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Work-in-Progress: Towards Real-time Smart City Communications using Software Defined Wireless Mesh Networking

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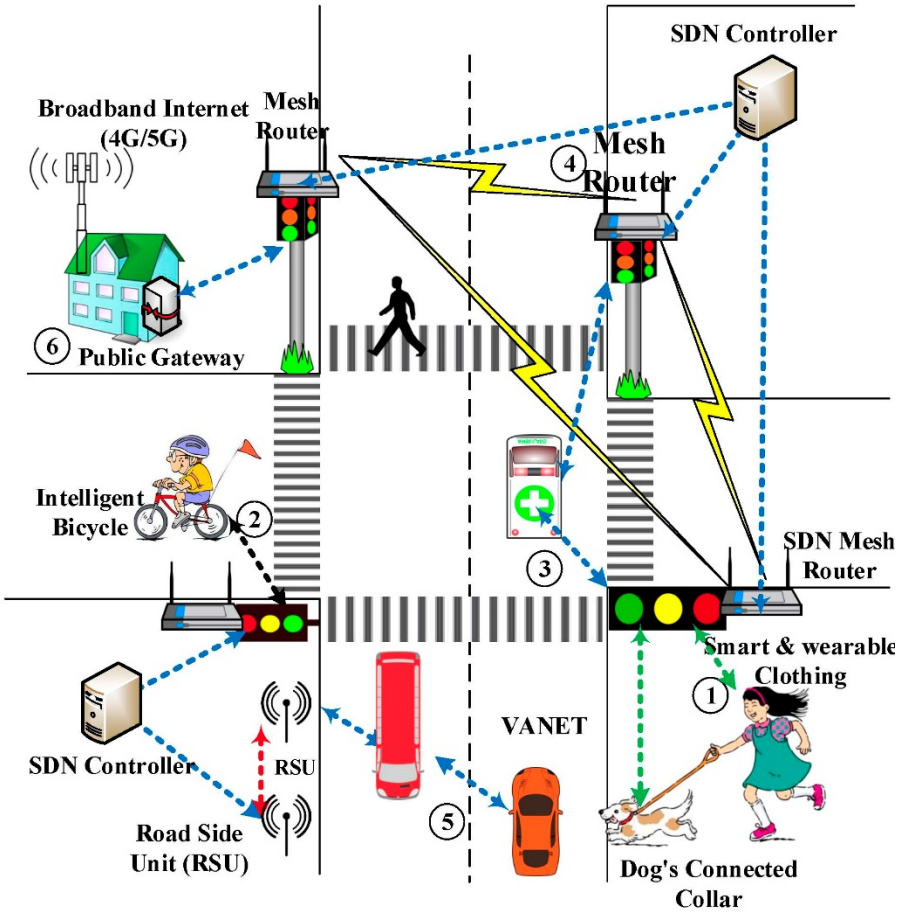
Motivation: Smart City CPS Networks



- Controlling and scheduling networking resources effectively is as important as managing CPU resources to realize cyber physical systems, e.g., smart cities
- Wireless mesh networks (WMNs) are a backbone of smart cities
- Enforcing distributed, consistent and global control is hard since individual routers have only local knowledge

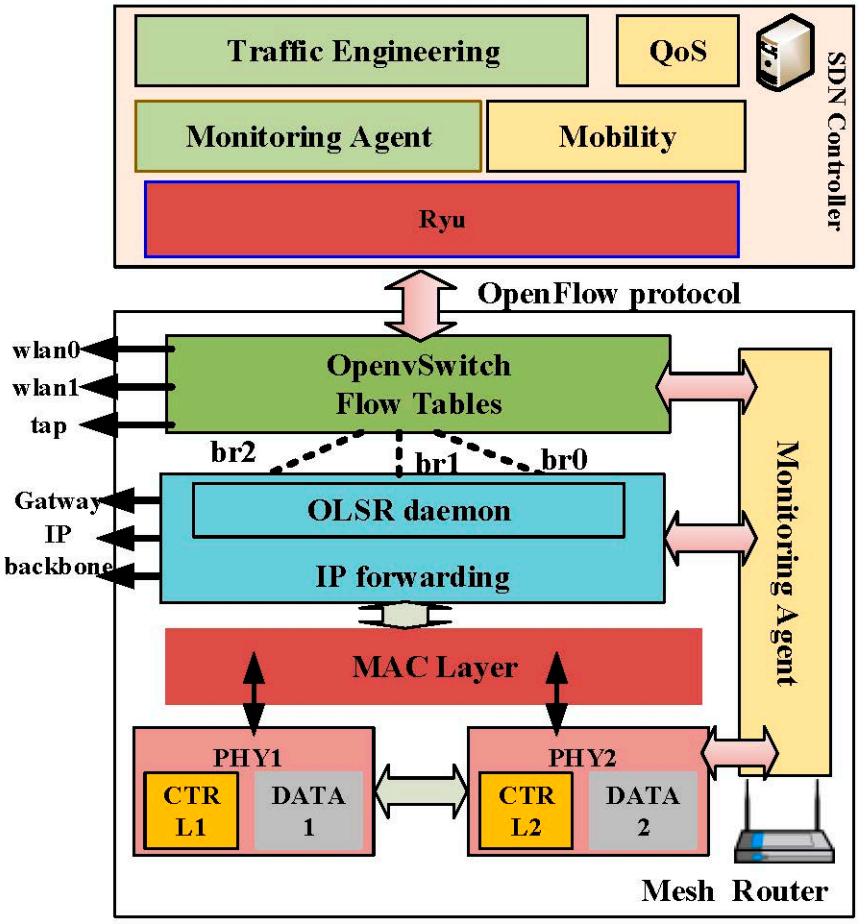
Proposed solution: Adopt a Software-defined Networking (SDN) approach for smart city WMNs

What is SDN?

- SDN brings software engineering principles of separation of concerns to networking
- Specifically, the control plane is separated from the data/forwarding plane
  - All the intelligence resides in the logically centralized control plane
    - e.g., routing protocol, firewall policies, etc
  - Control plane pushes results, such as created forwarding tables, to switches that reside in the data plane
  - Data plane comprises commodity hardware that enforces the decisions made by the control plane, e.g., forwarding of packets on outgoing links
- Simplifies network management, enables ease of evolution, etc.
- Applied primarily in wired networks (e.g., cloud data centers)

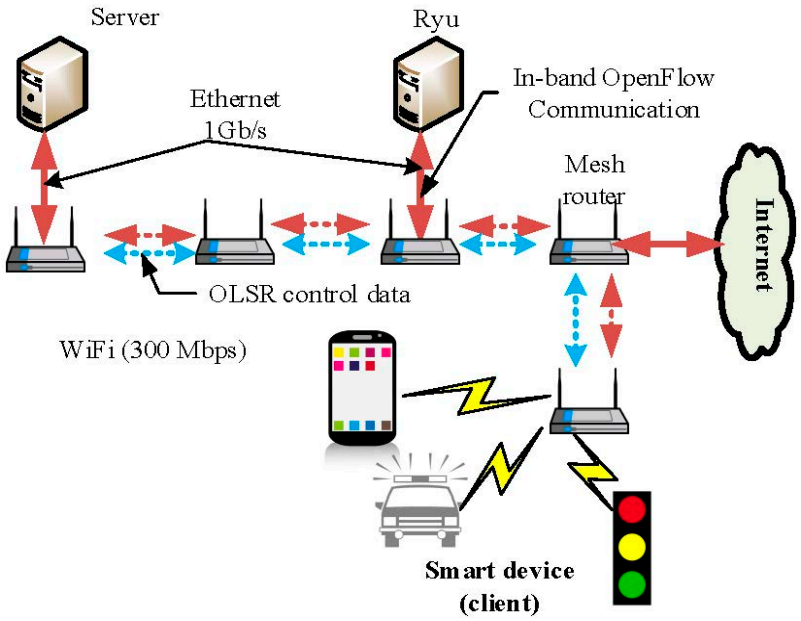
Many open research challenges for SDN in smart City WMNs, e.g., scaling, accounting for routing algos, switch design, etc

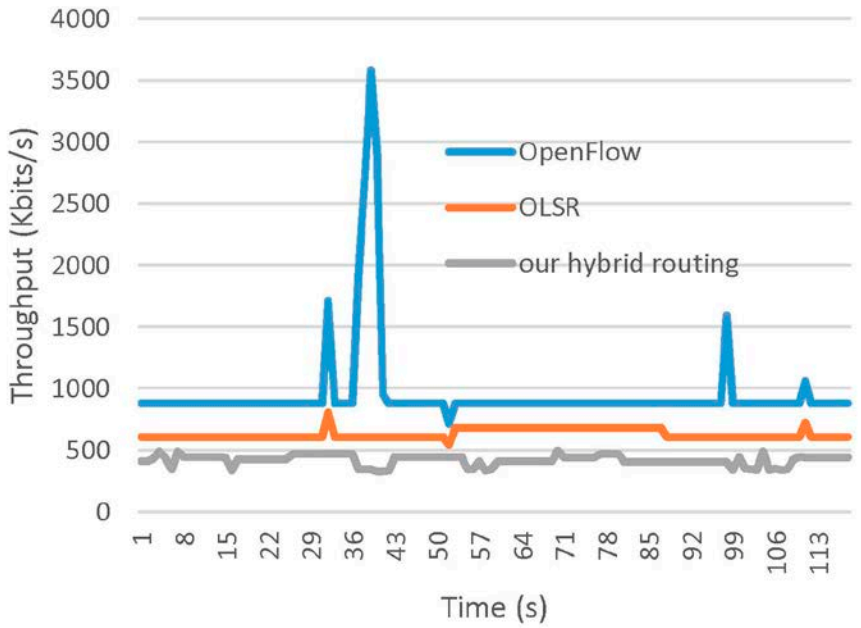
Architecture for SDN-enabled Smart City WMNs



- Logically centralized control plane
- Hybrid routing scheme
  - Controller-driven routing used for best path selection and configuring mesh routers
  - Data plane can use traditional algorithms like OLSR
- Initial effort realized using Ryu controller and OpenVSwitch soft router

Current Status & Concluding Remarks





- SDN shows promise in controlling wireless mesh networks for smart cities
- Evaluations carried out using Mininet (for SDN) + NS3 (for wireless and routing protocols)
- Ongoing work
  - Building prototype routers using Raspberry Pi with OpenWRT
  - Utilizing and integrating with time sensitive networking
  - Setting up laboratory-sized testbed