Computer Networks

BCST -502 BCSP- 502

B.Tech (CSE) 5th Semester

Course Instructor: Dr Bishwajeet Pandey

New 2020 Syllabus

Unit –I

Computer Network: Definitions, goals, components, Architecture, Classifications & Types.Layered Architecture: Protocol hierarchy, Design Issues, Interfaces and Services, ConnectionOriented & Connectionless Services, Service primitives, Design issues & its functionality. ISOOSI Reference Model: Principle, Model, Descriptions of various layers and its comparison with TCP/IP. Principals of physical layer: Media, Bandwidth, Data rate and Modulations

Unit-II

Data Link Layer: Need, Services Provided, Framing, Flow Control, Error control. Data Link Layer Protocol: Elementary &Sliding Window protocol: 1-bit, Go-Back-N, Selective Repeat, Hybrid ARQ. Protocol verification: Finite State Machine Models & Petri net models. ARP/RARP/GARP

Unit-III

MAC Sub layer: MAC Addressing, Binary Exponential Back-off (BEB) Algorithm, Distributed Random Access Schemes/Contention Schemes: for Data Services (ALOHA and Slotted- ALOHA), for Local-Area Networks (CSMA, CSMA/CD, CSMA/CA), CollisionFree Protocols: Basic Bit Map, BRAP, Binary Count Down, MLMA Limited Contention Protocols: Adaptive Tree Walk, Performance Measuring Metrics. IEEE Standards 802 series & their variant.

New 2020 Syllabus

Unit-IV

Network Layer: Need, Services Provided, Design issues, Routing algorithms: Least CostRouting algorithm, Dijkstra's algorithm, Bellman-ford algorithm, Hierarchical Routing,Broadcast Routing, Multicast Routing. IP Addresses, Header format, Packet forwarding,Fragmentation and reassembly, ICMP, Comparative study of IPv4 & IPv6

Unit-V

Transport Layer: Design Issues, UDP: Header Format, Per-Segment Checksum, CarryingUnicast/Multicast Real-Time Traffic, TCP: Connection Management, Reliability of DataTransfers, TCP Flow Control, TCP Congestion Control, TCP Header Format, TCP TimerManagement. Application Layer: WWW and HTTP, FTP, SSH, Email (SMTP, MIME, IMAP), DNS, Network Management (SNMP).

About Course Instructor

- PhD from Gran Sasso Science Institute, Italy
- PhD Supervisor Prof Paolo Prinetto from Politecnico Di Torino, World Rank 13 in Electrical Engineering
- MTech from Indian Institute of Information Technology, Gwalior
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- Contact: gyancity@gyancity.com, +91-7428640820 (For help in this Subject @ BIAS and Guidance for future MS from Europe and USA after BIAS)

About Course Outline

- UNIT 1: Lecture No 1-4
- UNIT 2: Lecture No 5-8
- UNIT 3: Lecture No 9-13
- UNIT 4: Lecture No 14-10
- UNIT 5: Lecture No 20-25
- Lecture No 26-35 to Discuss Question Paper of Previous 5 Years
- Out of 35 Lectures: 10 will delivered by Professor From Foreign University

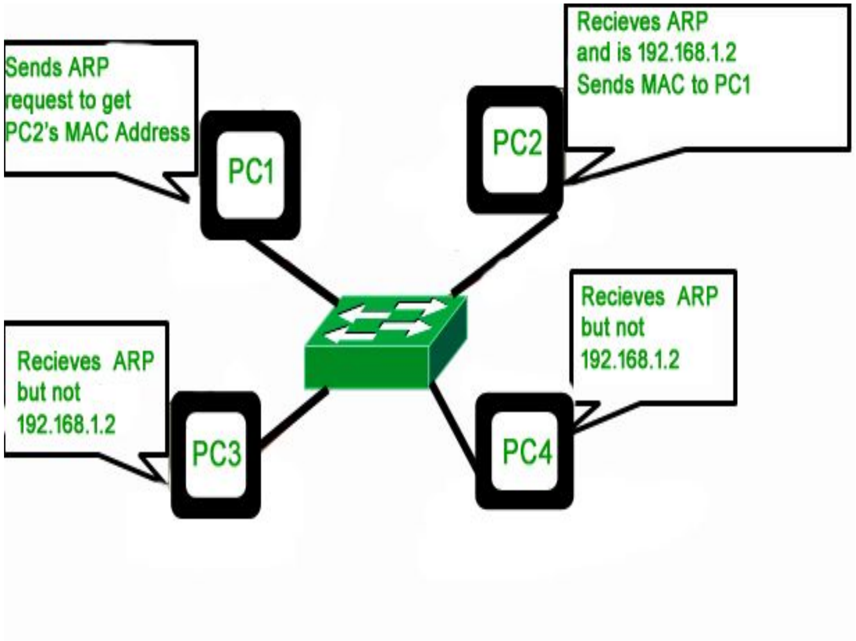
Data Link Layer

OUTLINE OF LECTURE 7

- ARP
- RARP
- GARP
- Protocol verification:
  - Finite State Machine Models
  - Petri net models.

ARP

- ARP is a network layer to data link layer mapping process, which is used to discover MAC address for given Internet Protocol Address.
- ARP-discovery is broadcast, every host inside that network will get this message but the packet will be discarded by everyone except that intended receiver host whose IP is associated.
- Now, this receiver will send a unicast packet with its MAC address (ARP-reply) to the sender of ARP-discovery packet.

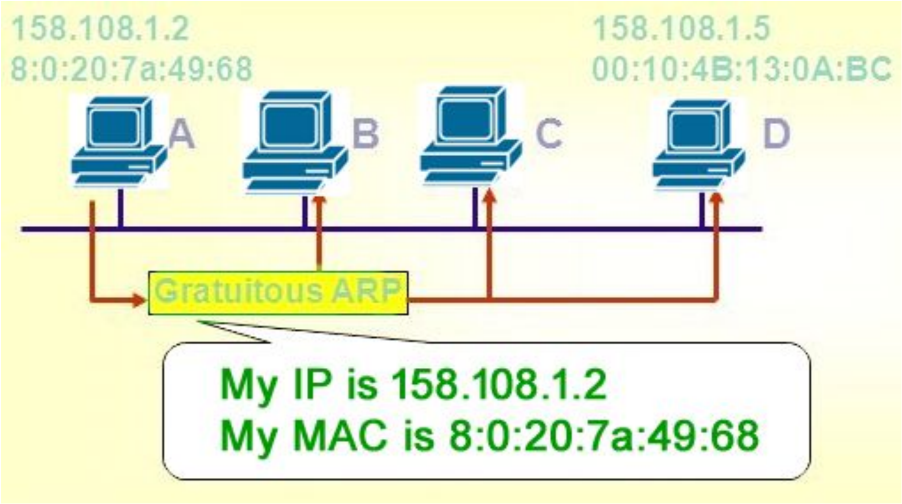


RARP

- Reverse ARP is a networking protocol used by a client machine in a local area network to request its Internet Protocol address (IPv4) from the gateway-router's ARP table.

GARP

- When the computer booted up (Network Interface Card is powered) for the first time, it automatically broadcast its MAC address to the entire network.

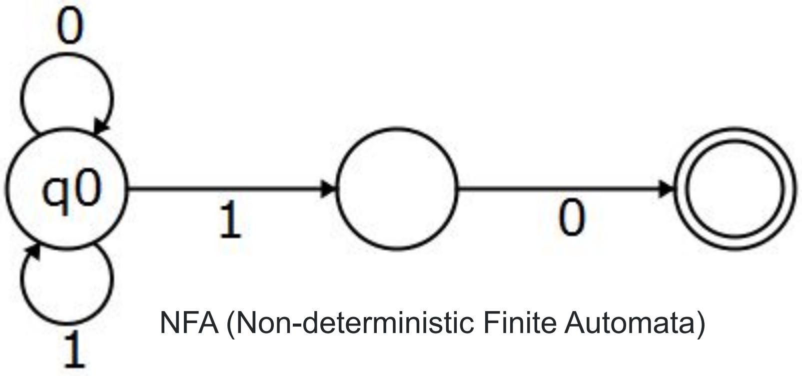


Protocol Verification

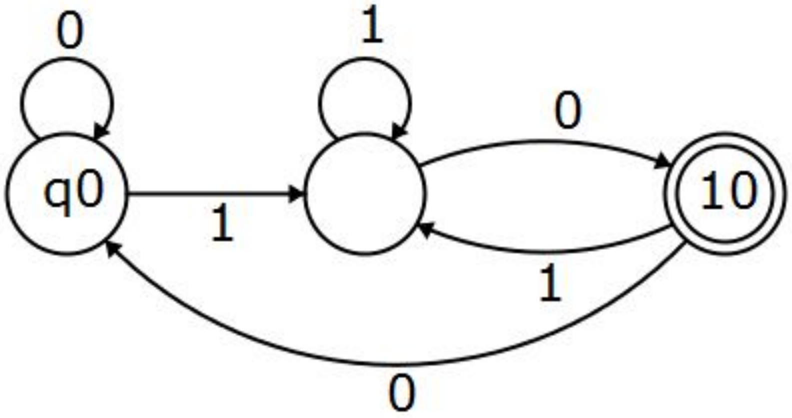
- Finite State Machine Models
- Petri Net Models

Finite State Machine

- Finite state machines mainly consist of a set of transition rules.
- In the traditional FSM, the environment of the machine consists of two finite and disjoint sets of signals, input signals and output signals.
- Also, each signal has an arbitrary range of finite possible values



NFA (Non-deterministic Finite Automata)



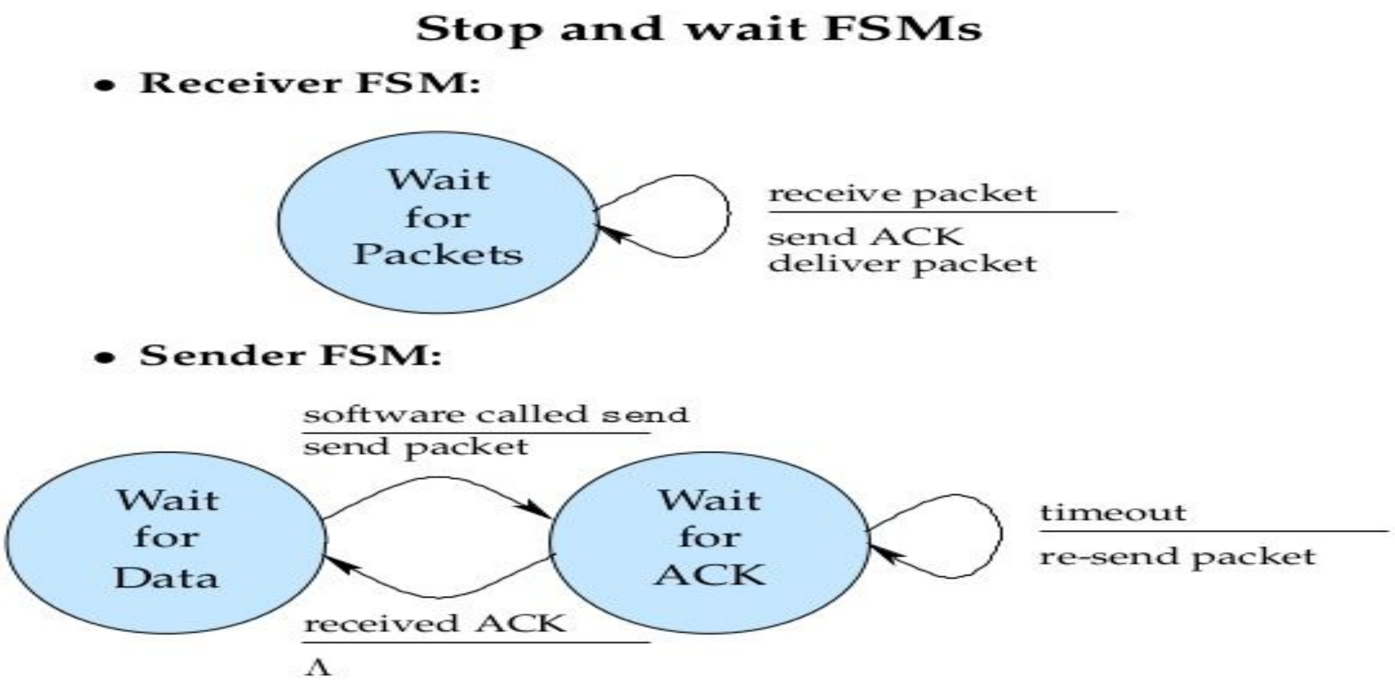
DFA (Deterministic Finite Automata)

Finite State Machine in Computer Network

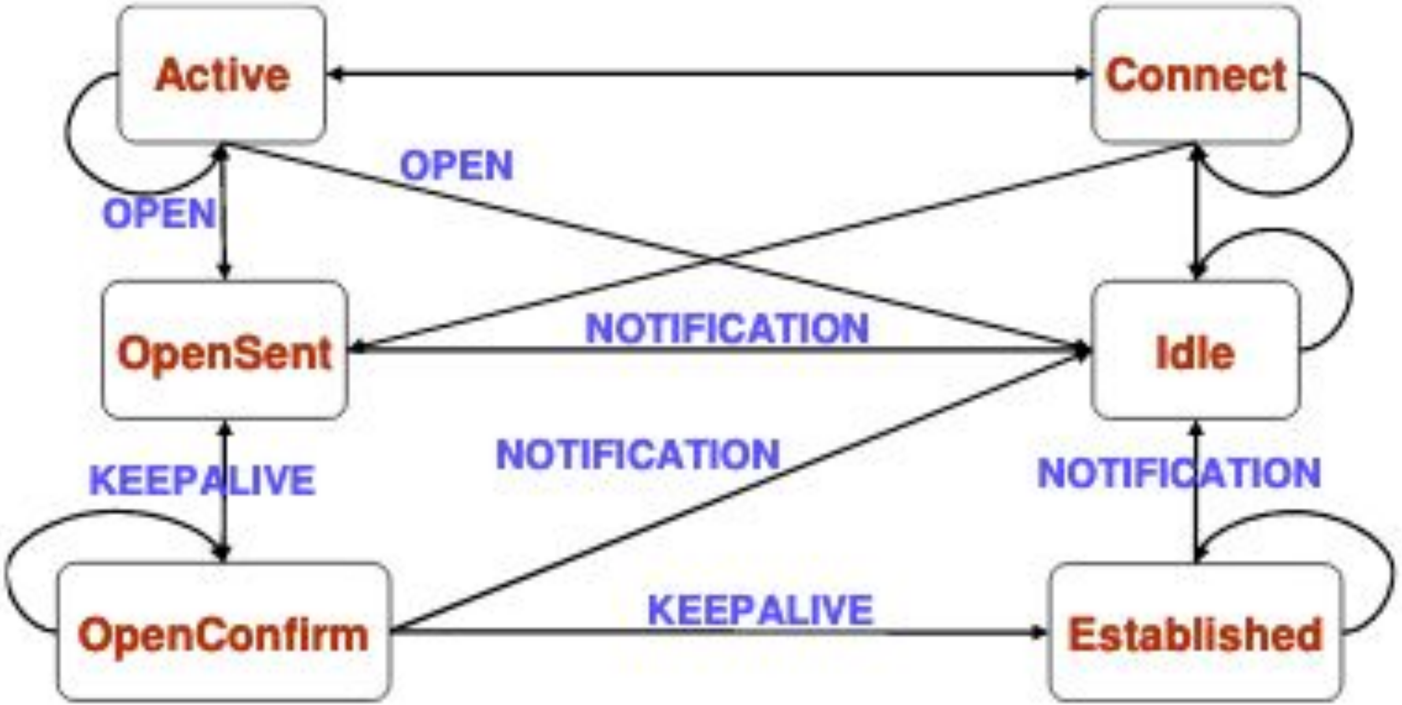
Finite State Machines

- **Represent protocols using state machines**
  - Sender and receiver each have a state machine
  - Start in some initial state
  - Events cause each side to select a state transition
- **Transition specifies action taken**
  - Specified as events/actions
  - E.g., software calls send/put packet on network
  - E.g., packet arrives/send acknowledgment

Finite State Machine in Computer Network



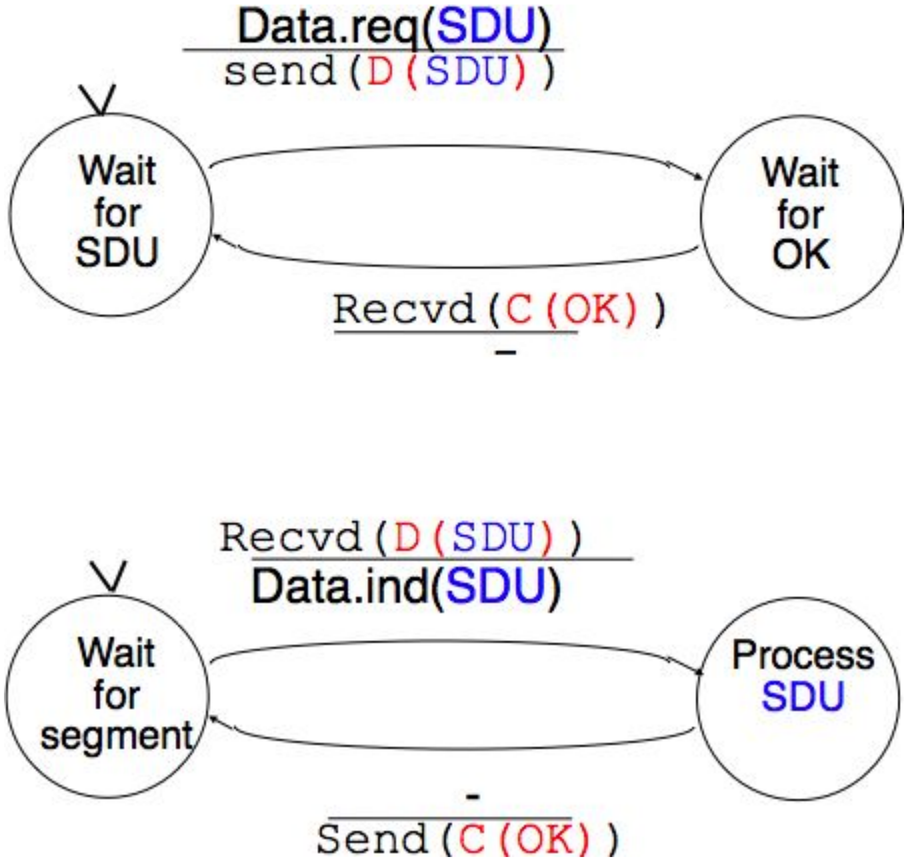
Finite State Machine in Computer Network



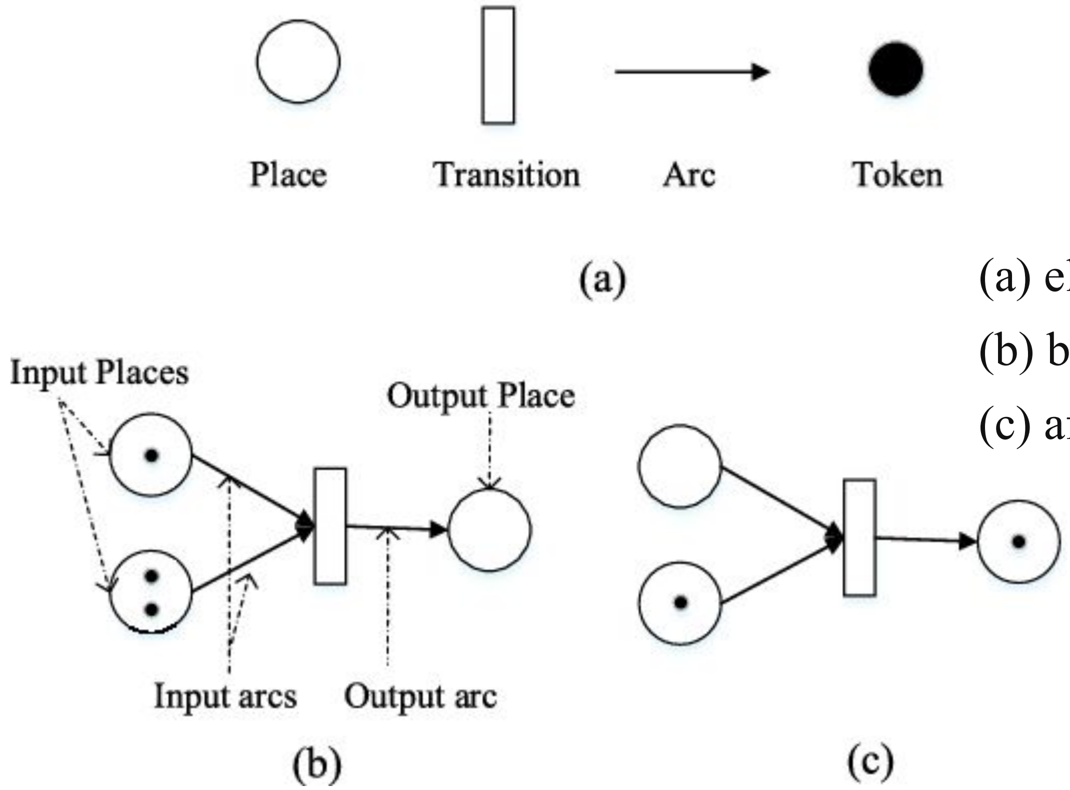
FSM of Border Gateway Protocol: will study BGP in Lecture of Routing

Finite State Machine in Computer Network

- The transport protocol can then be modelled as a finite state machine, containing two states for the receiver and two states for the sender.
- The figure provides a graphical representation of this state machine with the sender above and the receiver below.
- The sender has to wait for an acknowledgement from the receiver before being able to transmit the next SDU.



Petri Net Models



(a) elements of Petri net.

(b) before transition firing.

(c) after transition firing.

Quantitative Formal Methods

Lecture 5: LAB for Stochastic Petri Nets

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Overview of this lecture

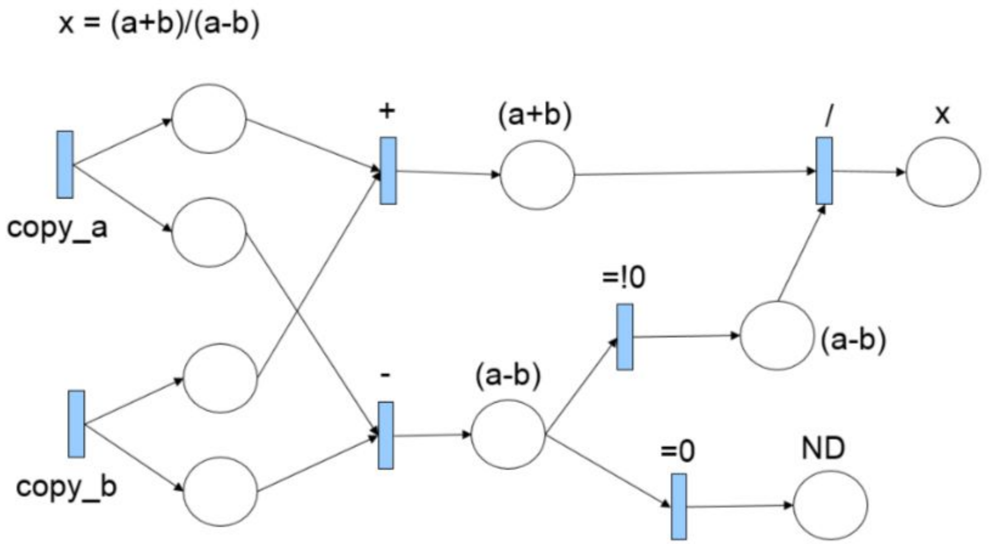
1. Exercises to model a system with SPN
   - A calculator
   - A coffee machine
   - A communication protocol
   - A restaurant
   - An elevator
   - Dining philosophers
2. Literature review for Stochastic Petri Nets
3. A tool to model and analyze Stochastic Petri Nets: PIPE

Exercise: mathematical computation

Build a SPN that models the following calculation: $(a + b)/(a - b)$

- A calculator has two variables: a and b
- It allows to perform some operation on the variables: $+$, $-$, $/$

Exercise: SPN for mathematical computation

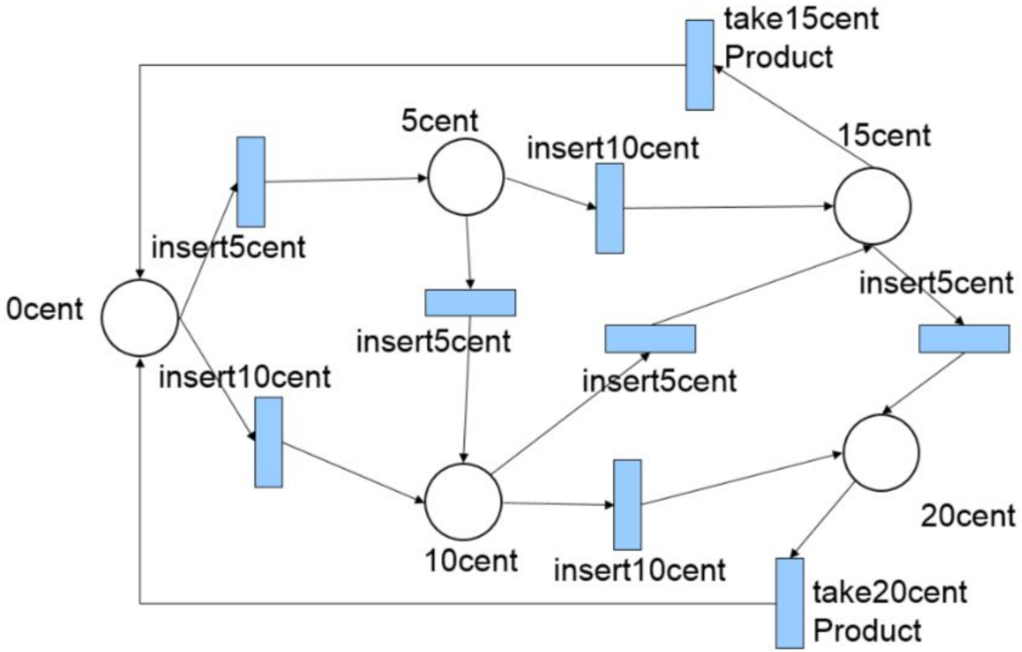


Exercise: coffee machine

Build a SPN that models the coffee machine showing the following rules:

- A coffee machine accepts 5 cents or 10 cents
- The cost of products is 15 cents or 20 cents
- No change

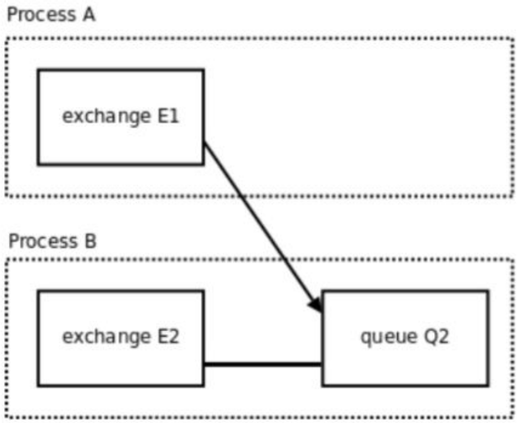
Exercise: SPN for the coffee machine



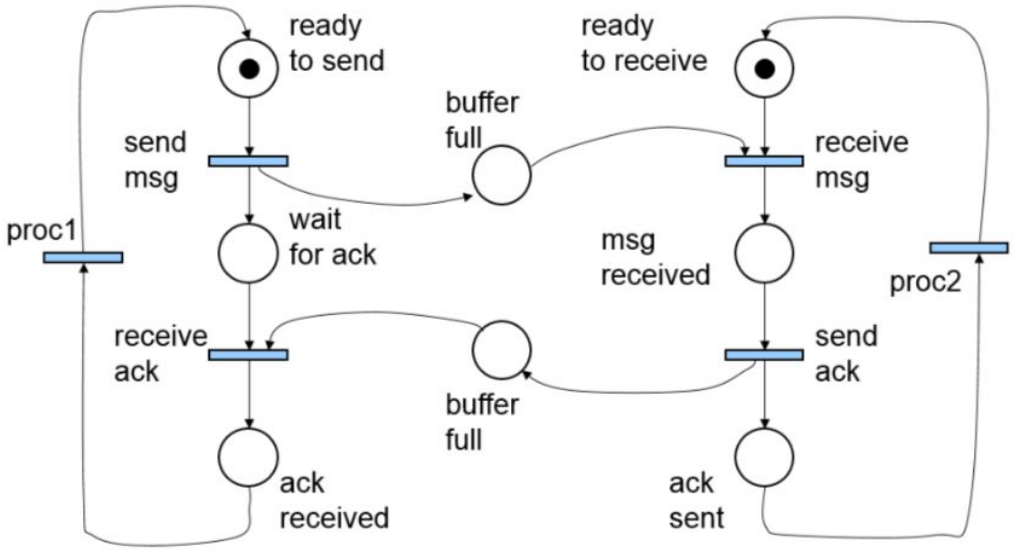
Exercise: communication protocol

Build a SPN that models the following communication protocol:

- There are two processes able to communicate
- One process sends messages, the other process receives
- The buffer accumulates one message at once



Exercise: SPN for Communication protocol



OUTLINE OF LECTURE 8

Gate Question Related to UNIT I-II