

# Control Using Distributed Information

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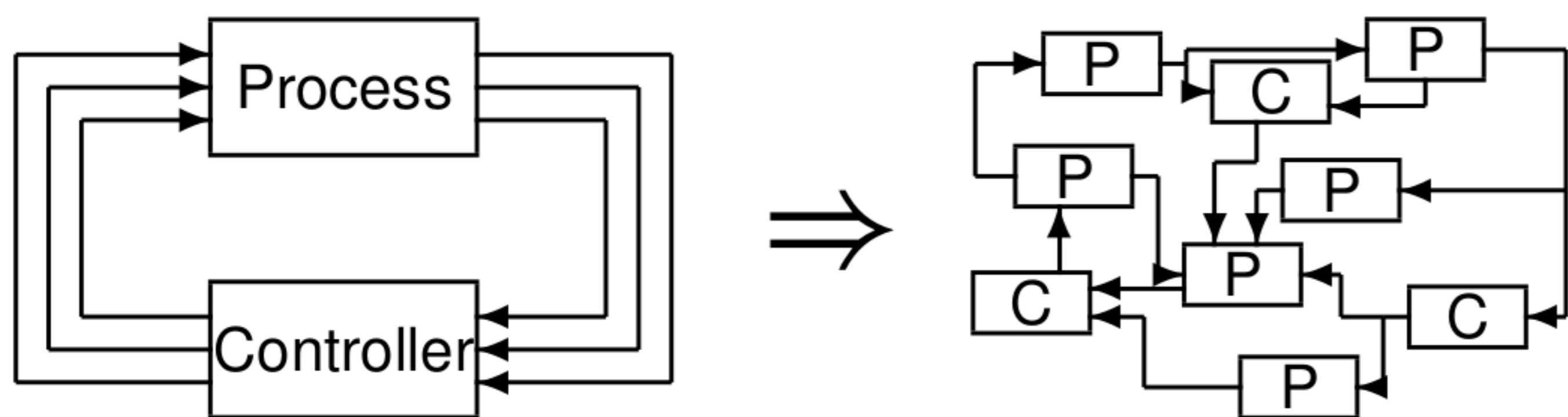
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## Description:

Motivated by applications in infrastructure networks (mainly traffic and transportation) we are studying how network flows can be optimized using distributed controllers. Existing results for linear systems with an H-infinity objective will be generalized to accommodate non-linear flow constraints and other convex objectives.

## Background & Motivation

- ❑ Networks for energy, transportation, communications
- ❑ Complex, due to size, heterogeneity and autonomy
- ❑ Centralized paradigm hard to use for large-scale systems
- ❑ State-of-the-art paradigm scales poorly with growing numbers of devices and interactions
- ❑ Systematic theory for large-scale control is needed



## Research Goal & Questions

### Goals:

- ❑ Scalable methodology for control of network flow
- ❑ Stable and robust systems, optimal performance
- ❑ Apply methods to traffic/transportation systems

### Initial questions:

- ❑ Can the H-infinity performance *objective* be modified to better fit the needs in traffic and transportation systems?
- ❑ How do we introduce capacity *constraints* in recent methods for distributed H-infinity control?

## Methods & Preliminary Results

- ❑ Rantzer, A., Lidstrom, C., & Pates, R. (2016). Structure Preserving H-infinity Optimal PI Control. arXiv preprint arXiv:1612.07824.
- ❑ Lovisari, E., Como, G., Rantzer, A., & Savla, K. (2014). Stability analysis and control synthesis for dynamical transportation networks. arXiv preprint arXiv:1410.5956.
- ❑ Lidstrom, C., Rantzer, A., (2016, July). Optimal H $\infty$  state feedback for systems with symmetric and Hurwitz state matrix. In American Control Conference (ACC), 2016 (pp. 3366-3371). American Automatic Control Council (AACC).

## Roadmap & Milestones

- ❑ We will study how desirable static performance objectives can be met using distributed feedback
- ❑ Objectives and constraints appearing in traffic and transportation networks will be emphasized
- ❑ A next step is to design dynamic properties of the distributed controllers, while keeping the static properties intact

