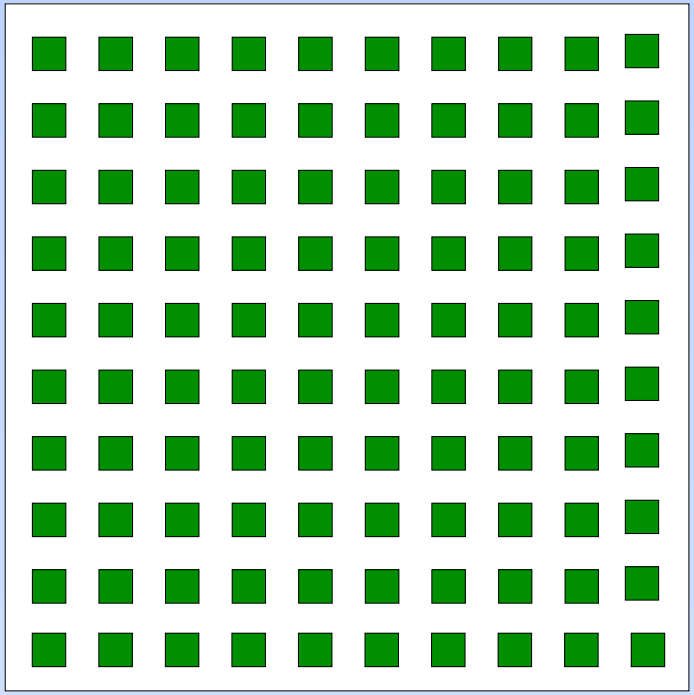
Standards for NoC: What can we gain?



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March 2006

What Kind of Standards

- Informal Standards are a set of assumptions shared and agreed upon in a community
- Industrial standards are set by companies that guess right
- Formal standards (IEEE, ISO, ...) are usually preceded by an informal consensus

Standards vs. Creativity

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+

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+

=


Standardizing Interfaces and Protocols

- Pins
- Data link
- Transactions
- End-to-end communication services
- Functionality + performance contracts

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We gain:

- Reuse of IPs
- Reuse or verification
- Outsourcing and specialization
- Separation of
  - ⋆ Physical design issues
  - ⋆ Communication design
  - ⋆ Component design
  - ⋆ Verification
  - ⋆ System design

Standardization of Design Methodologies

- Reuse of concepts
- Methodologies
- Methods
- Design languages
- Tools

Reuse, separation of concerns and specialization are driving forces

We can build on top of standards

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- Design tools:
  - ⋆ System performance analysis
  - ⋆ Formal communication verification
  - ⋆ Allocation, mapping, and scheduling
  - ⋆ etc.

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- Design tools:
  - ⋆ System performance analysis
  - ⋆ Formal communication verification
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  - ⋆ etc.

- New services:
  - ⋆ Dynamic resource allocation and management
  - ⋆ Dynamic power management
  - ⋆ On-line testing and diagnostics
  - ⋆ Off-chip communication services
  - ⋆ etc.

Standardization of Performance Metrics

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- Benchmark applications and Stochastic micro-benchmarks

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Standardization of Performance Metrics

- Benchmark applications and Stochastic micro-benchmarks
- Packet level and Transaction level
- Unloaded and Loaded case
- Various temporal and Spatial distributions of traffic
- Best effort and Guaranty services
- Sizes between 16 and 200 nodes

Unloaded Case

	Delay	Bandwidth	Energy	Area
Packet				
Transaction				
Read 16/32/64b				
Write 16/32/64b				
Open Stream				
Close Stream				
Message 1/4/16/32B				

Loaded Case

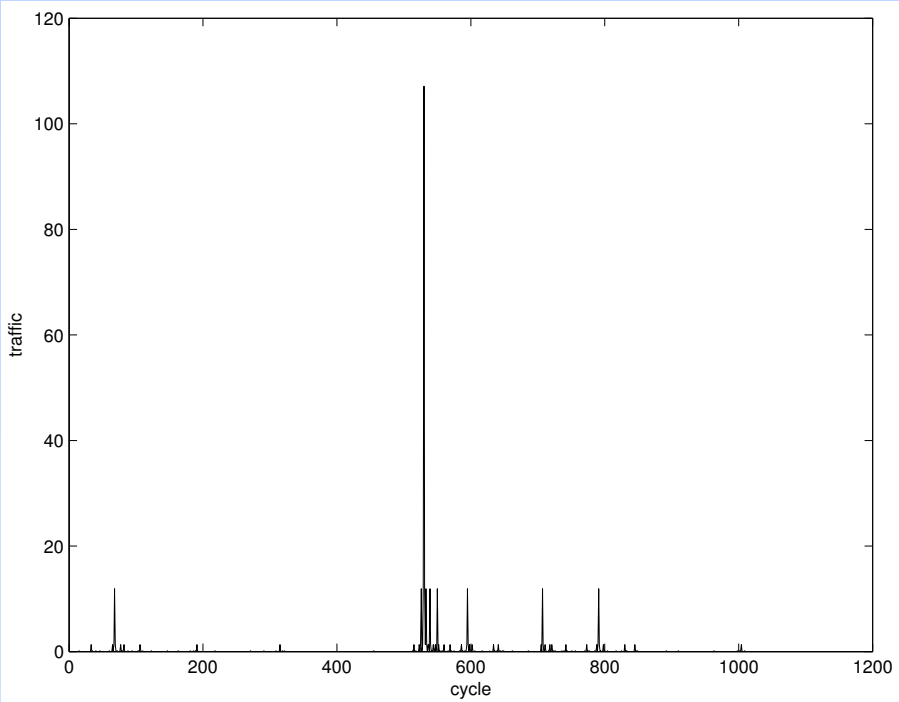
	D_1	D_2	D_3	D_n	Sustained bandwidth	Energy /byte
Packet						
Transaction						
Read 16/32/64b						
Write 16/32/64b						
Open Stream						
Close Stream						
Message 1/4/16/32B						

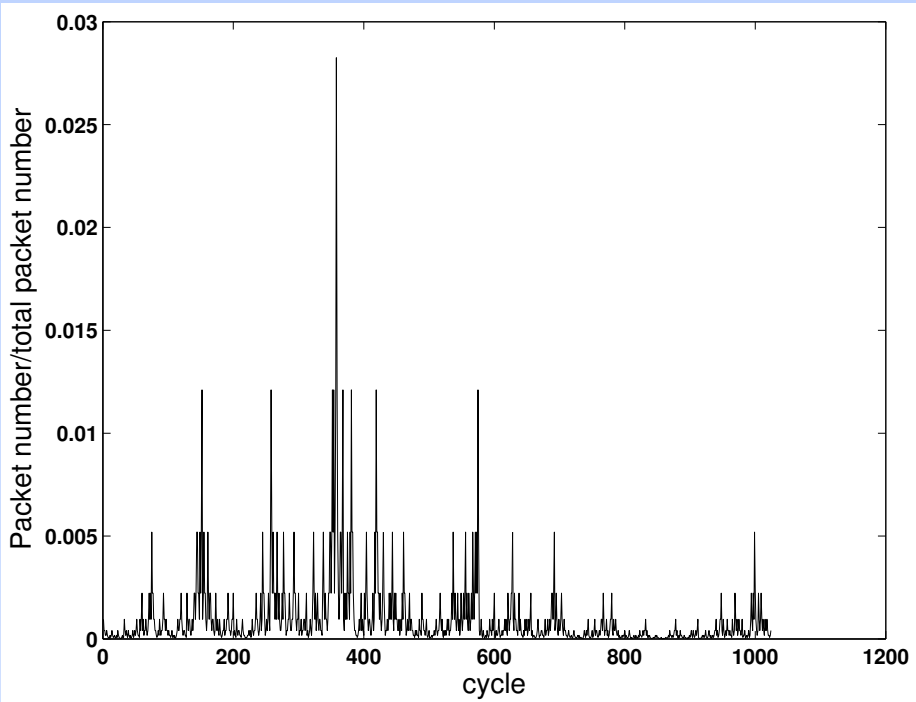
$1 - 10^{-i}$ of all packets p: $\dfrac{\text{delay}(p)}{\text{mindelay}(p)} \leq D_i$

$D_1 : 90\%, \quad D_2 : 99\%, \quad D_3 : 99.9\%, \quad D_n : 100\%$

Temporal Distributions

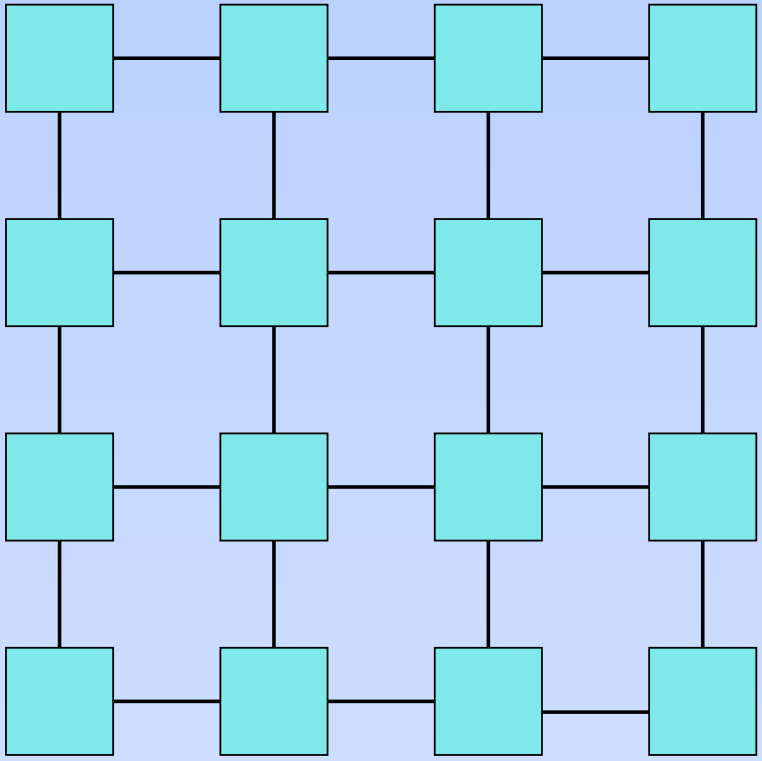
- Uniform
- Bursty traffic according to the B-Model: $B_{0.2}$, $B_{0.3}$, $B_{0.4}$





Spatial Patterns

- Uniform
- Uniform with locality
- Bit Rotate
- Bit Complement
- Hot Spot
- Fork-Join Pipeline



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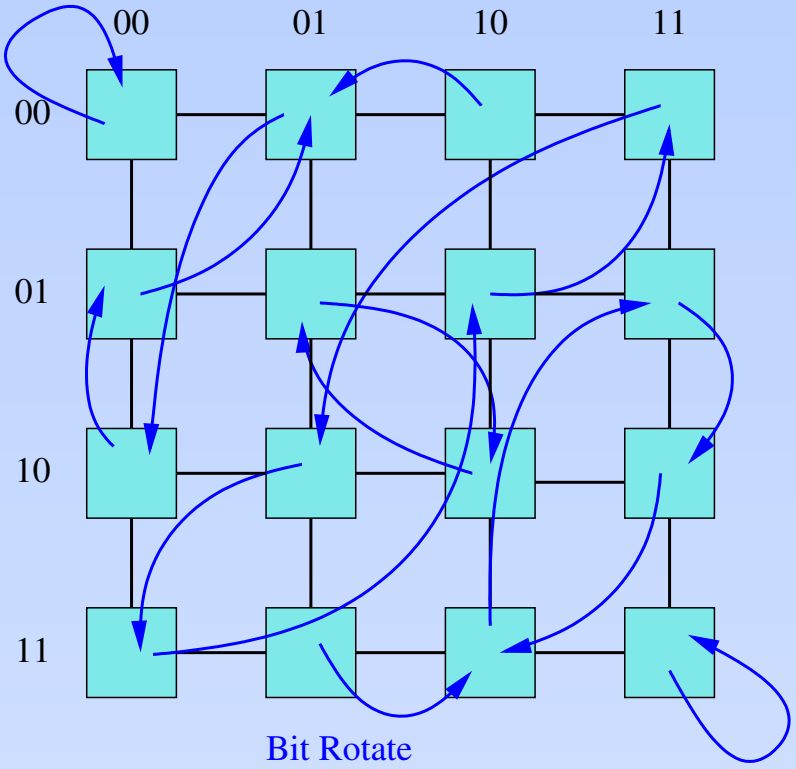

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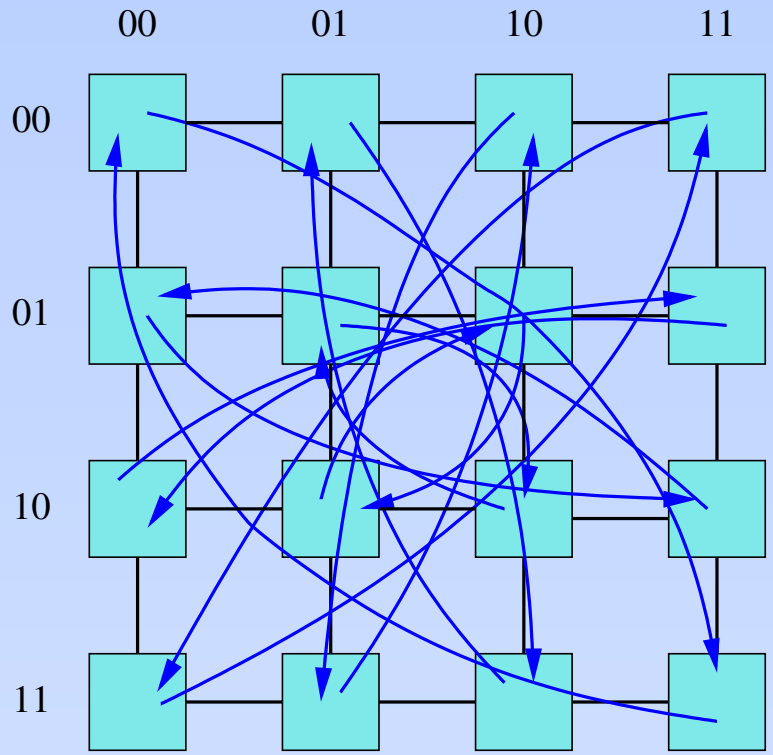

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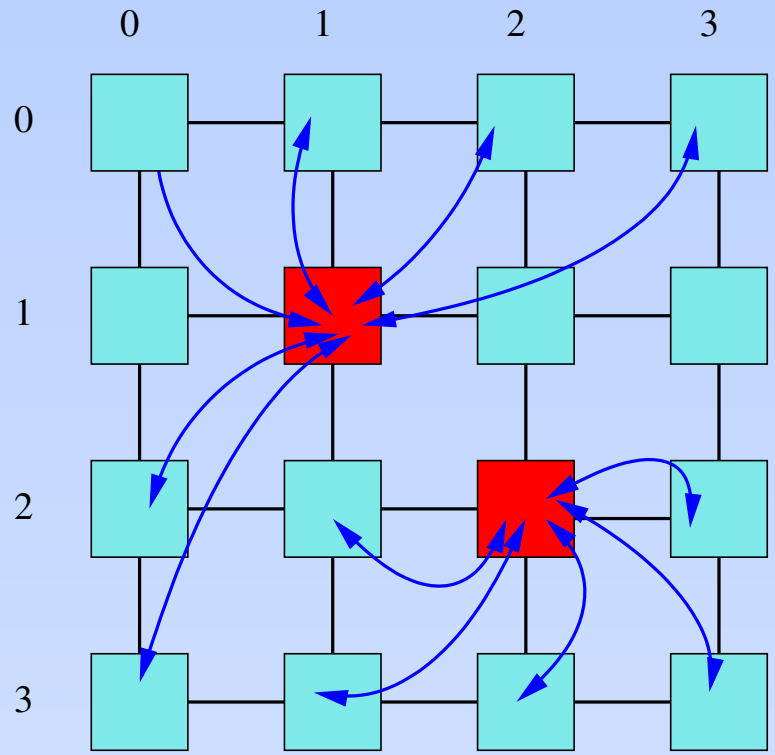

Hot Spot

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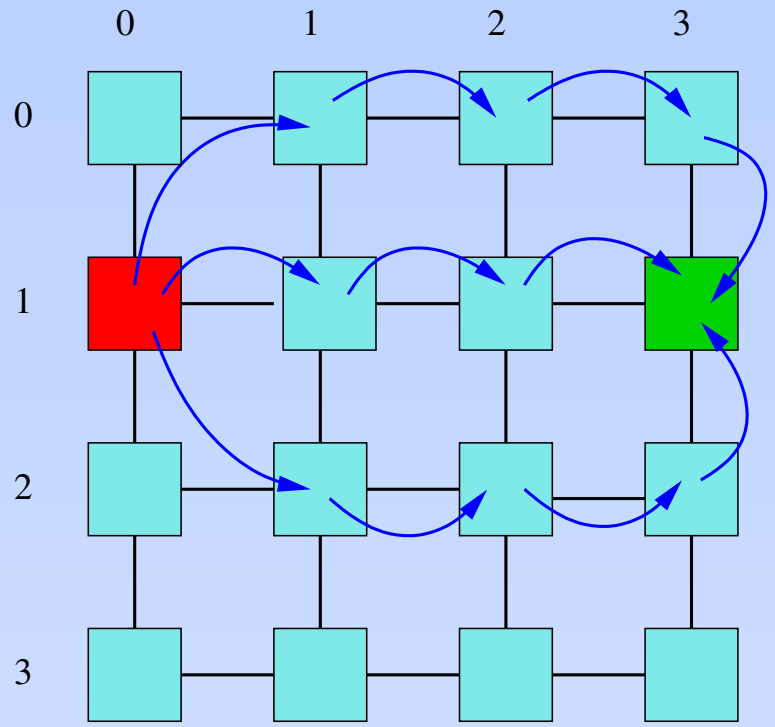


Fork–Join Pipeline

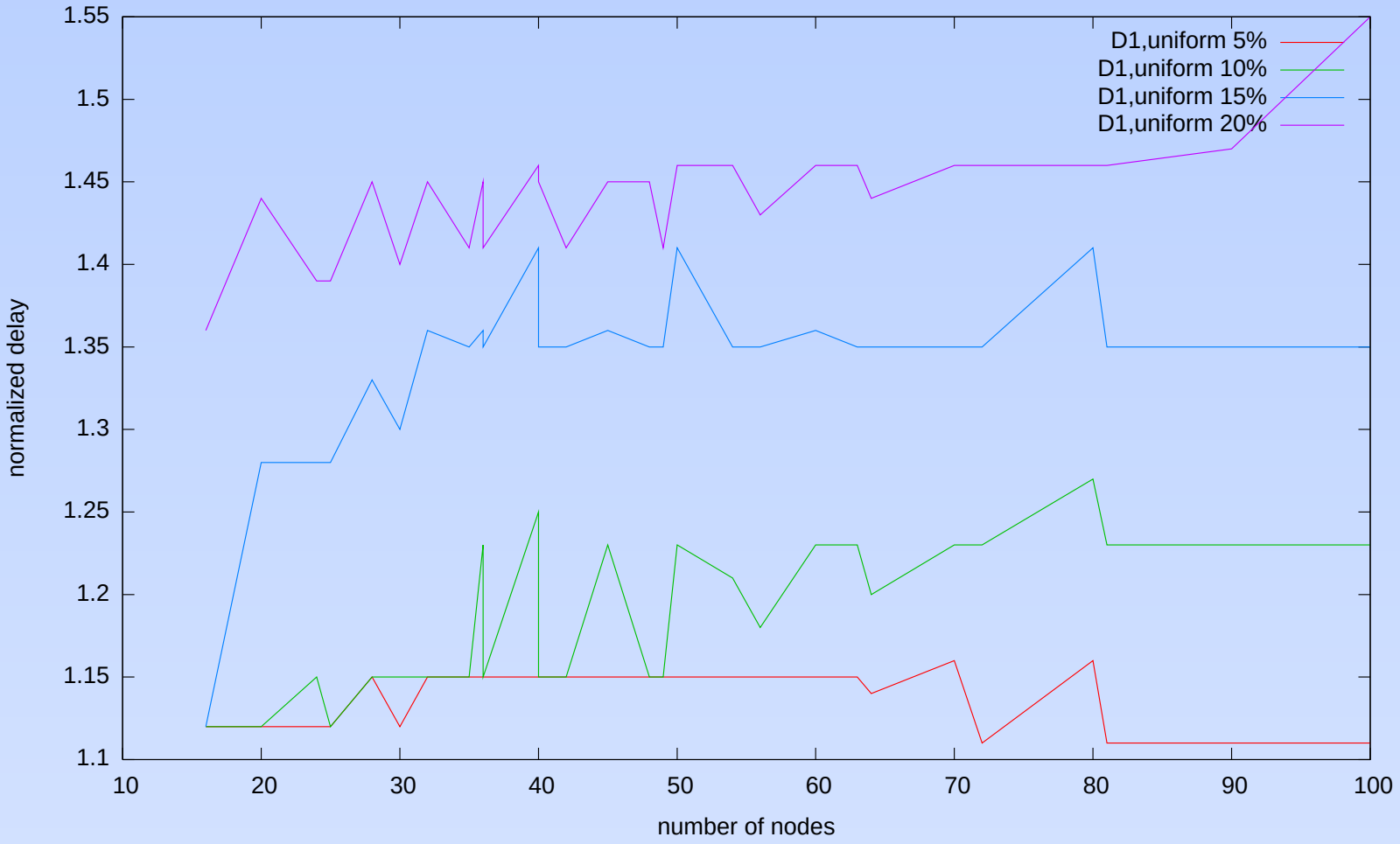
Size

Number of nodes: 8, 16, 25, 40, 60, 80, 100, 150, 200

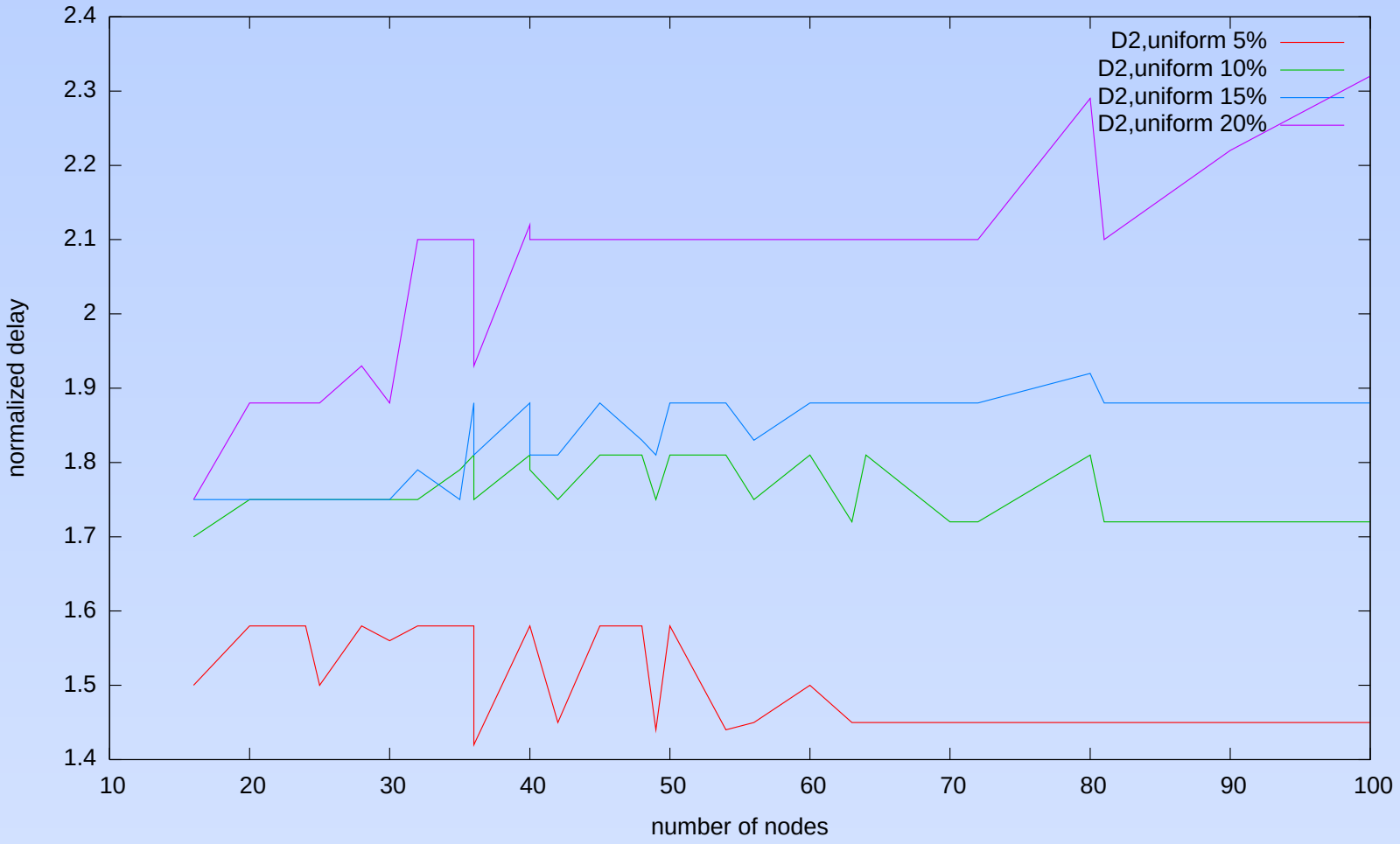
Data Points for Stochastic Micro Benchmarks

- Temporal distribution: $4\times$
- Spatial patterns: $12\times$
- Unloaded case: $((14 \times 4)+$
- Loaded case: $((14 \times 6))\times$
- Size: $9 = 60480$

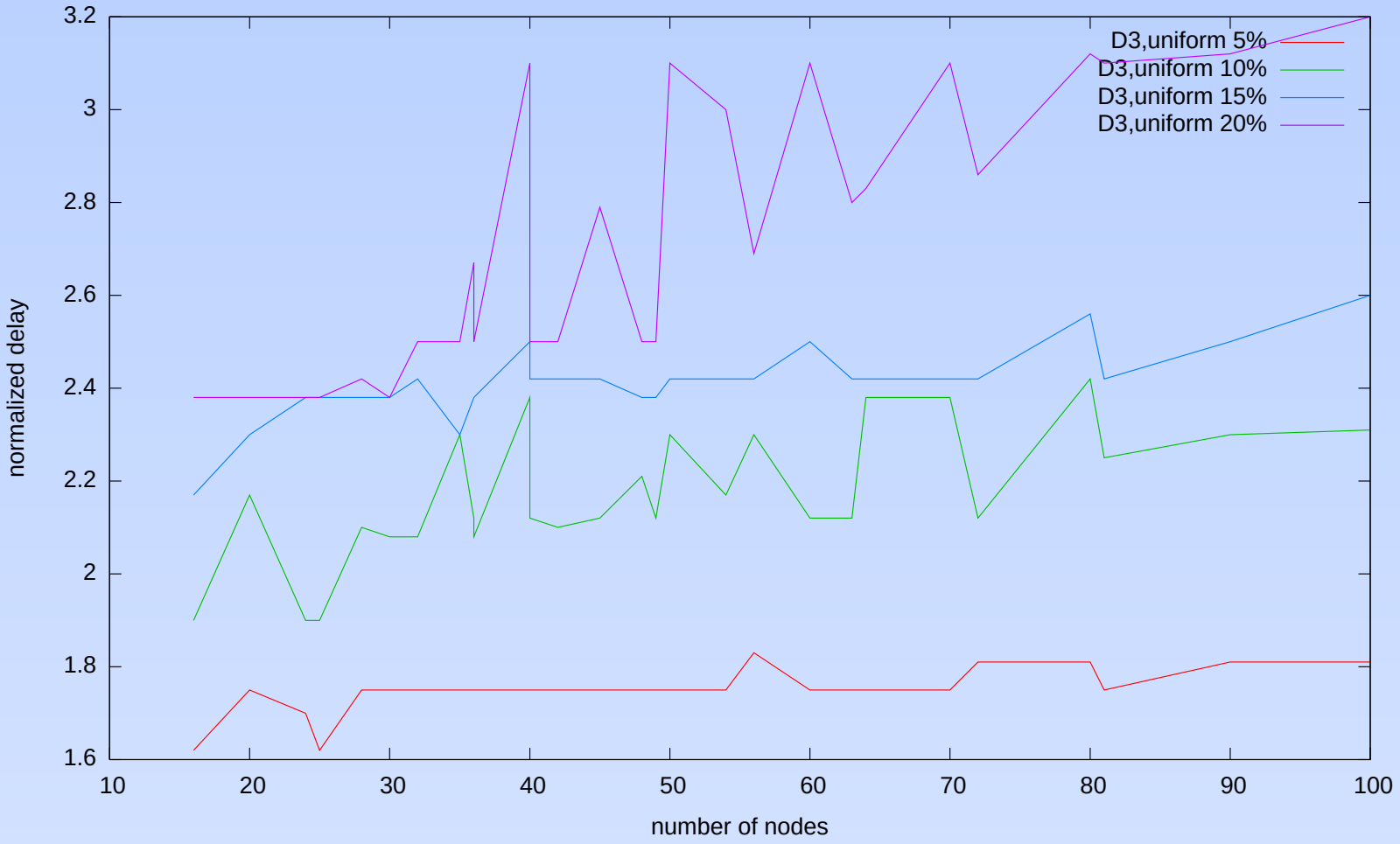
D_1 versus network size in Nostrum



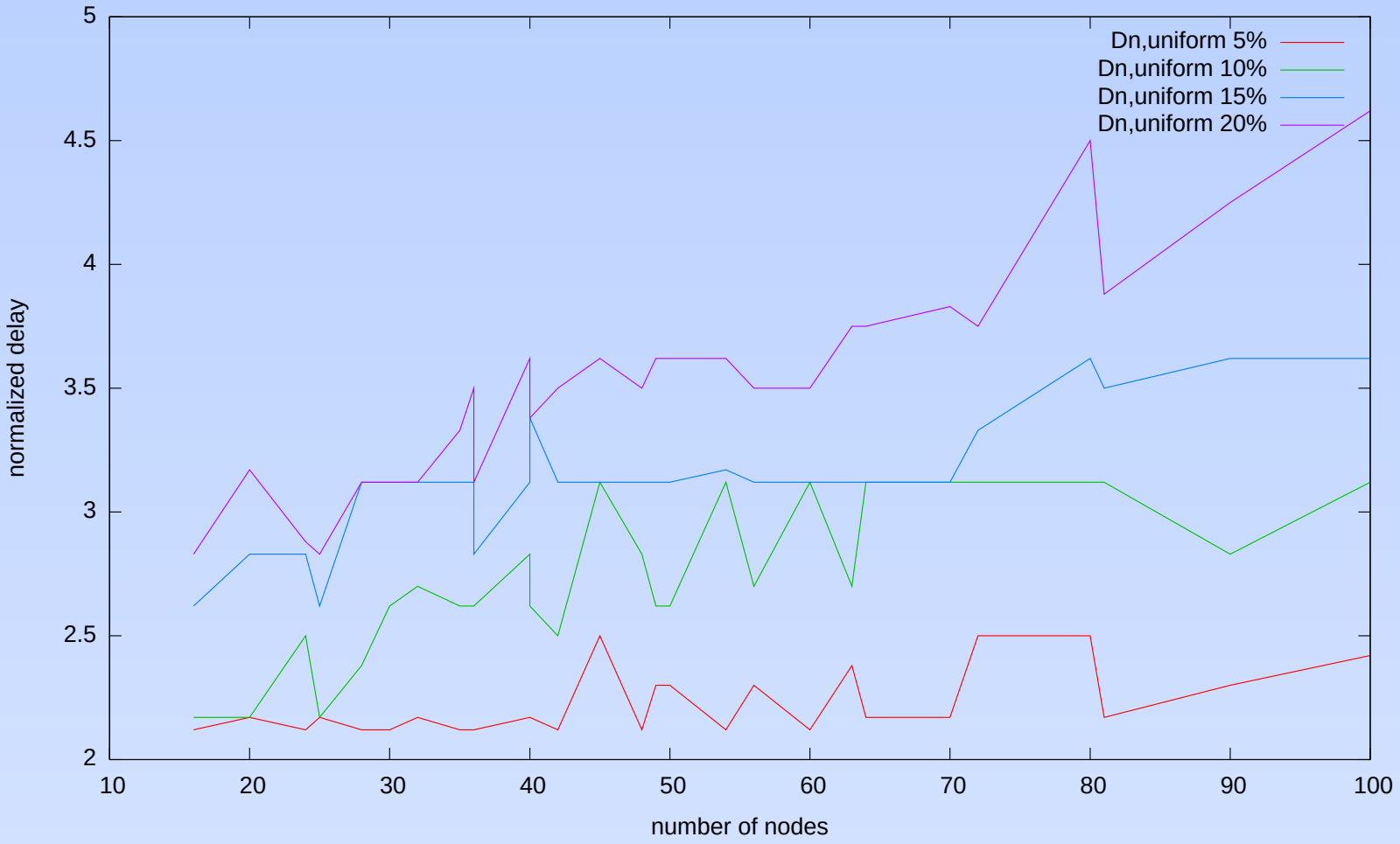
D_2 versus network size in Nostrum



D_3 versus network size in Nostrum



D_n versus network size in Nostrum



Summary

- Standards are crucial and complementary to innovative research
- Let's standardize performance metrics