Two Dimensional Switching
Lecture 2

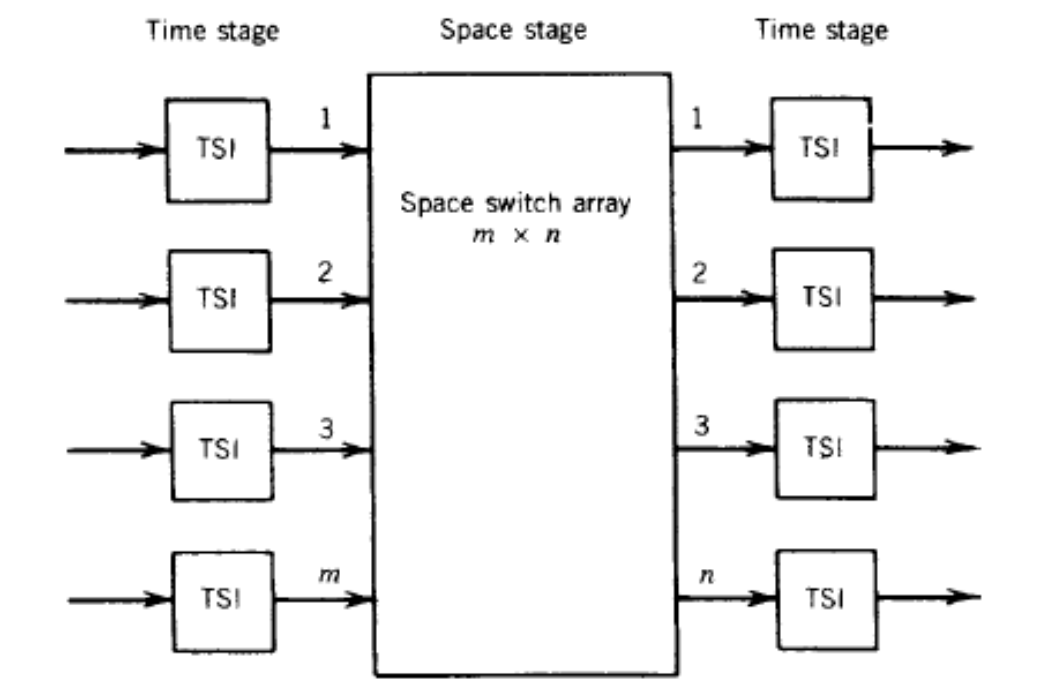
Time–Space–Time Switch

- Digital switches are composed of time and space switches in any order.14 We use the letter T to designate a time-switching stage and use S to designate a space-switching stage. For instance, a switch that consists of a sequence of a time-switching stage, a space-switching stage, and a time-switching stage is called a TST switch.
- A switching consisting of a space-switching stage, a time-switching stage, and a space-switching stage is designated an STS switch. There are other combinations of T and S like AT&T No. 4 ESS switch is a good example. It is a TSSSST switch.
- The first stage of the switch is the TSI or time stages that interchange time slots (in the time domain) between external incoming digital channels and the subsequent space stage. The space stage provides connectivity between time stages at the input and output. It is a multiplier of call-handling capacity.
- The multiplier is either the value for M or value for N, whichever is smaller. We also saw earlier that space-stage time slots need not have any relation to either external incoming or outgoing time slots regarding number, numbering, or position. For instance, incoming time slot 4 can be connected to outgoing time slot 19 via space network time slot 8.

If the space stage of a TST switch is non blocking, blocking in the overall switch occurs if there is no internal space-stage time slot during which the link from the inlet time stage and the link to the outlet time stage are both idle. The blocking probability can be minimized if the number of space-stage time slots is large. A TST switch is strictly non blocking if

$$l = 2c - 1$$

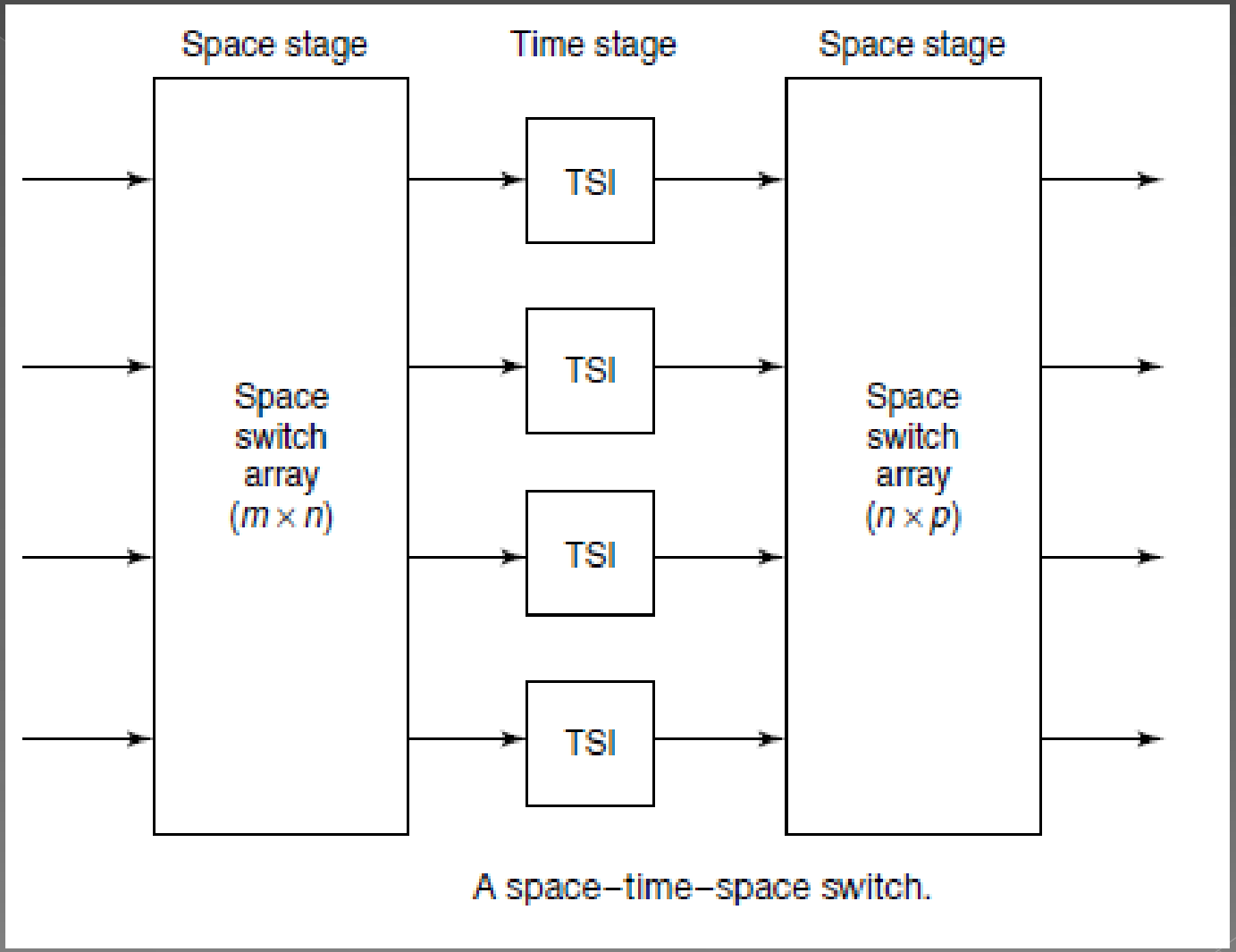
where l is the number of space-stage time slots and c is the number of external TDM time slots



A time–space–time (TST) switch. TSI = time-slot interchanger.

Space–Time–Space Switch

- A space–time–space switch reverses the order architecture of a TST switch. The STS switch consists of a space cross–point matrix at the input followed by an array of time-slot interchangers whose ports feed another cross-point matrix at the output.
- Consider this operational example with an STS. Suppose that an incoming time slot 5 on port No. 1 must be connected to an output slot 12 at outgoing port 4. This can be accomplished by time-slot interchanger No. 1, which would switch it to time slot 12; then the outgoing space stage would place that on outgoing trunk No. 4.
- Alternatively, time slot 5 could be placed at the input of TSI No. 4 by the incoming space switch, where it would be switched to time slot 12, and then out port No. 4.



A space–time–space switch.

TST Compared with STS

- ✓Both TST and STS switches can be designed with identical call-carrying capacities and blocking probabilities. It can be shown that a direct one-to-one mapping exists between time-division and space-division networks. The architecture of TST switching is more complex than STS switching with space concentration.
- ✓The TST switch becomes more cost-effective because time expansion can be achieved at less cost than space expansion. Such expansion is required as link utilization increases because less concentration is acceptable as utilization increases. It would follow, then, that TST switches have a distinct implementation advantage over STS switches when a large amount of traffic must be handled.
- ✓The choice of a particular switch architecture may be more dependent on such factors as modularity, testability, and expandability. One consideration that generally favors an STS implementation is the relatively simpler control requirements.However, for large switches with heavy traffic loads, the implementation advantage of the TST switch and its derivatives is dominant.