Scalable Event Notification for MENTER

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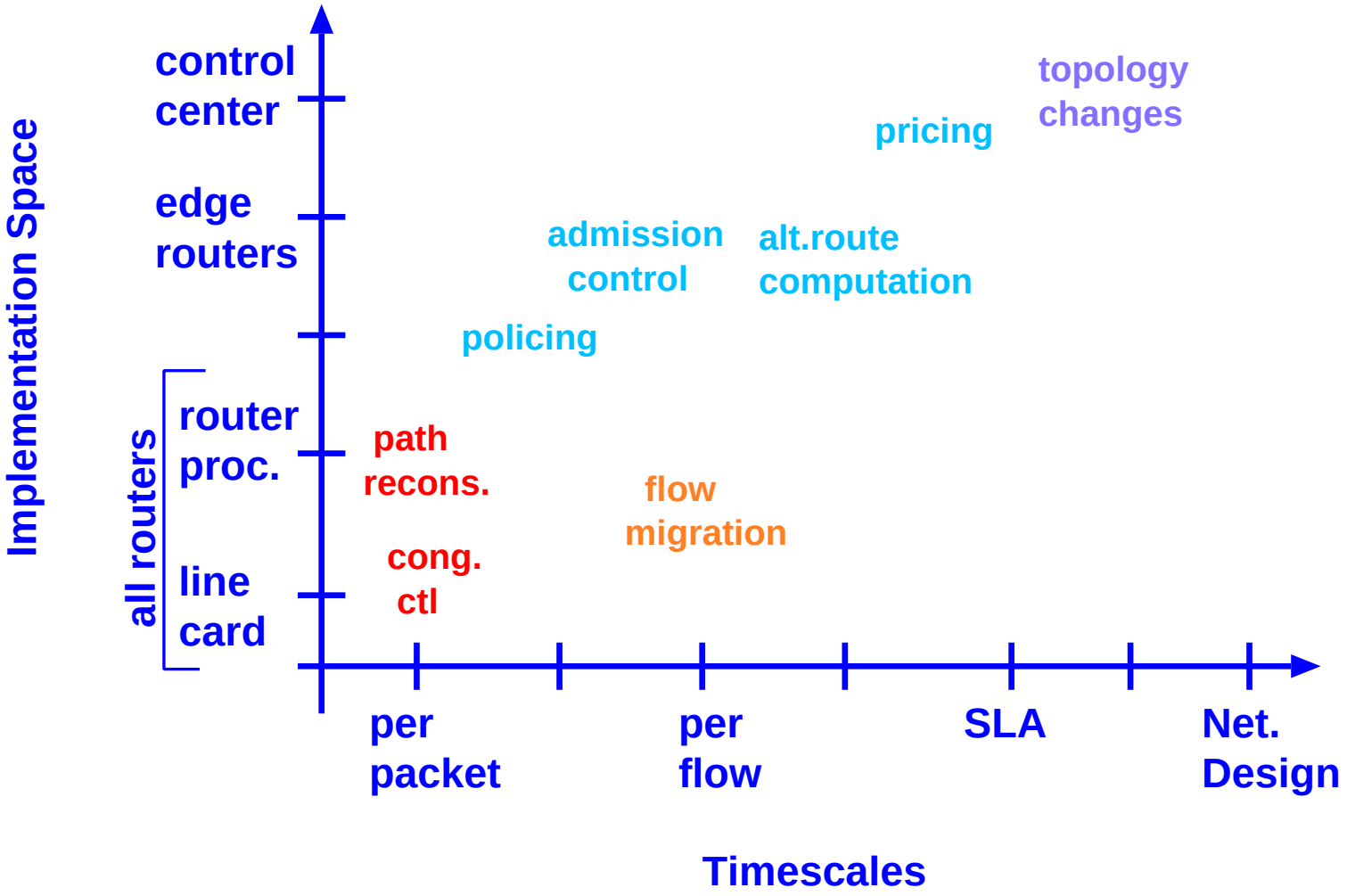
Motivation

- MENTER goals:
  - Integrate traffic engineering and network management
  - Monitor and modify network-level properties at fine timescales
- MENTER deviates from existing approaches by reducing the feedback loop between monitoring and control
- However, need new feedback and control mechanisms
- Active events — Scalable, flexible messaging layer for MENTER

When is a scalable event notification system useful?



Why can’t we do this using existing protocols?

- Consider existing event notification protocols, e.g. SNMP
- Traps do exist for catastropic events
- However, the polling architecture does not scale for fine grained events
- Difficult (impossible?) to properly configure intrastructure if specific event is not in a MIB
- Pins solutions to the centralized part of the soln. space

What can we do better?

- Define arbitrary, dynamically extensible atomic events, potentially on a per-flow/per-application basis

  I-frame dropped event

- Combine events using customizable aggregation functions, and across nodes

  x GOPs in a row not decodeable

- Custom event triggers based upon the evolution of variables

  Latency for a premium flow monotonically increasing

- Subscription-based synthesis and forwarding of events to network-edge and centralized controller

  Fetch the highest jitter on a large multicast group

Event Specification

- Need a simple, extensible format to specify and execute queries
- Use tuples of the form:

$$\langle when : what : where \rangle$$

- $when \in \{\text{periodic},\ \text{based upon node state}\}$
- $where \in$
  $\{\text{to named node},\ \text{to neighbors},\ \text{up} - \text{down LSP}\}$
- *How to specify and query node state?*

A little-language for node-state specification

- Need a system that is light-weight and relatively expressive

  Do not need full Turing-complete language

  The data-path must be preserved

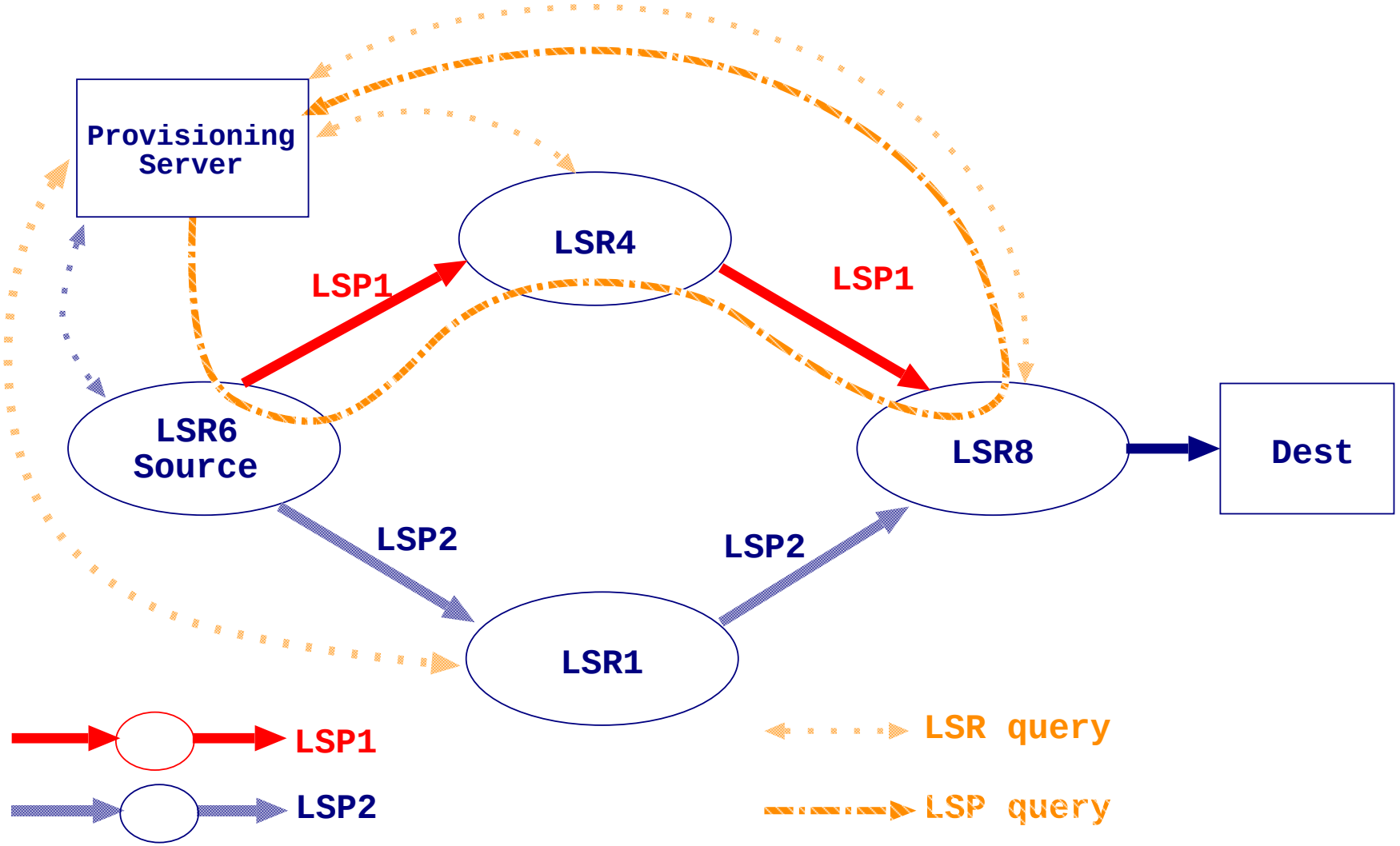
- Current effort: extend work done at BBN in the **SmartPackets** project

A quick overview of SmartPackets

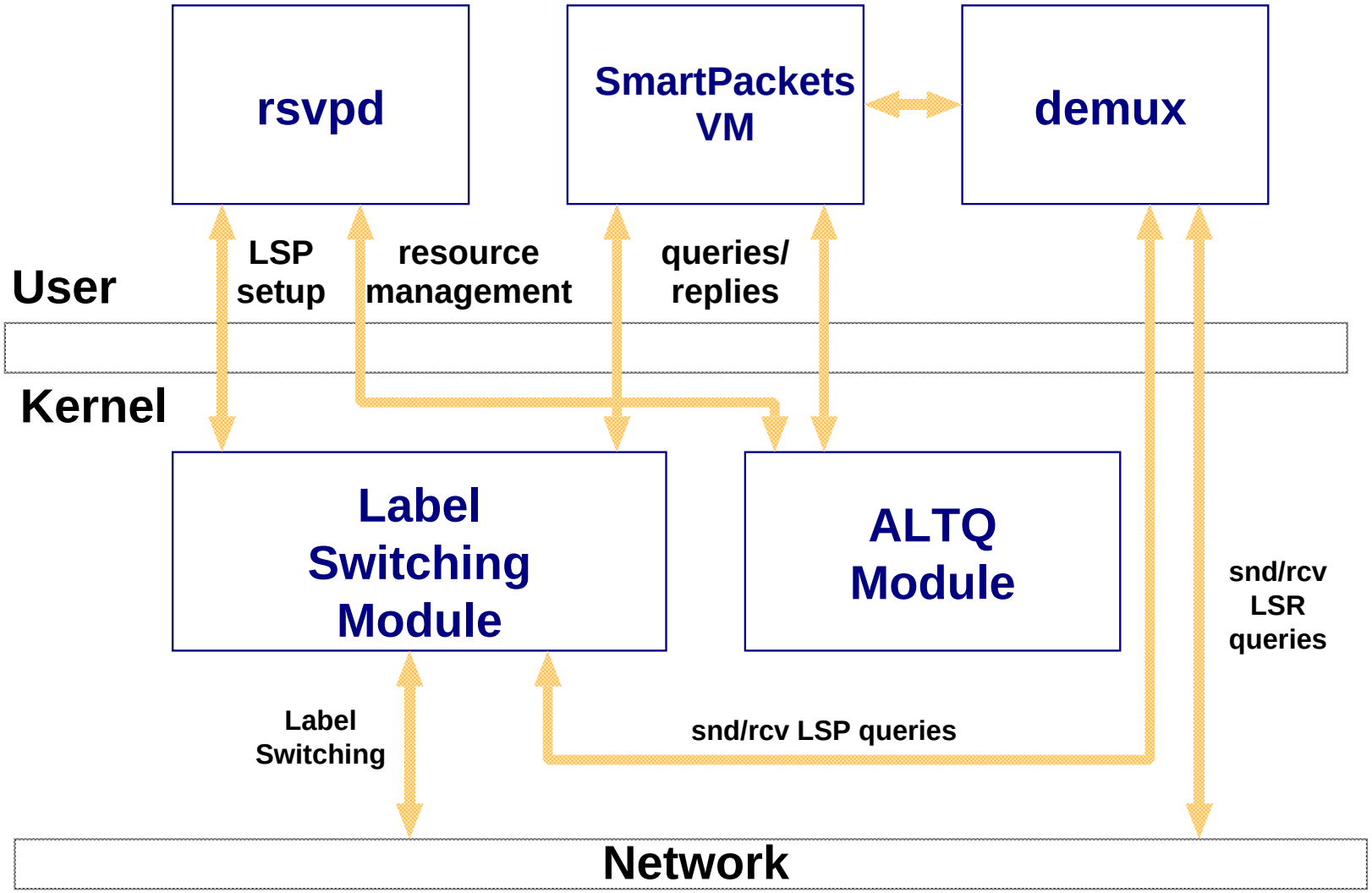
. . . and how it fits into MENTER

- SmartPackets consist of two languages: Sprocket and Spanner.
- Sprocket: C-like high level language (safe)
- Spanner: CISC-assembly for Sprocket
- Spanner is translated into a portable binary format and executed by a safe VM
- Sprocket and Spanner original design goals well aligned with our goals for MENTER

Example Operation



Node-level detail



Current Work

- Integrate and test NIST/SmartPacket and our own software
- Testbed ready for defining customizable events

  Several LSP-specific events have been defined and tested

- Leverage prior work for event transport

Research Challenges

- Define useful atomic and aggregate events in conjunction with simulation work
- Analyze safety and stability properties for in-network distributed control