we have data*)**
  - 2005 (Current) and 2010 (Planned) CLEC Network maps with connectivity information

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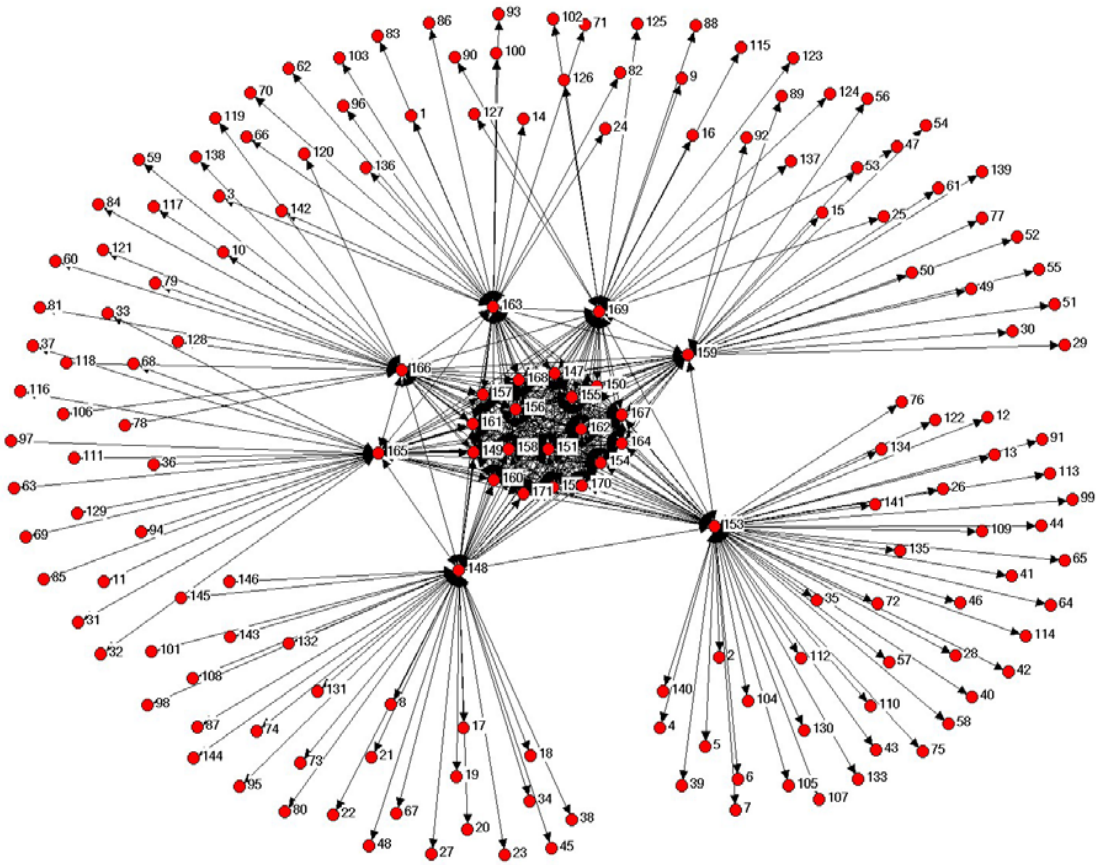
Modeling the combination of a Nano Bell network and its connectivity to Mini Bell allows us to analyze most inter and intrastate call scenarios.

Mini Bell Network



Tandem: 25

- Three type of Tandem:
  - ACCESS
  - LOCAL
  - E911
- All tandems are connected each other
- 7 of them directly connect to central offices
- One tandem is out of state (node 165)

Central Office: 146

- Each central office only directly connect to one tandem

Some Metrics:

- **n = 171**
- **m = 892**
- **Mean degree: z = 5.216**
- **Cluster coefficient: C = 0.807**

Nano Bell Data Descriptions

- **Nodes**
  - Black dots: host locations that are actively involved in the larger switching network
  - Red dots: remote locations where calls originate and terminate
- **Links**
  - Copper or fiber wires

Image removed for copyright reasons.

- **Rings**
  - Connect host locations via high bandwidth fiber
  - Represented by various thick colored lines
  - 2005: 6 rings connecting approximately 1/3 of host locations
  - 2010: 18 rings roughly connecting all host locations
- **Structural Changes**

2005: Image removed for copyright reasons.

2010: Image removed for copyright reasons.

Nano Bell: 2010 Network Analysis

- **Basic metrics**
  - Number of host nodes: n = 123
    - 4 tandem switches
  - Number of links: m = 296
  - Mean degree: z = 2.047
  - Cluster coefficient: C = 0.032
- **Betweenness (node centrality)**
  - When ranked, 3 of the top 4 nodes in betweenness are tandem switches (4th of top 4 is adjacent to the tandem switch with highest betweenness)
  - Last tandem switch is ranked #12

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Next Steps

- Connect Nano Bell to Mini Bell for larger network analysis
- Further analysis of each network individually
- Network analysis comparison of 2005 and 2010 Nano Bell structures
- Analysis of ‘illities’
  - Survivability (Robustness) - Collapsed vs. physically separated SONET rings (bulldozer proofing the network)
  - Availability - Node capacity and link bandwidth (transition to fiber)