



---

# Real-Time Multiple-Description Coding of Speech Signals

---

**Technische Universität Berlin**

Communication Systems Group

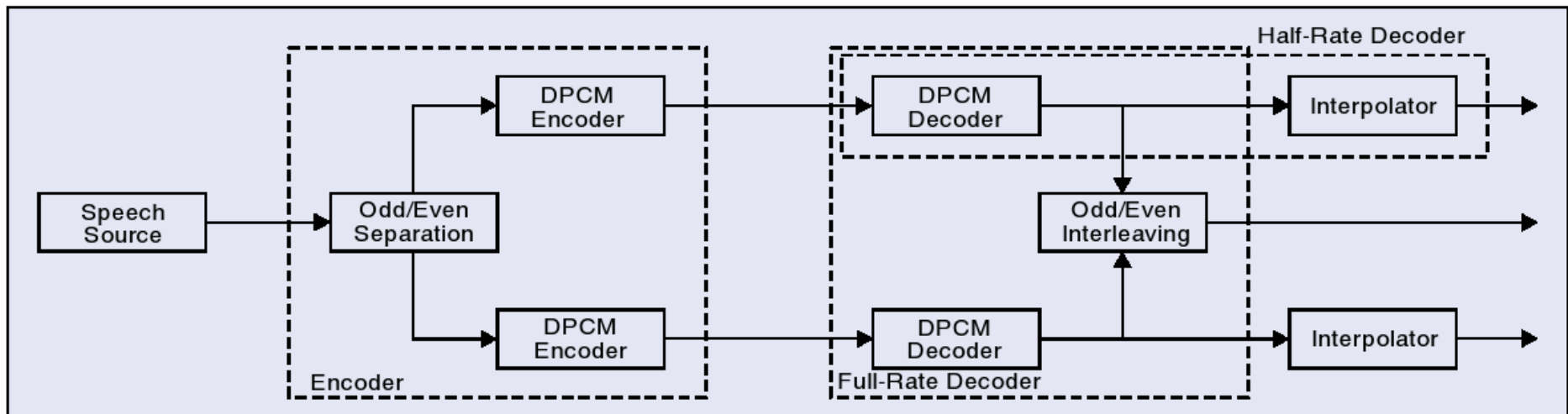
Director: Prof. Thomas Sikora

Jan Weil

[weil@nue.tu-berlin.de](mailto:weil@nue.tu-berlin.de)

22.03.2007

- How can transmission link outages be dealt with?
- Solution: Standby transmission links
- Better: Speech coding for channel splitting (N. S. Jayant, 1981)

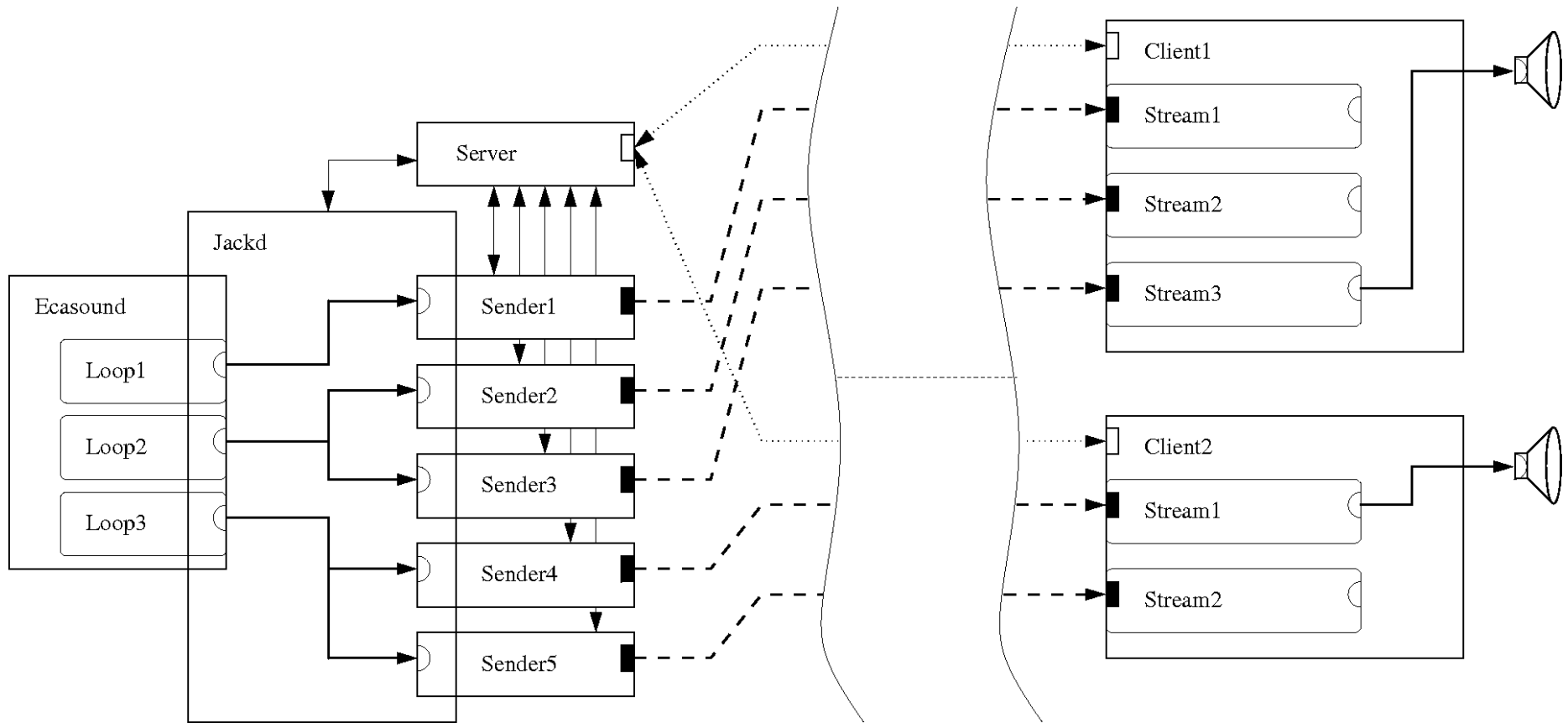


- Packet-switched network
- Packets are lost, delayed, duplicated
- Retransmission is not feasible in real-time
- Only within limits frame losses can be concealed
- Solution: Multiple-Description Coding

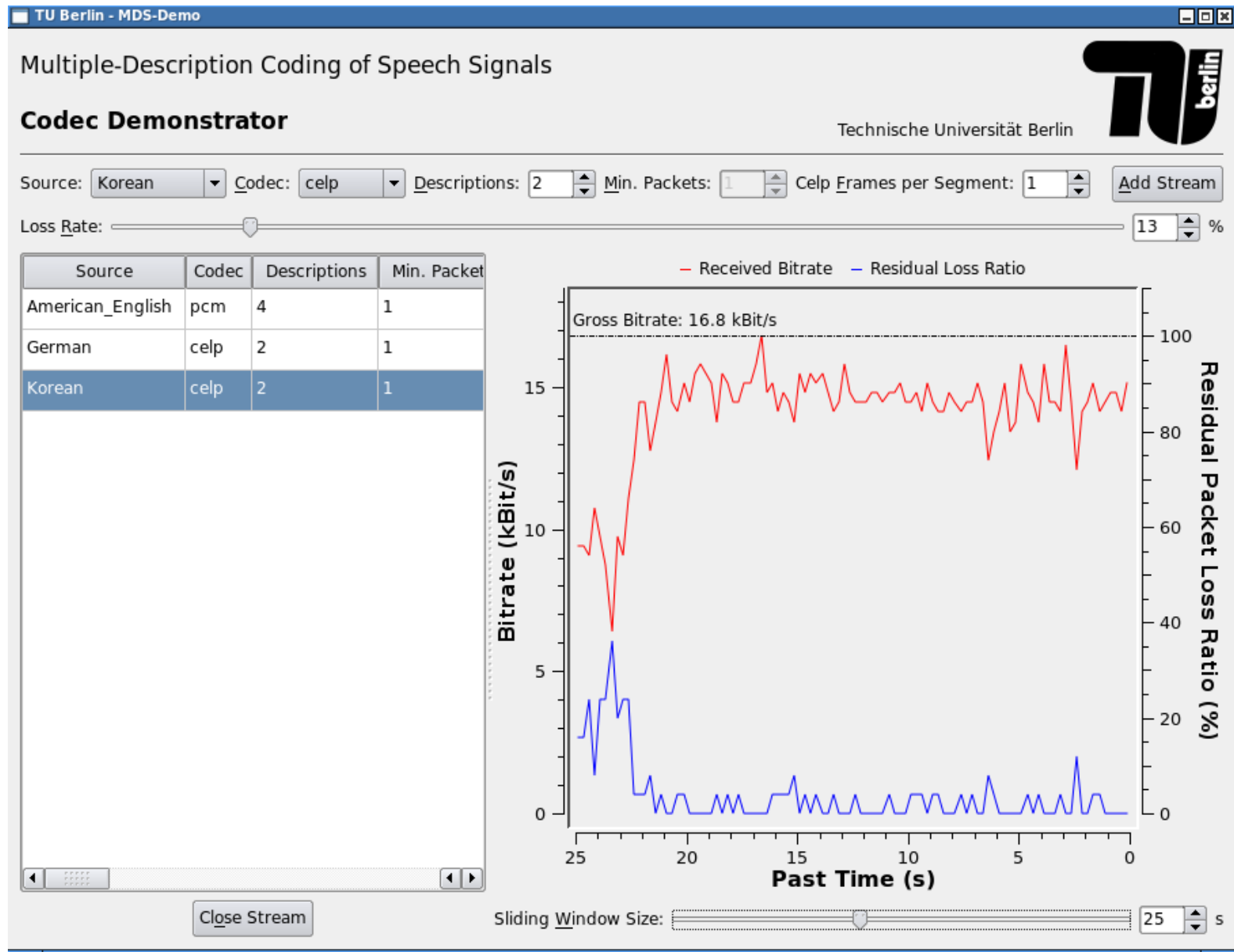
- Receiver of  $L$  descriptions consists of  $2^L - 1$  decoders
- Solution: Hierarchical (layered) speech coder + Forward Error Correction
- On the right: Construction of a four-description code
- Codecs: PCM, CELP

1	p	p	p
1	p	p	p
2	2	p	p
3	3	3	p
4	4	4	4

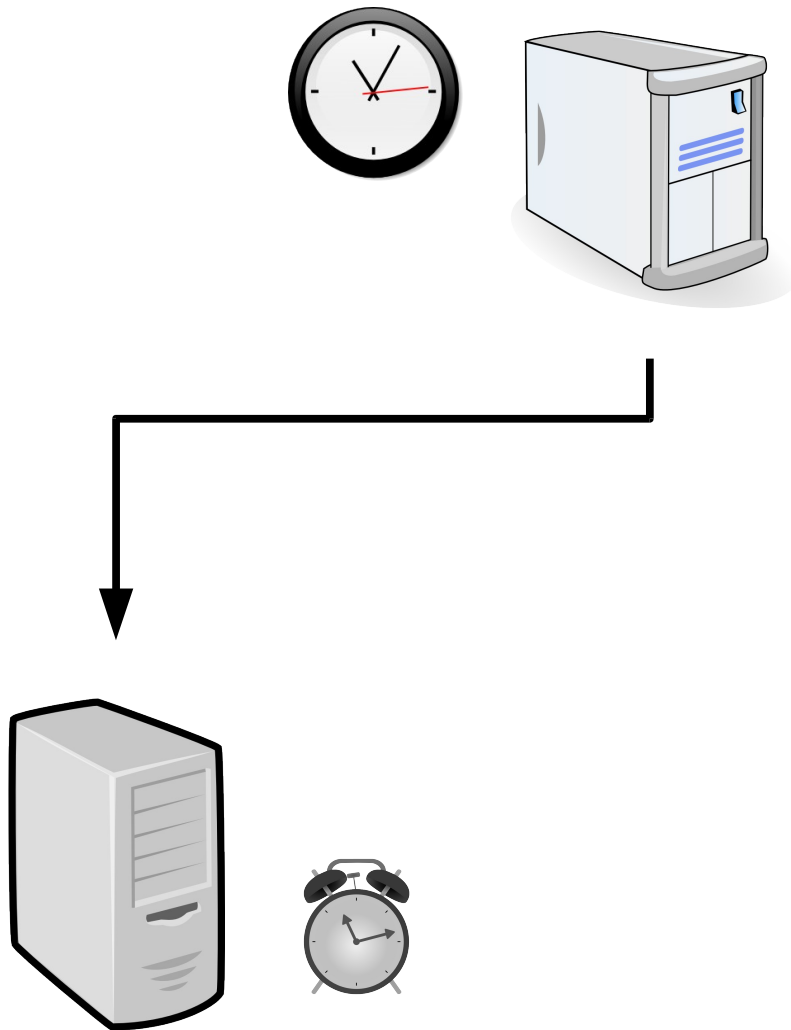
Description No.    1    2    3    4



- Server waits for incoming requests on TCP port 55555
- Simple plain-text protocol
- Four known commands
  - SOURCES
  - PORT
  - OPEN
  - CLOSE
- Response: OK or ERROR
- Transport protocol: UDP + sequence number



- Packets can be delayed or duplicated
- Solution: Jitter buffer
- Collects packets in a separate thread, delivers them in order
- Delivers all available descriptions of the current frame
- Drawback: Additional delay



- Clocks on the serving and on the receiving side are not synchronous
- With typical clocks this skew can amount to up to  $\pm 0.5\%$
- Jitter buffer overflows/runs empty
- Solution: Cubic spline interpolator

---

**Thank you for your attention.**

**After a short demonstration, I will gladly answer your questions.**