

# Collaboration & Virtualization in Cyber-Physical Systems

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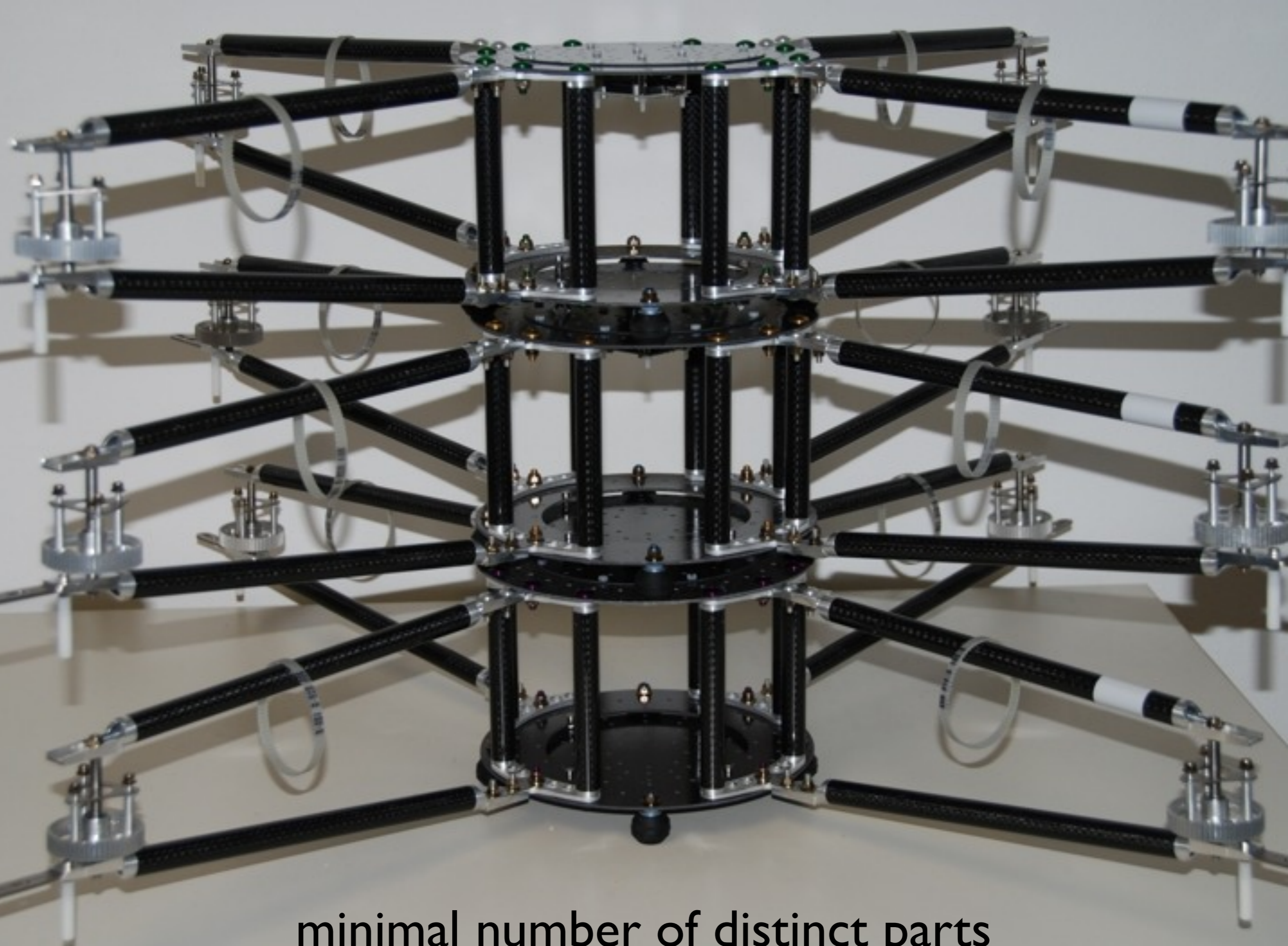


# The JAviator

[javiator.cs.uni-salzburg.at](http://javiator.cs.uni-salzburg.at)



40min flight time @ 2.2kg  
2kg additional payload capacity



minimal number of distinct parts

# Automatic Attitude & Altitude Control (Many thanks to the STARMAC team!)



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<http://javiator.cs.uni-salzburg.at>

# Virtualization

- Non-trivial physical systems including digital computers are **non-linear** systems
- Traditional virtualization technology enables **concurrency** through spatial isolation
  - ▶ machine registers, linear address space, ...
- Virtualization may **linearize** all aspects of physical systems
  - ▶ space, time, energy, reliability, ...

# Collaboration

- Cyber-physical systems are networked on many **different** levels
  - ▶ physical, economical, social, ...
- Traditional network designs focus on **communication**
  - ▶ client-server model, P2P networks, ...
- Real strengths of networks is in **collaboration**
  - ▶ aggregation of information [RTAS09]

# Uncertainty in Software

- Uncertainty = **infinite** environments/platforms
- Traditional software enjoys the **certainty** of **finite** environments/platforms
- Real strength of software is **flexibility** but **semantics of change** is difficult
  - ▶ patch software at runtime only if patch could have been applied already at compile time (if the patch had been known) [APRES08]
  - ▶ virtualization enables runtime patching



Scalable Collaboration

+

Virtualization of Everything

=

Cyber-Physical Systems

?



Thank you