

# Resource Reservation in Information Centric Networking

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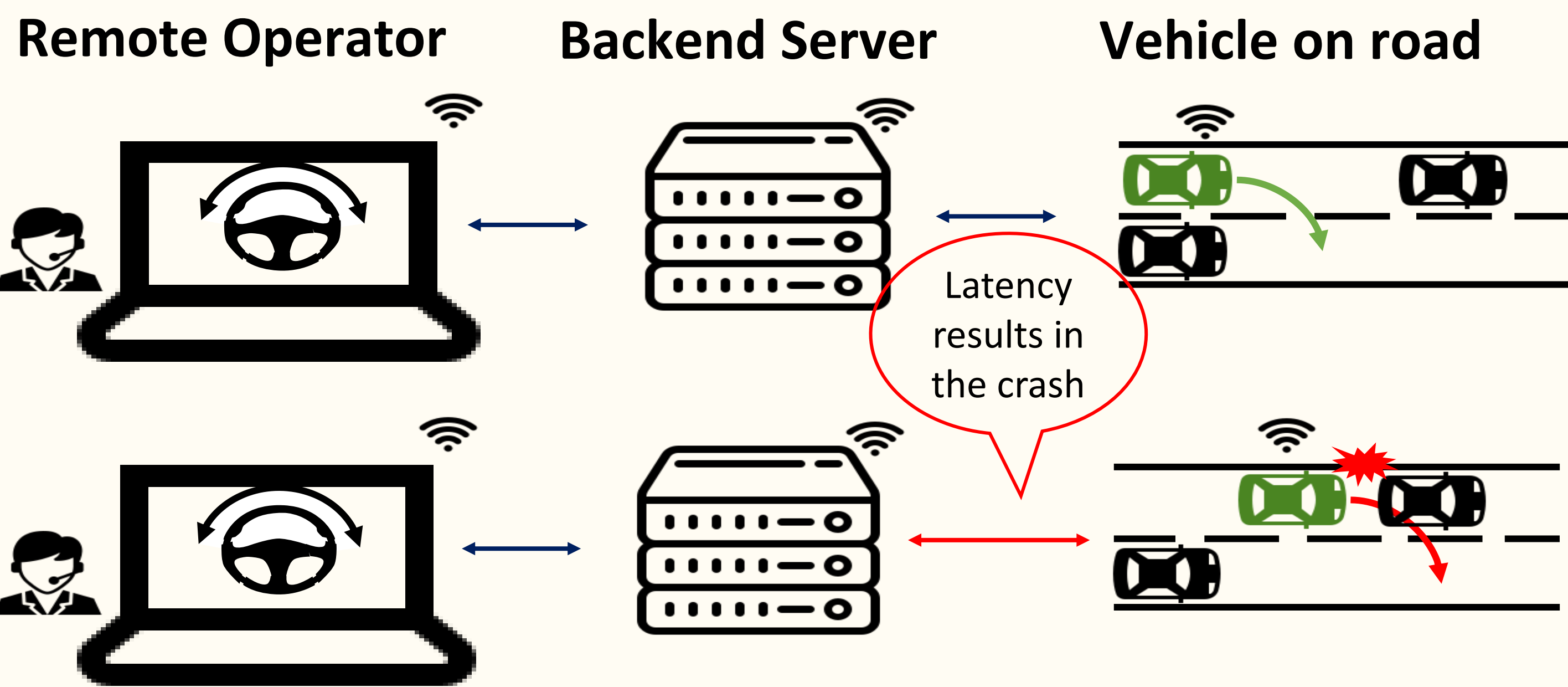
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## Introduction

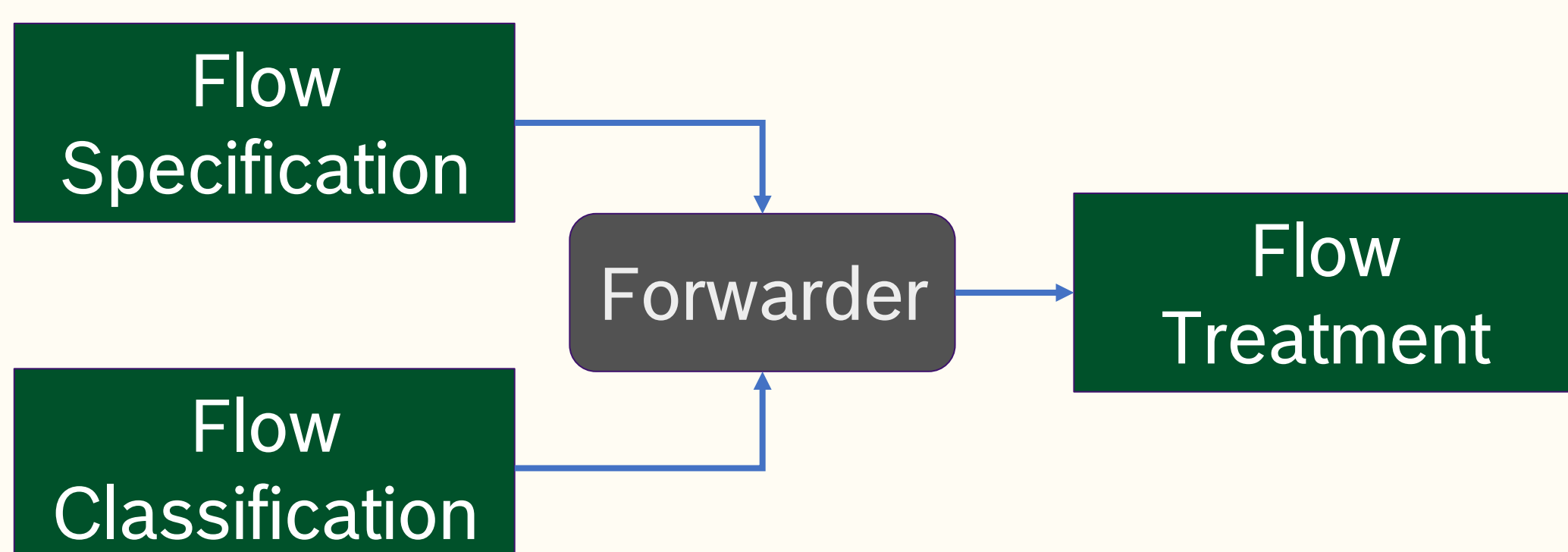
- Several safety critical demand guaranteed network resource provisioning with extremely low latencies.
- Video conferencing applications demand dedicated bandwidth.
- **Quality of Service (QoS)** is “managed unfairness”.



- QoS, is still left unresolved in ICN architectures.
- NDN offers predominantly **best effort service**.
- A need for “**better than best effort**” service provisioning.
- **Resource reservation** helps achieve performance guarantees in real time applications.
- NDN has similarities with the IP-based **Resource reSerVation Protocol (RSVP)**

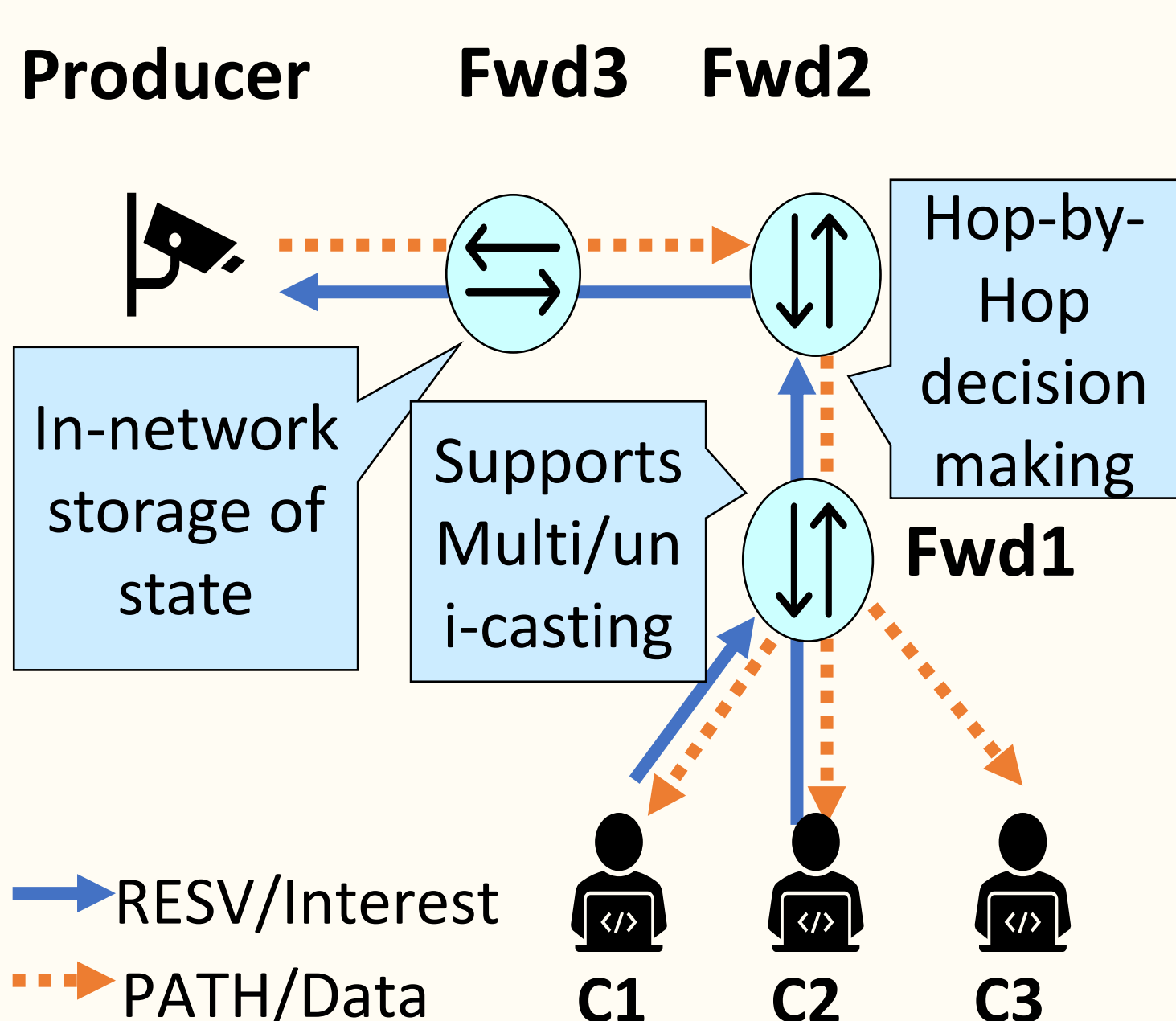
## Quality of Service for NDN

- The QoS mechanisms comprise three main functions
- **Flow identification/classification** – traffic distinction
  - **Flow specification** - the QoS requirements to be met
  - **Flow treatment** - how the flow is handled



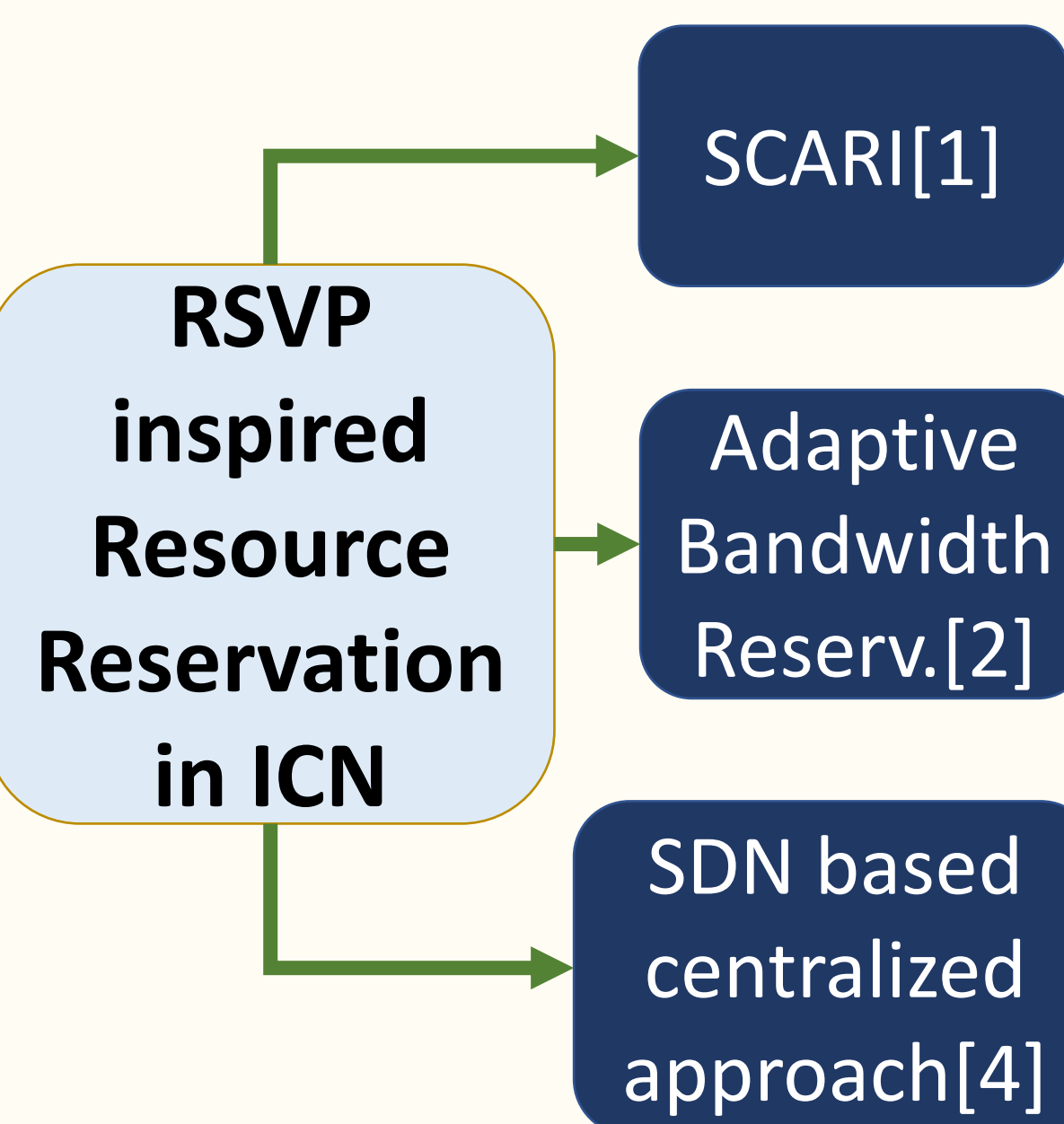
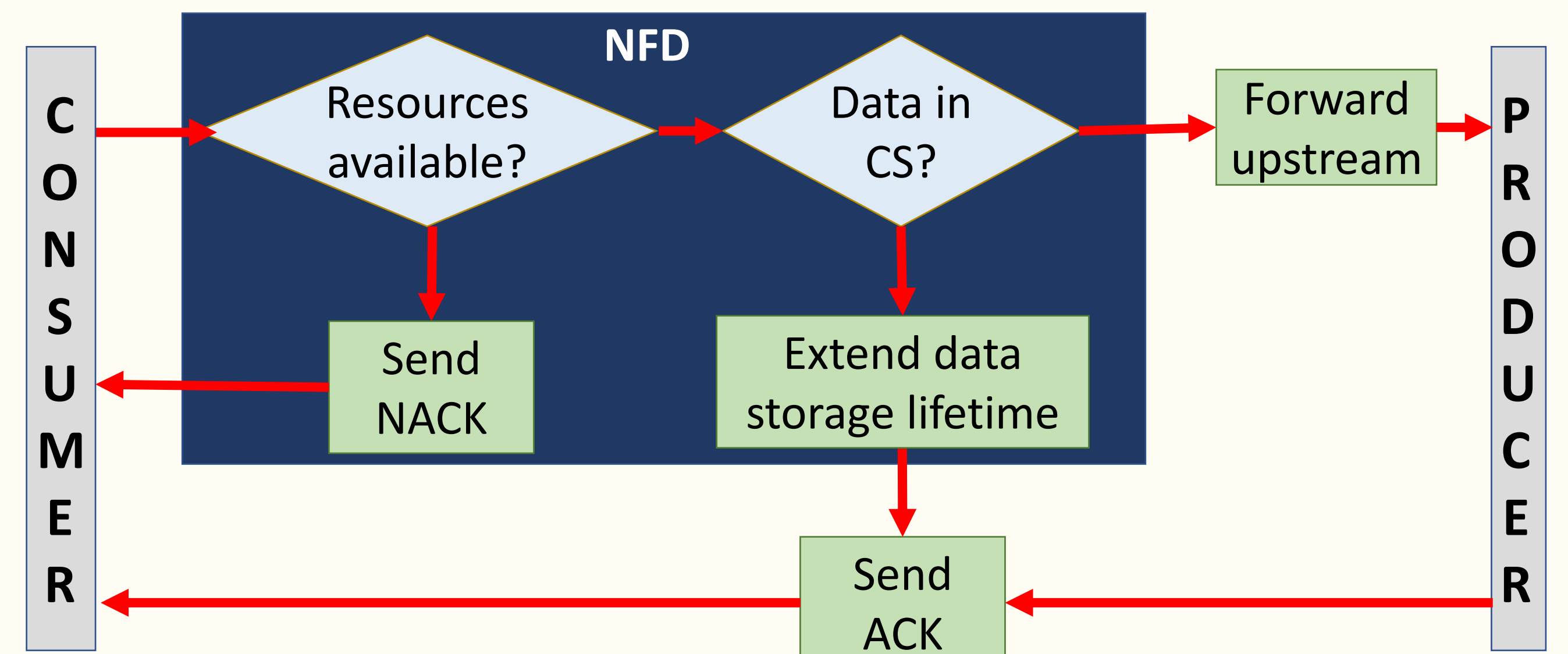
Flow Classification	Flow Specification	Flow Treatment
EC3 ECNCT	Name based specification. e.g., “Bandwidth-hungry”, “Delay Sensitive”, “reliable”, “prompt”, etc.	Content Store [1][2] Pending Interest Table Forwarding Information Base

## NDN and RSVP - Similarities



- Receiver driven.
- Storage of soft state.
- Aggregation of queries.
- Unicasting/multicasting.
- Hop-by-hop decision making
- NACK response
- Lifetime of resource reservation is analogous to the interest lifetime in ICN.

## RSVP-like Reservation in NDN – Related work and Open Challenges



- Scalability.
- Distinguished flow treatments.
- End-to-end resource reservation.
- Admission control
- Mitigation of wasteful resource reservation.
- Using resource reservation to attack the network.

## Resource Reservation in NDN – Potential Directions

- Need for **coarse grained treatment**
- **Traffic classes from 5G network slicing**

**High Bandwidth**  
e.g. internet streaming

**Traffic Aggregation Types**

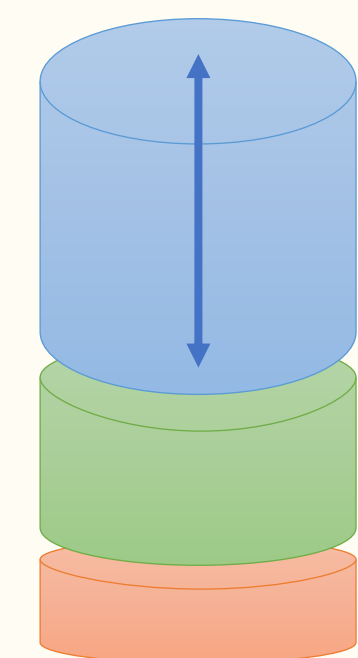
**High Connection Density**  
e.g. smart factory

**Low Latency**  
e.g. tele-operated driving

### In Band Reservation

- Assumptions on the data characteristics and take advance actions.
- Fixed path routing is avoided.

### Content Store



**High Bandwidth Content** cached at **reserved storage** only at the edge for short time, increase lifetime of data on demand.  
**Dedicated storage** at all nodes for low latency, ultra reliable content.  
**Dedicated storage** at all nodes for high connection density, can be replaced by low latency reliable content on demand.

### Pending Interest Table

Higher PIT entries, lowest processing priority	Highest processing priority	Processed for link BW reservation
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### References

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2. Tomoharu Endo, Atsuko Yokotani, Satoshi Ohzahata, Ryo Yamamoto, and Toshihiko Kato. 2018. An Adaptive Bandwidth Reservation Method for a Content-Centric Network. In 2018 IEEE 42nd Annual Computer Software and Applications Conference (COMPSAC).
3. L. Zhang, S. Deering, D. Estrin, S. Shenker, and D. Zappala. 1993. RSVP: a new resource ReSerVation Protocol. IEEE Network (1993)
4. Tian Pan, Cheng Xu, Jianhui Lv, Qianqian Shi, Qing Li, Chenhao Jia, Tao Huang, and Xingchen Lin. 2019. LD-ICN: Towards Latency Deterministic Information-Centric Networking. In 2019 IEEE 21st International Conference on High Performance Computing and Communications; IEEE 17th International Conference on Smart City; IEEE 5th International Conference on Data Science and Systems (HPC-C/SmartCity/DSS). 973–980.