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Lecture #4
Network Costing

- Importance of Network Cost Modeling
- Network Costing Fundamentals / Costing Building Blocks
  - Capital and Expenses
- Network Capacity Costing (capacity unit cost)
- Network Investment Forecast
Importance of Network Costing

- **Product pricing for Product / Marketing team**
  - Network Costing is a must for product team to develop the market pricing

- **Company Finances**
  - Profitability (revenue) analysis
  - Network investment forecast
  - Company internal financial purposes

- **Strategic / Others**
  - Business case development
  - Understanding the unit cost trend of future technologies
  - Regulatory
Network Costing Building Blocks (Capital)

- (a) Capital  (b) Expenses

- Capital
  - Tangible assets such as Equipment, Property, Plant etc.

- Initial Capital Cost for Network Equipments
  - Equipment itself (Standard price vs discounted price)
  - Taxes
  - Install and deployment related cost
    - Furnishing cost
    - CO technician time to physically connect the device to the network
Network Costing Building Blocks (Expense)

- Expenses
  - Help Desk expense - driven by customer tickets
  - Billing expense - driven by Customer Bill processing
    - Preparing, Printing, Mailing, and Processing
  - Maintenance expense - driven by ISP-Vendor contract
  - Repair expense driven by equipment failure
  - Replacement / Life Cycle Management related expenses
  - Service / Product / Project specific expenses
  - Service Provisioning
Advertising

Sales Management

Employee Unit Cost
  - Cost of an employee per hour / month / year
  - It includes Salary, Training, Pension, Benefits, Taxes, Consumable Material, Motor Vehicle, Office IT systems, other office facilities etc.
  - Real estate related cost - power/utilities, land, building etc.
Network Costing Concepts Fundamentals

- Dedicated Costing Concept
- Shared Costing Concept
- Costing Methodologies
  - Infrastructure Costing
  - Capacity Costing
  - Service Costing
Network Costing: Project Examples

- **Project #1: Network Capacity Costing for Router & Link**
  - **Project:** Given a network equipment, capacity and cost details; you need to develop a methodology and a tool that can provide capacity costing (cost per port and / or cost per BW unit).

- **Project #2: Network Capacity Costing for a Cloud (Core for example)**
  - **Project:** Given a network topology for a particular network segment, capacity and cost details; you need to develop a methodology and a tool that can provide capacity costing (cost per port and / or cost per BW unit).
Network Costing: Project Examples

- **Project #3: Develop a Network Service Costing Model**
  - **Project:** Given a network topology, topology cost details, a specific service (Internet service for example) architecture; you need to develop a methodology and a tool that can cost out the specific service.

- **Project #4: A Service Costing-Pricing Tool**
  - **Project:** Given a network topology, topology cost details, a specific service (Internet service for example) architecture, and pricing guideline; you need to develop a methodology and a tool that can cost out the specific service and suggest a market price based on the pricing strategy.
Network Security: A Connected Vehicle Perspective

- Network Security: Past vs Present
- Network Intrusion Prevention vs Detection
- Malware: Virus, Worm, Trojan Horse, Spyware, Adware, Rootkits, Sniffers, Backdoors, Botnets, Ransomware
- DoS / DDoS

Reasons behind attacks:
- Financial
- Spying
- Political
- Industrial / Personal rivalry
Network Security: A Connected Vehicle Perspective

- **Connected Vehicle Communication Building Blocks**
  - Internet
  - V2X: Vehicle to Vehicle; Vehicle to Infrastructure
  - In Vehicle Networks
  - Infotainment
  - Hundreds of Electronic Control Units (ECUs)
  - On Board Diagnostics (OBD)
  - Smart Phone/Device Connectivity

- Numerous ways malware can enter into a connected vehicle systems
Major Connected Vehicle OS

- Linux and QNX

Types of Malware Attacks for CV

- Stealing sensitive information through vehicle’s audio-visual channels
- Steal or modify stored vehicle information (manufacturer/insurance)
- Compromise ECU and take control of the vehicle
- Monitors vehicle’s status including tracking
- Compromised vehicle can attack other V2X entities
Existing Security Measures for CV and Challenges

- Network Protection: Separating ECUs from networks
- Software Protection: Limiting use of user apps
- ECUs are task specific with limited resource and thus lacks the ability for intrusion prevention or detection
- Lifetime of vehicle: Hardware solution would be extremely expensive for the manufacturers
- Massive data generated by CVs: Privacy issues
CV Networks Security: Project Examples

- **Project #1:**
  - Given a CV configuration (building blocks of vehicle’s connectivity), you need to develop a high level architecture that would provide security and protection against malware attack for individual components of a CV.

- **Project #2:**
  - Given a CV configuration (building blocks of vehicle’s connectivity), and assume a CV has been compromised, you need to design a post-attack protocol that will isolate the vehicle from the networks (V2X) and safely switch to a full manual mode.