

Learning-Capable Communication Networks (LCCN)

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**IETF 81 Meeting
Quebec City, Canada
July 28, 2011**

(Self-adaptive) Learning-based Control

Current situation: once configured, network systems follow explicitly pre-defined behavior, persistently decide and uniformly execute

=> Self-adaptive learning-based control

- Aware of their state, activity/behavior, and environment over time
- Capable to react and adapt to changing environment and running conditions over time
- Operate autonomously and when needed cooperatively (no global coordination or synchronization)



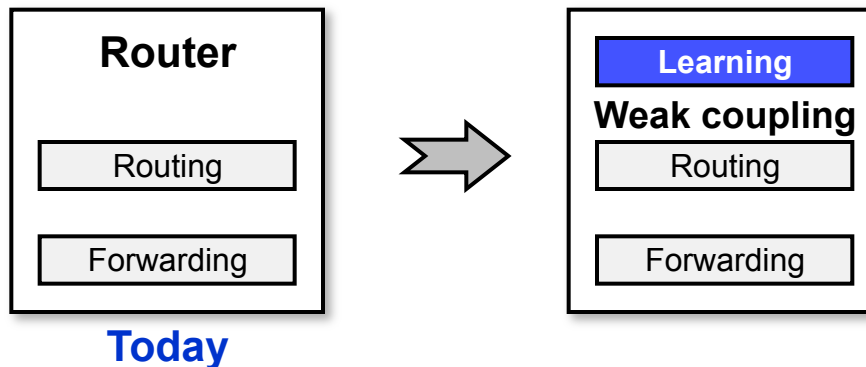
Learning to avoid need to iteratively re-design systems as they should adapt to their environment and running conditions

Role/challenges of learning

- **WHAT/WHY: diagnose** internal state, own activity, and network environment over time (detect -> identify -> analyze)
- **HOW: adapt** decisions and **tune** actions automatically and timely
- **WHEN: determine** when to operate autonomously and when to cooperate

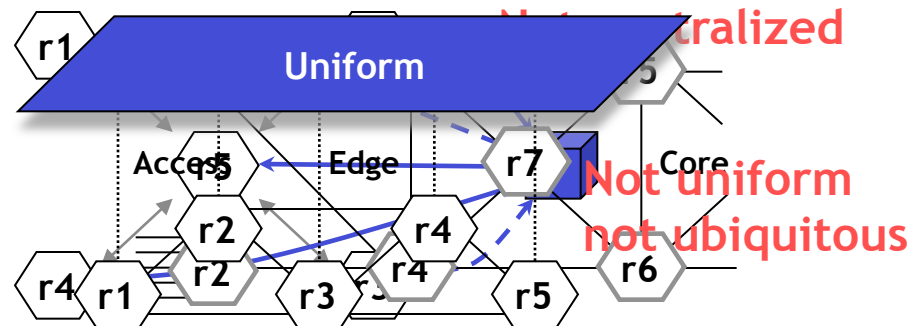
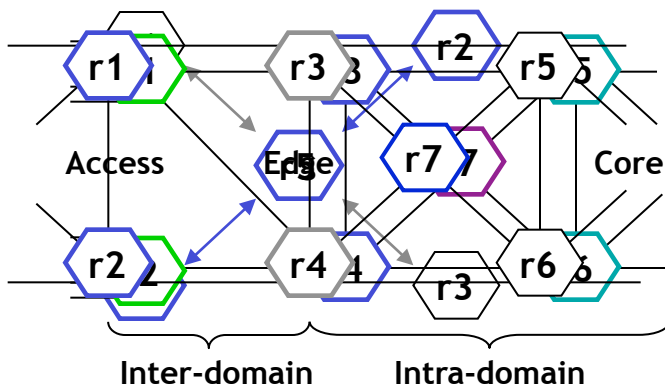
(Self-adaptive) Learning-based Control

Augment network systems (e.g. routers) with **learning component**

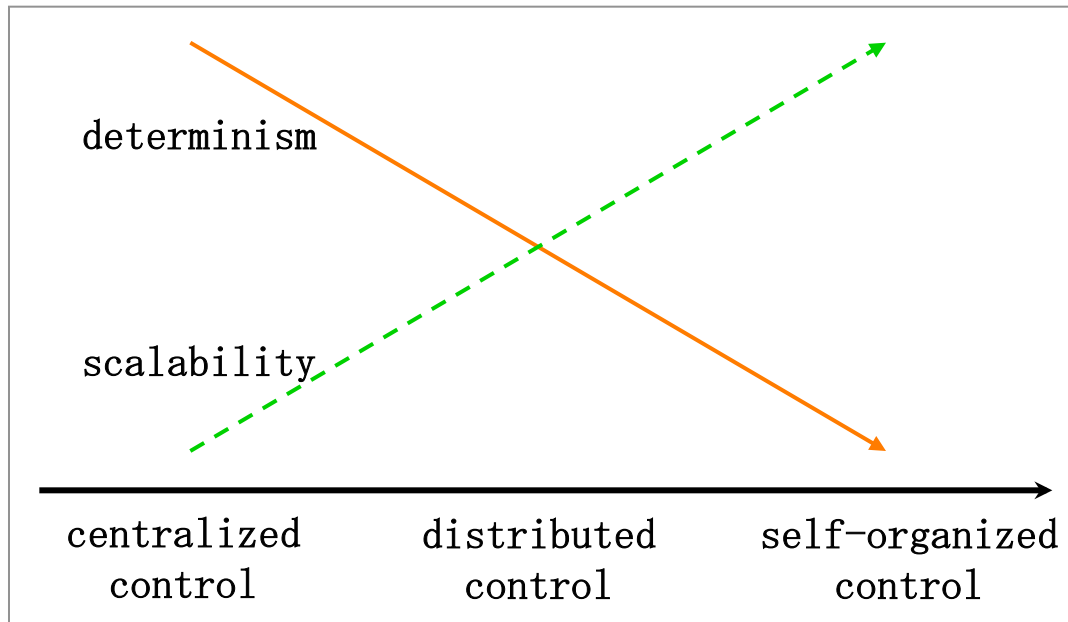
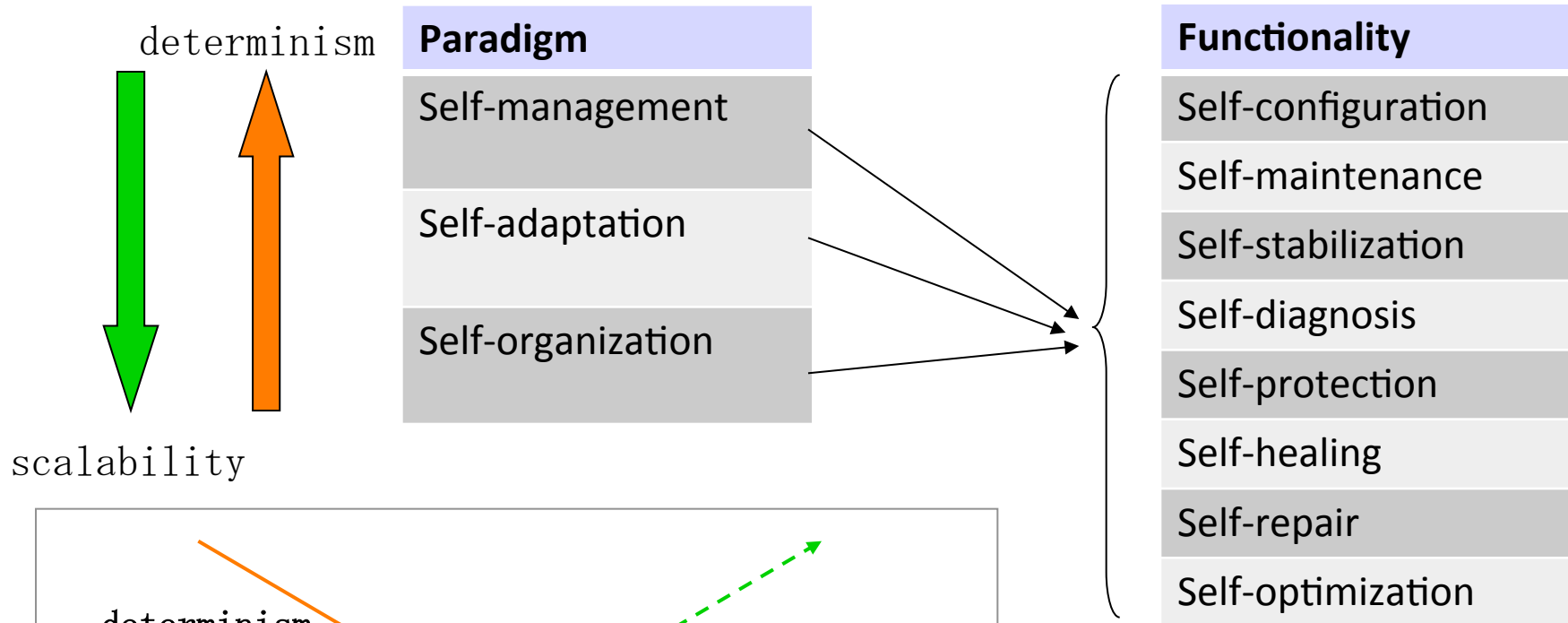


Guiding principles

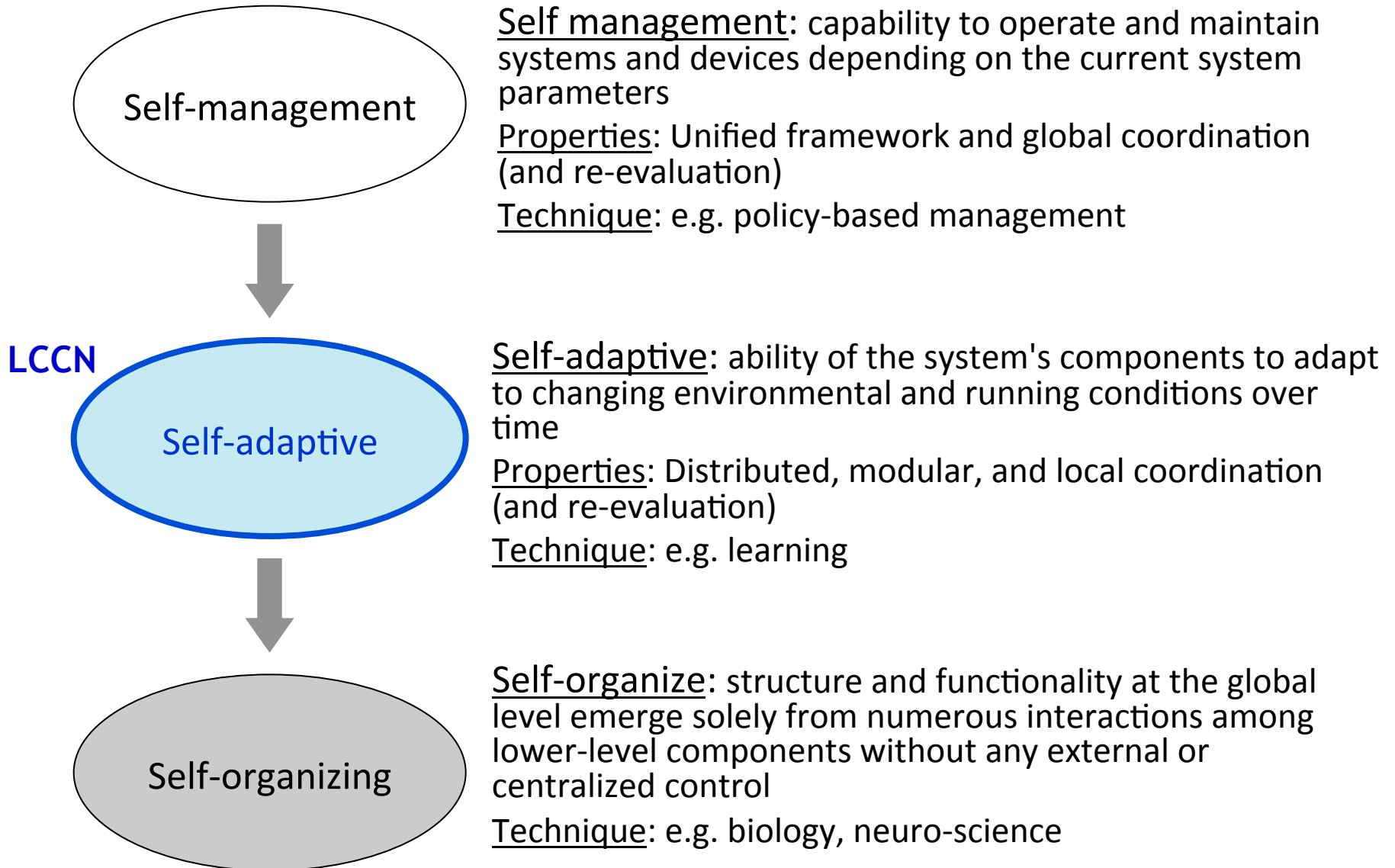
- **Local view and decision** (no network global view or coordination): to ensure scalability and robustness
- **Modular** (no monolithic or unified framework): to ensure gradual development
- **Distribution** (no uniform or ubiquitous plane): to ensure organic deployment



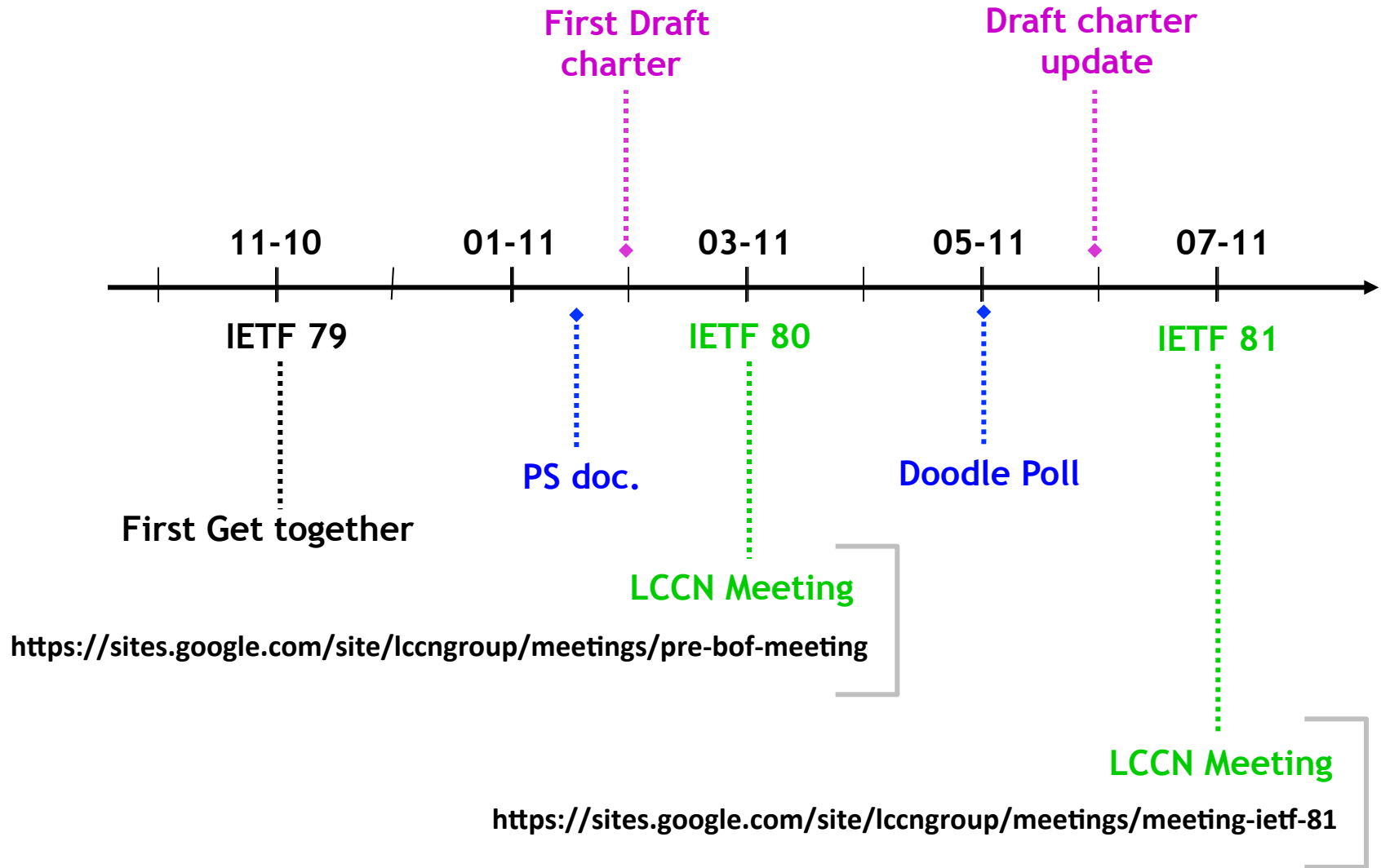
Self-X paradigms vs functionality



LCCN Research Activity Positioning



Activities Timeline



Research Space/Domains

- Doodle poll (25, about 50% of participants)

	Network self-defense (incl. distributed intrusion/attack detection, distributed anomaly detection, etc.)	Routing (incl. traffic engineering, resiliency, stability, etc.)	Control of optical networks	Mobile/Ad-Hoc/Sensor networks	Other Suggestion
Count	11	21	10	10	5

- Outcome: several people will present state-of-the-art/challenges in these selected experimental domains during LCCN meeting @ IETF 81
- Identify research challenges and potentials wrt application of various learning models and techniques inside each of these domains and between domains (specialization vs generalization)
- Architectural baseline (common principles, control model, etc.)

LCCN Initiative

- **One-line abstract:** learning-based control for network systems to automatically and timely adapt to network environment and running conditions over time
- **Description:** <<https://sites.google.com/site/lccngroup/>>
- **LCCN Meeting:** Wednesday July 27th from 1:00 to 3:00PM (303AB)
Goals (of this meeting)
 - Identify research challenges & potentials when applying learning to i) Routing (incl. traffic engineering, resiliency, stability, etc.), ii) Network self-defense (incl. distributed intrusion/attack detection, distributed anomaly detection, etc.), iii) Mobile/ad-hoc/sensor networks.
 - Assess level of interest to initiate research on them
 - Determine if IRTF is the right place to conduct such research work
 - Estimate readiness for opening an IRTF Research Group by IETF 82
- **Agenda:** <<https://sites.google.com/site/lccngroup/bof-description-and-agenda>>
- **Problem statement I-D:** draft-tavernier-irtf-lccn-problem-statement-01
- **Contact:** <<http://groups.google.com/group/lccn/>>

LCCN Initiative

LCCN Mailing list countries (60+ members)

