Organizational Chemical Computation:

Information in organizational chemical computations is not represented symbolically, and not represented by concentrations (numeric), but by the presence or absence of molecules of certain species. Organization is set of species that a system is able to maintain for a long time. It is only important for one of the molecules in the set to survive. It doesn’t matter how many. Def: An organization is a set of molecular species that is closed and self-maintaining. Closed: The set only contains species that can be produced by reactions among those species (The set cannot “generate” new species.). Self-Maintaining: The set of species is able to maintain its mass under influence of reactions between those species. Examples of X<->Y, X->XX->XXX…, X<->Y->0.

// definitely important for the whole message is the SUMMARY, on the pages 16, 17, 18 that he skipped at lectures.

//Chemical Congestion Control Algorithm uses dynamical information to do the control loop.

Data packets are in source node. They have sequence number. The number of “window” molecules determines the transmission rate. Window molecules W are injected at a constant rate so the concentration of W increases linearly so the transmission rate increases linearly. Species L contains the number of packets lost. Whenever jump in the sequence number of received ACKs is detected, number of L molecules is increased by one. Each lost packet catalyzes the destruction of window molecules and by that it slows the transmission rate. From the law of mass action we get that more lost packets, the faster the decrease of W. The influence of a lost packet to the decrease of W has to be stopped eventually, so L molecules are decayed by a first-order reaction.

The C3A is a hybrid protocol, meaning that user-information is encoded symbolically inside the (data) packets and control is carried out implicitly by coupling packet rates with a chemical reaction network. The two information processing levels can be used at the same time without bothering each other. Advantages of controlling the dynamics with a chemical reaction network are: intuitive design with the help of the reaction network graph, sound mathematical analysis methods (Chemical Organization Theory, ODEs), easy to extend (by adding additional reactions).

// Self-healing algorithm is pretty much explained on the slides with animations, so I won’t type any more.