A Virtual Sink-based Strategy for reducing the Funneling Effect in IEEE 802.15.4 DSME Networks

Ivonne Mantilla-Gonzalez and Volker Turau

DCOSS 2022
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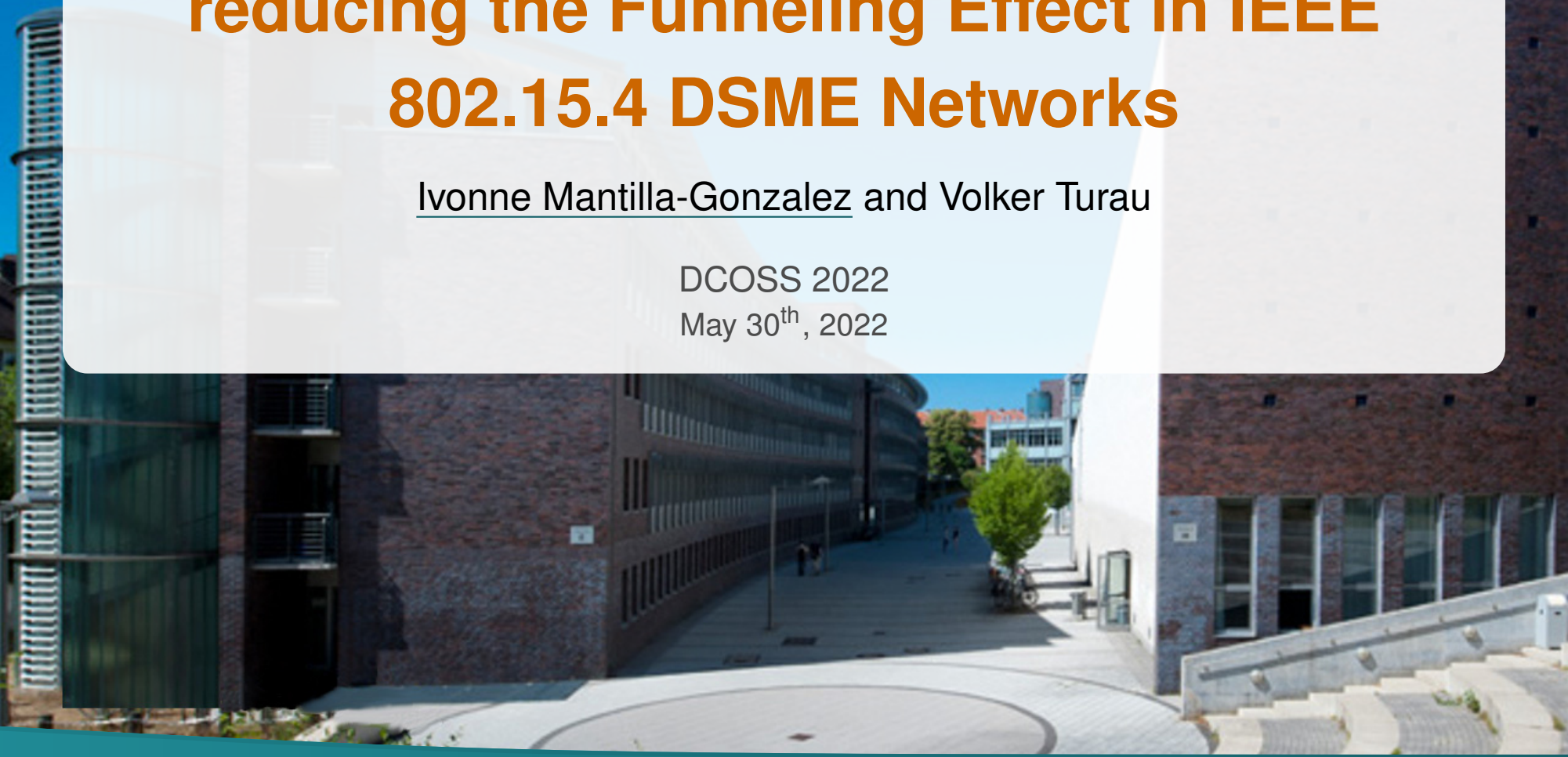

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Agenda

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- Motivation

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- Description of the Virtual Sink-based strategy

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- Simulative assessment

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- Simulative assessment
- Conclusions and Outlook

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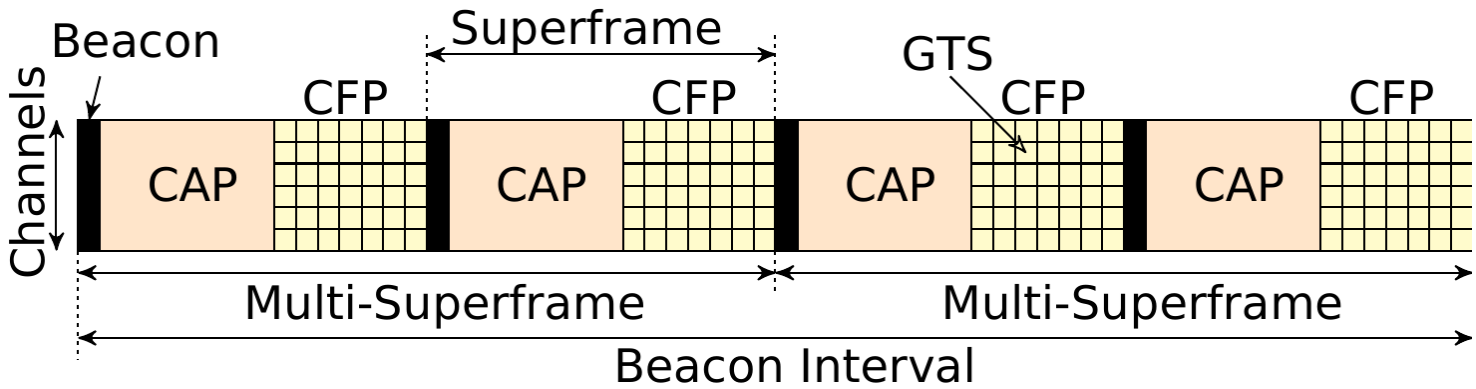
  Resource allocation $\Rightarrow$ efficient, dynamic and adaptable!
- IEEE 802.15.4 DSME $\Rightarrow$ reliability, scalability and energy efficiency in IoT applications



Challenge

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$\Rightarrow$ **We propose a strategy to improve the scheduling of resources through coexistence between centralized and decentralized algorithms**

Virtual Sink Concept

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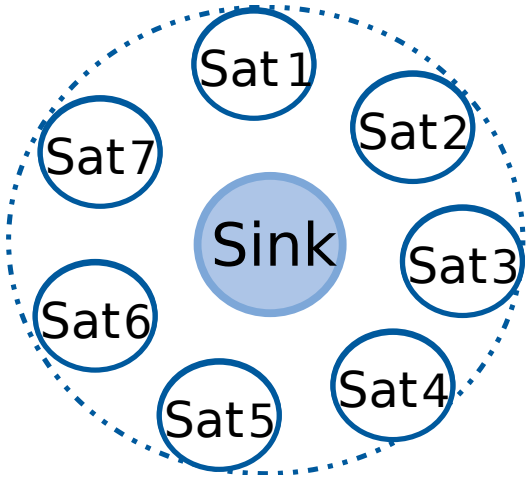

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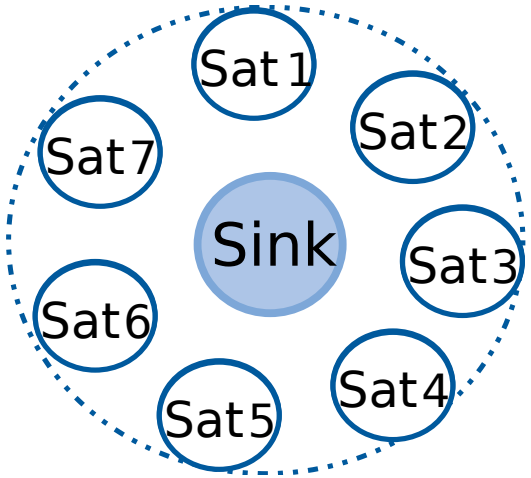
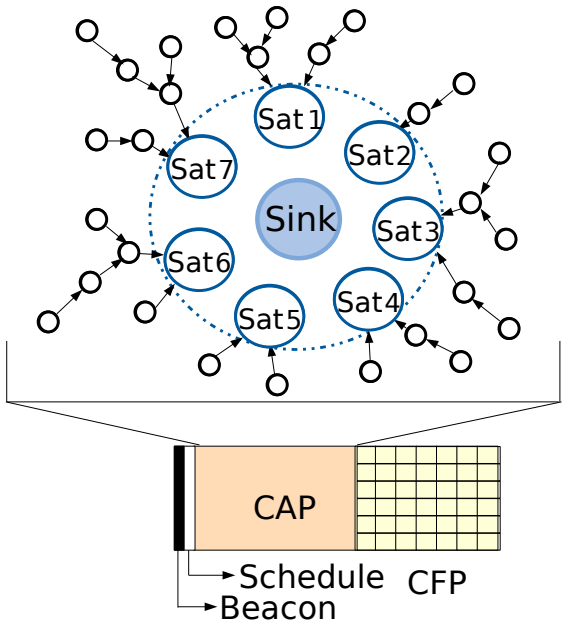


- star topology $\Rightarrow$ sink + up to 7 child nodes
- sink controls the resource allocation at child nodes
- easy and cheap way for the sink to obtain information about traffic
- nodes outside the virtual sink $\Rightarrow$ decentralized scheduling algorithm

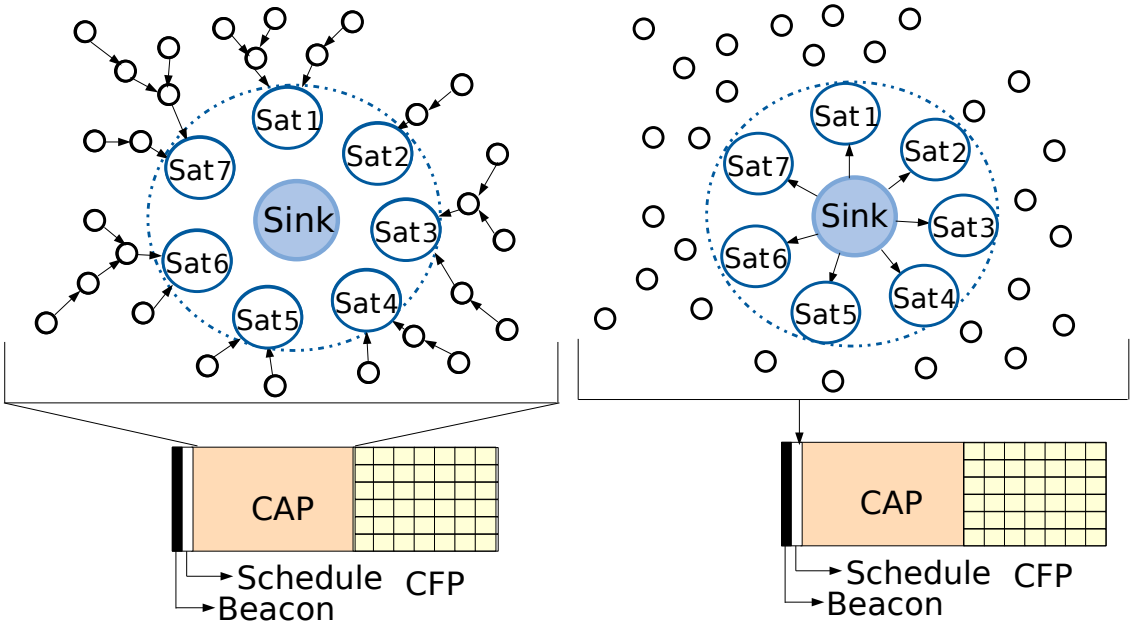
Virtual Sink Strategy

Virtual Sink Strategy



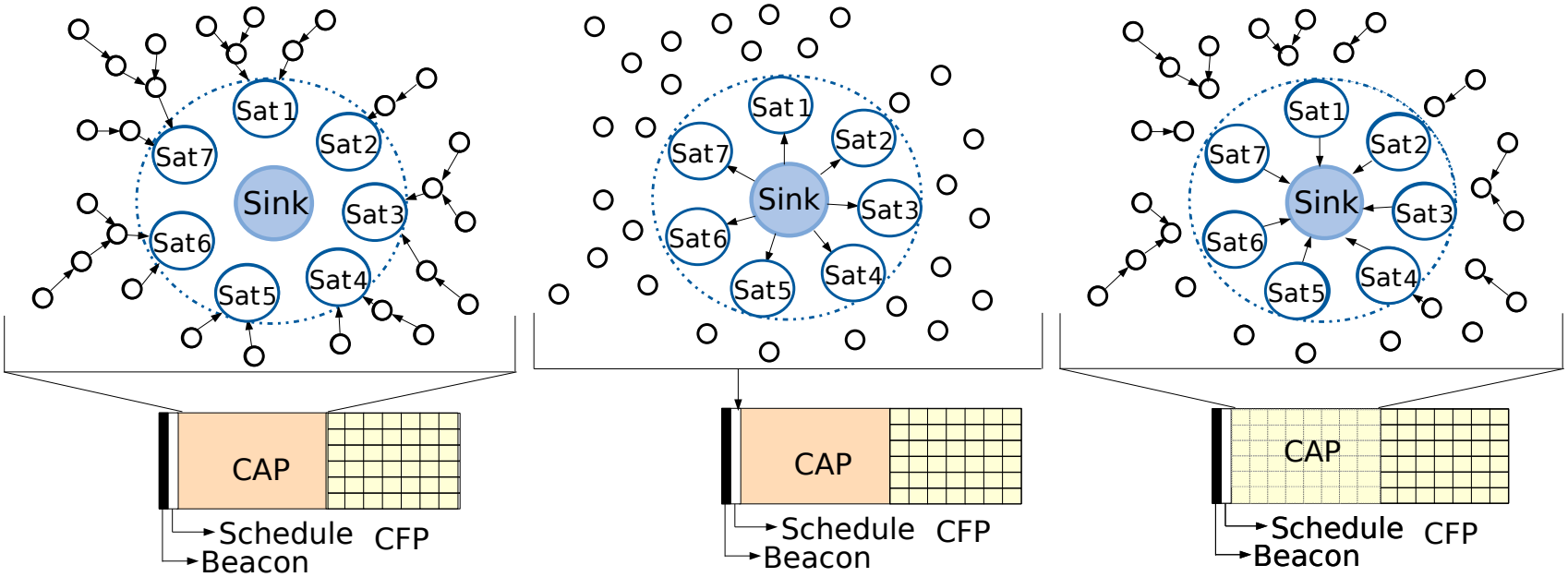
- Direct slot allocation mechanism

Virtual Sink Strategy



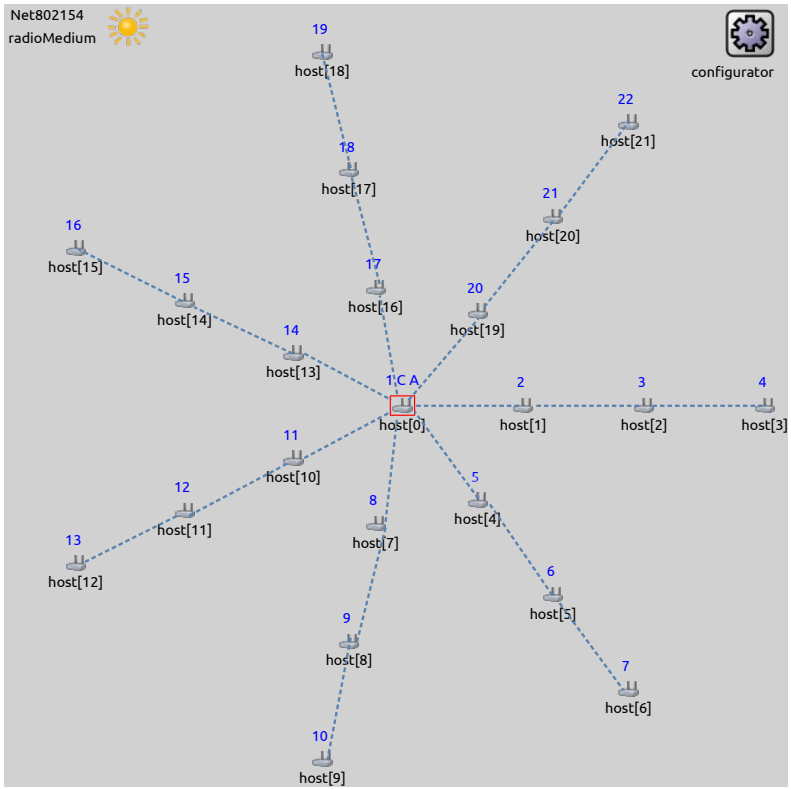
- Direct slot allocation mechanism
- Centralized scheduling performed by sink node

Virtual Sink Strategy



- Direct slot allocation mechanism
- Centralized scheduling performed by sink node
- Dynamic bandwidth expansion

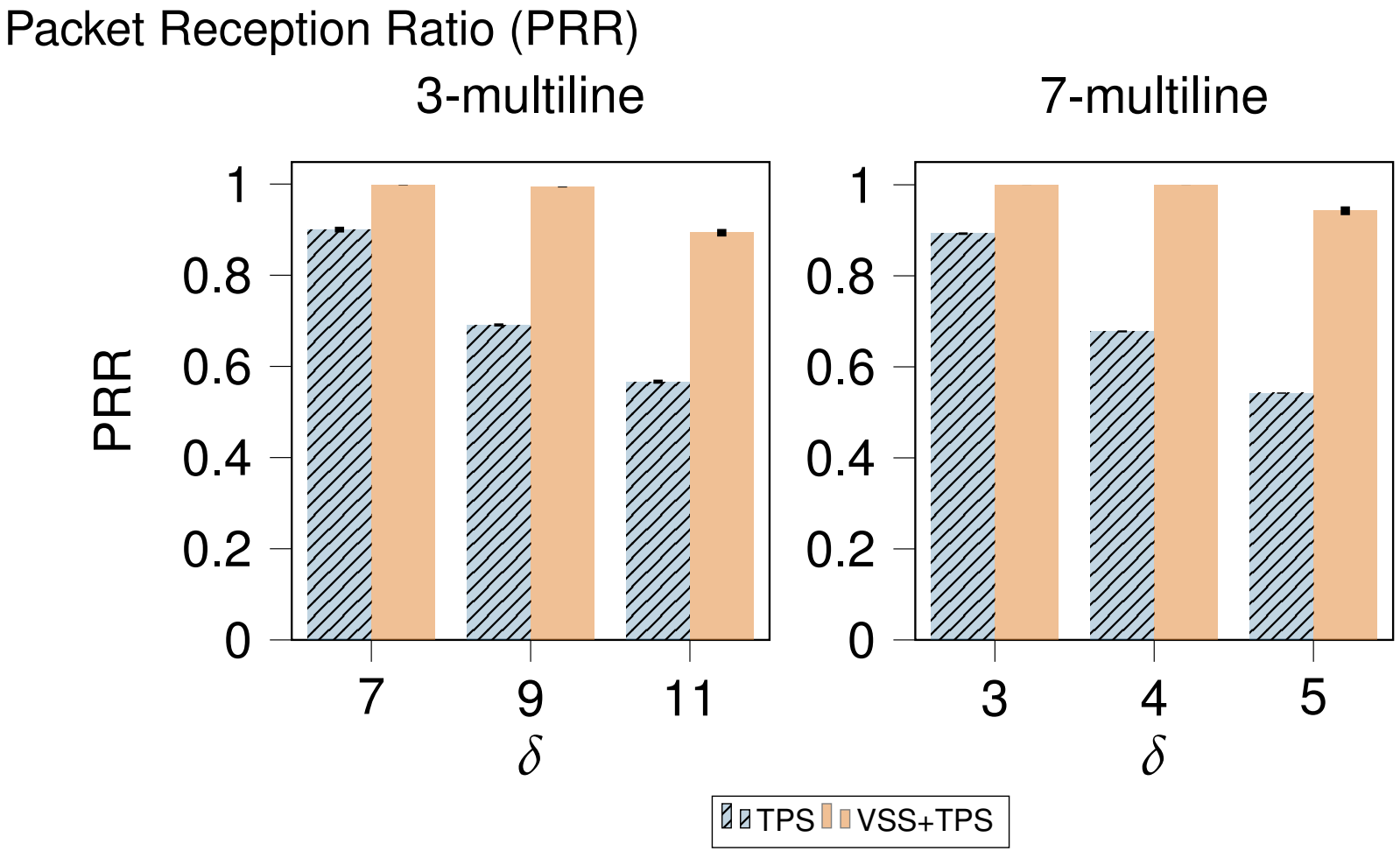
Simulative evaluation



- Data collection - convergecast pattern
- Rooted 3 and 7-multiline (10 and 22 nodes)
- Packet generation rate $\Rightarrow$ δ [packets/s]
- Packet generation $\Rightarrow$ Poisson distribution with mean$= \lambda$
  - Varying δ

Parameter	*SO*	*MO*	*BO*	Q_{GTS}	δ
Values	3	6	12	92	{3,4,5} for 3-multiline
	3	6	12	92	{7,9,11} for 7-multiline

Simulative evaluation



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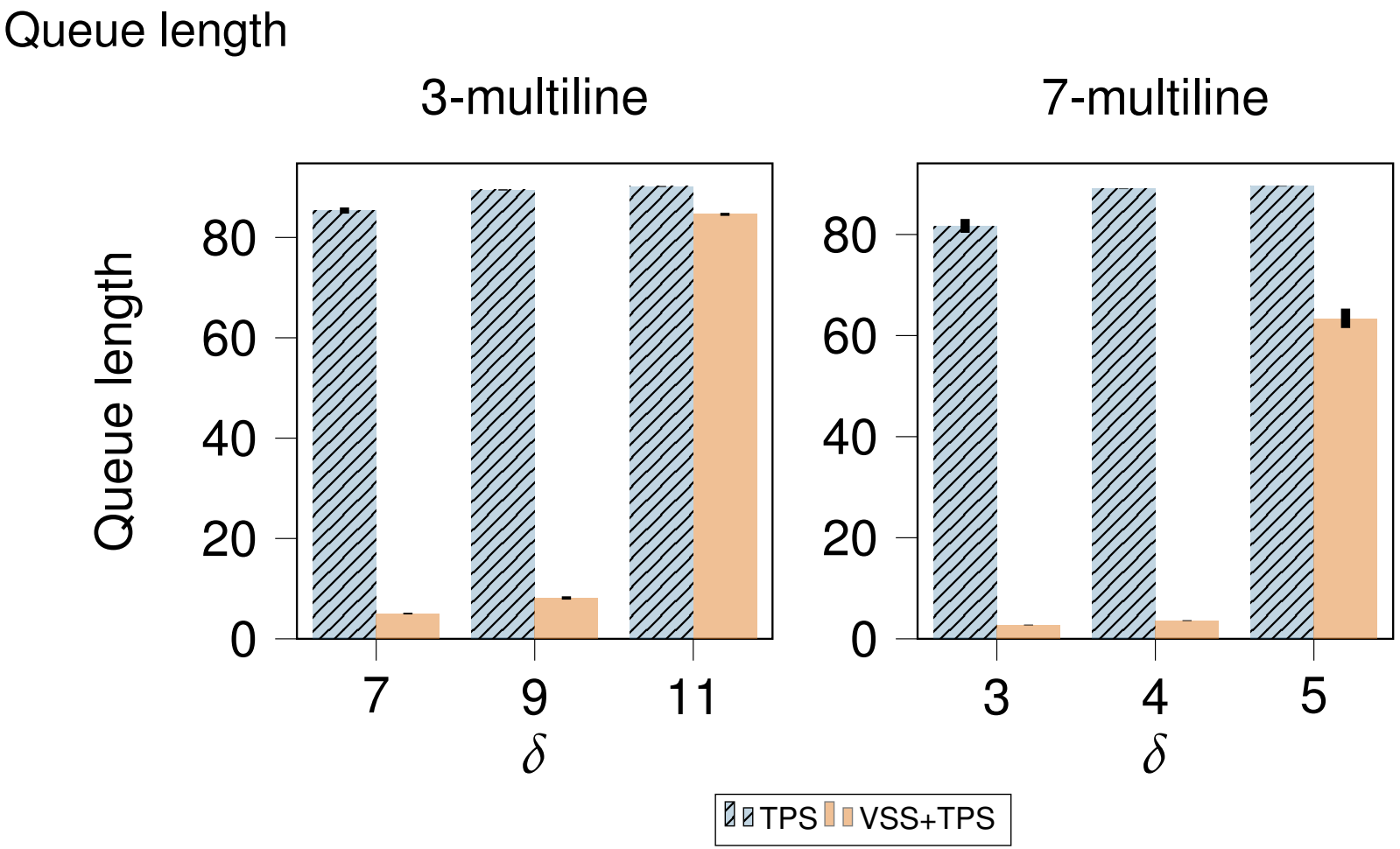

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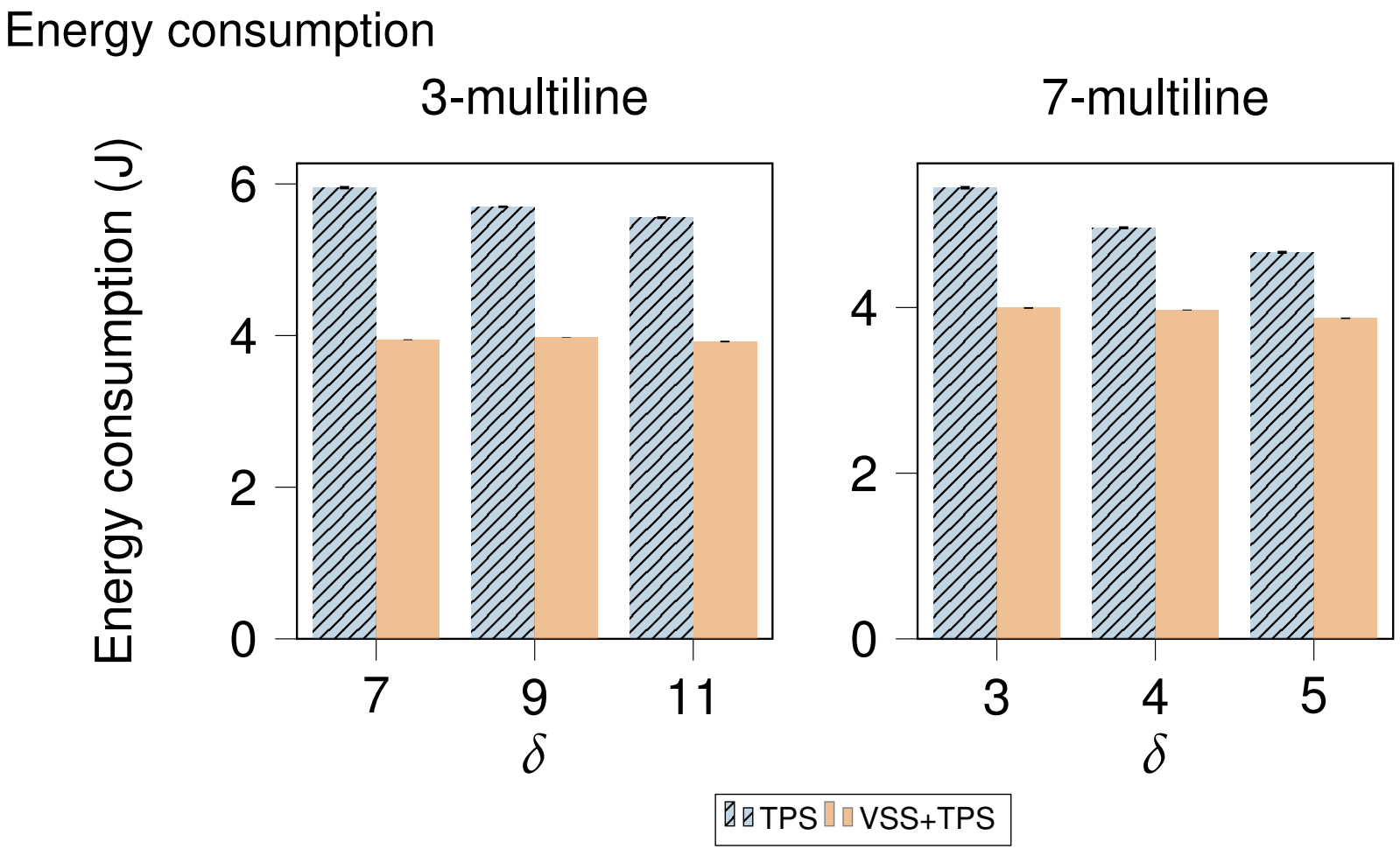

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by increasing sink's capabilities $\Rightarrow$ **Virtual Sink concept**

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Advantages

- Computational load lies at the sink
- Remaining network nodes operate according to the standard
- Throughput is improved up to 38%, as well as a reduction of delay and overall energy consumption

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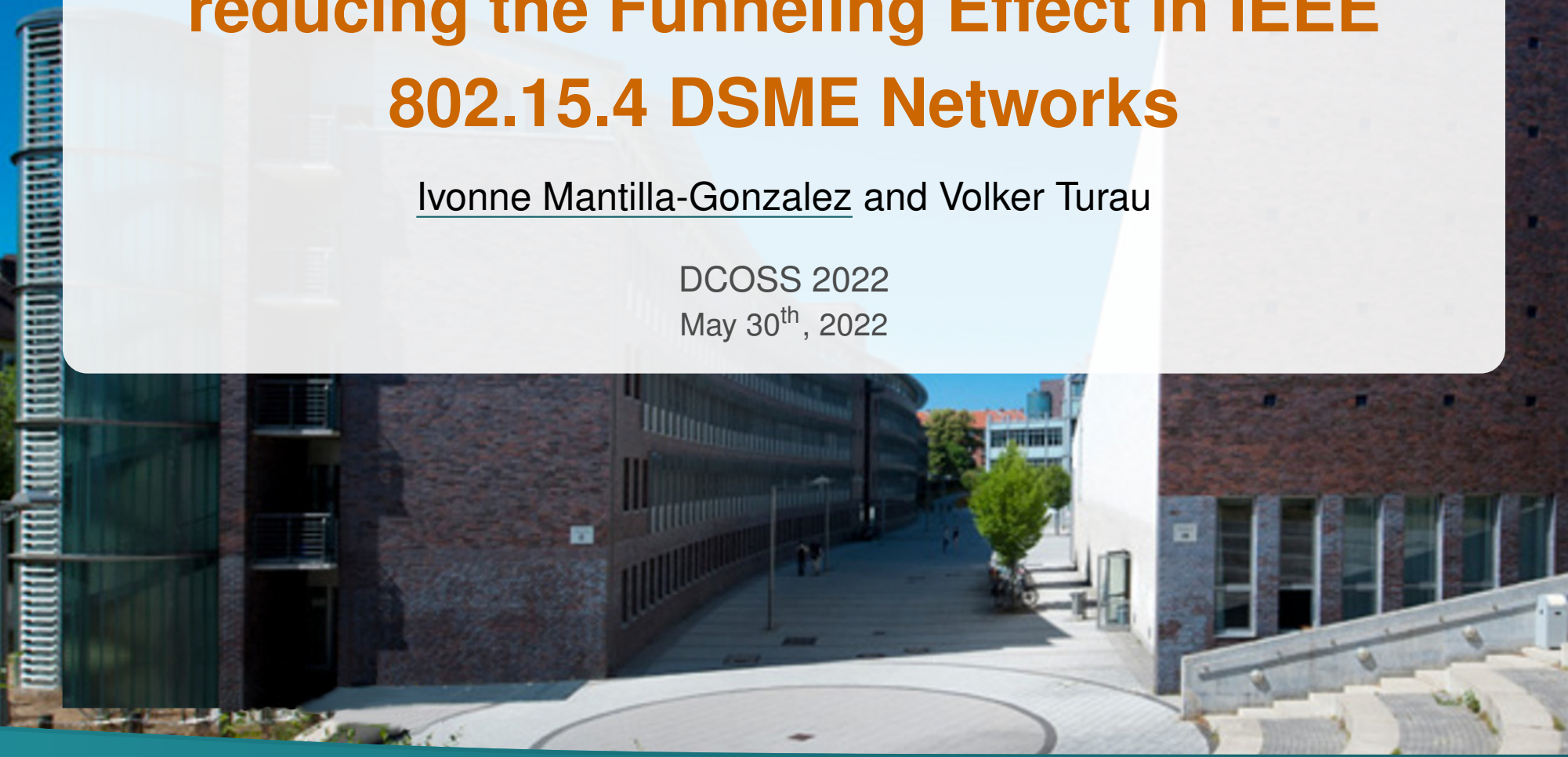

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