S-38.3183: Internet Traffic Measurements and Measurement Analysis

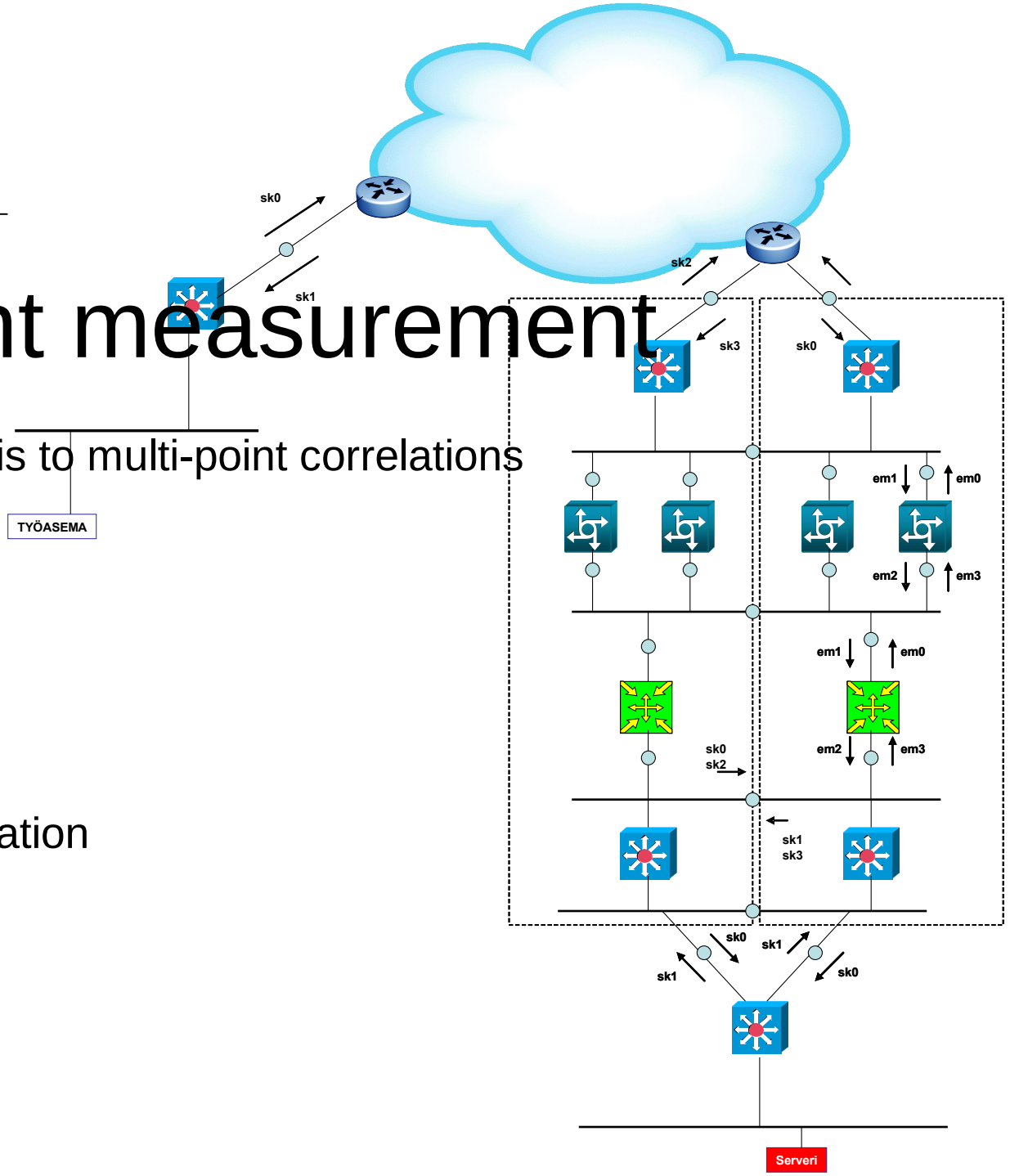
Lecture 10: Multipoint Network Measurements

Multipoint measurement

- Passive measurement done on the several locations at the same time
  - Each PoP
  - Each step of the network
  - Each step within service center
- Active measurements done from several locations at the same time
  - Mesh measurements
    - Between PE routers
  - Spatial measurement
    - Each access loop individually and mesh between PEs
  - Consolidation measurements
    - Various locations against single point

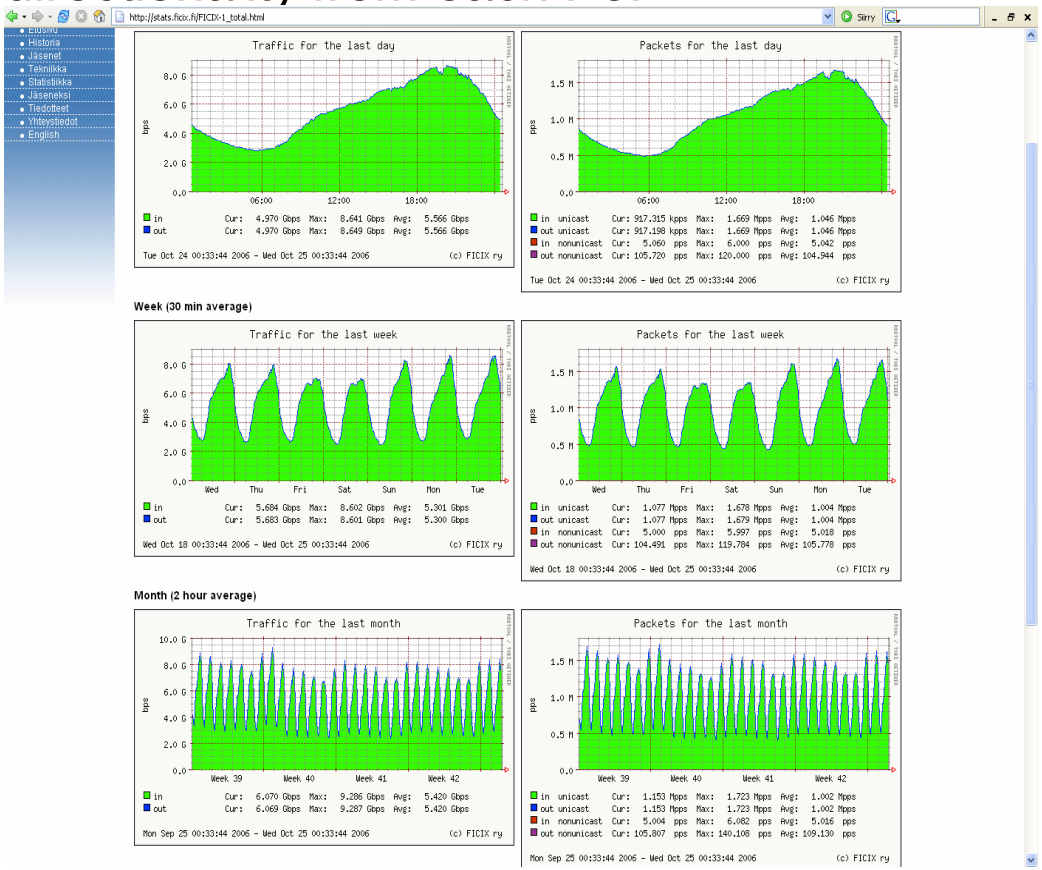
Multipoint measurement

- From single point of analysis to multi-point correlations
  - Added accuracy
  - Spatial differences
- Added challenges
  - N times more data
  - N times more devices
  - N point time synchronization



Passive multipoint measurement

- Analyze traffic load, pattern and directionality from each PoP
  - Traffic matrices
    - Offered load vs goodput
    - Delays
    - Flow patterns
    - Load patterns
    - Protocol patterns
  - Trend analysis
    - Input for dimensioning
  - Charging records
    - Usage based charging



Passive multipoint measurement

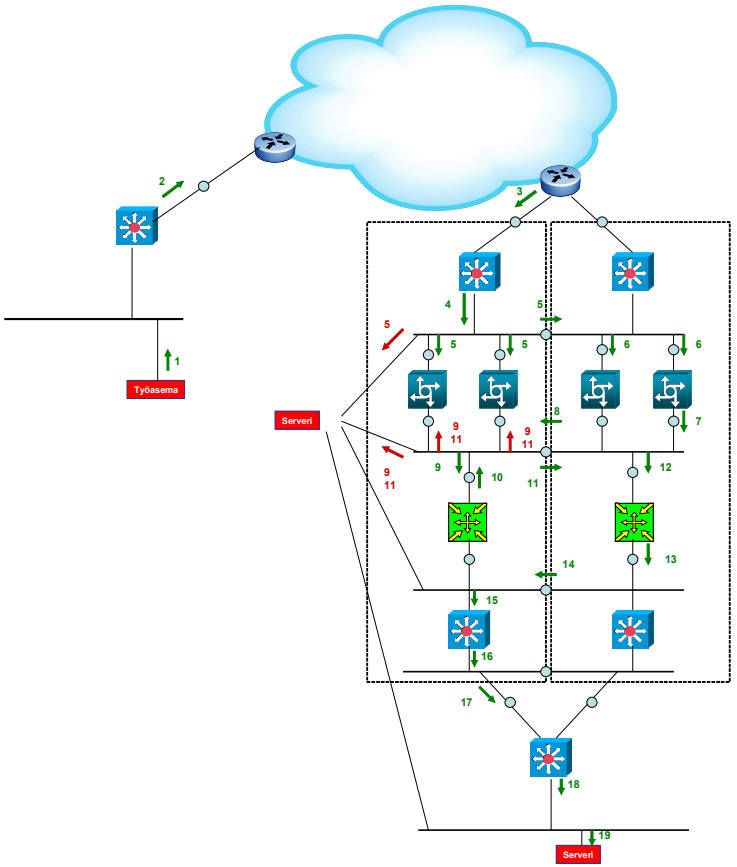
- Spatial analysis
  - Customer traffic generation
    - LAN traffic
  - Access network traffic
    - Shaping to the access link
  - PoP traffic
    - First stage of multiplexing
  - Core traffic
    - Second stage of multiplexing
- Traffic patterns
- Service usages
- Quality requirements
  - Dimensioning goals
- Lost packets
- Delays in different stages of the network

Passive multipoint measurement

- Each step within service center
  - Offered load from the core network
  - VPN effects
  - FW effects
  - Load balancer effects
  - Service switching network
    - Storage services
    - Collaboration services
    - Mediation services
    - Consolidated services
- Progress of traffic
- Delays
- Errors
- Lost packets or connections
- Availability of services
- Misdirections

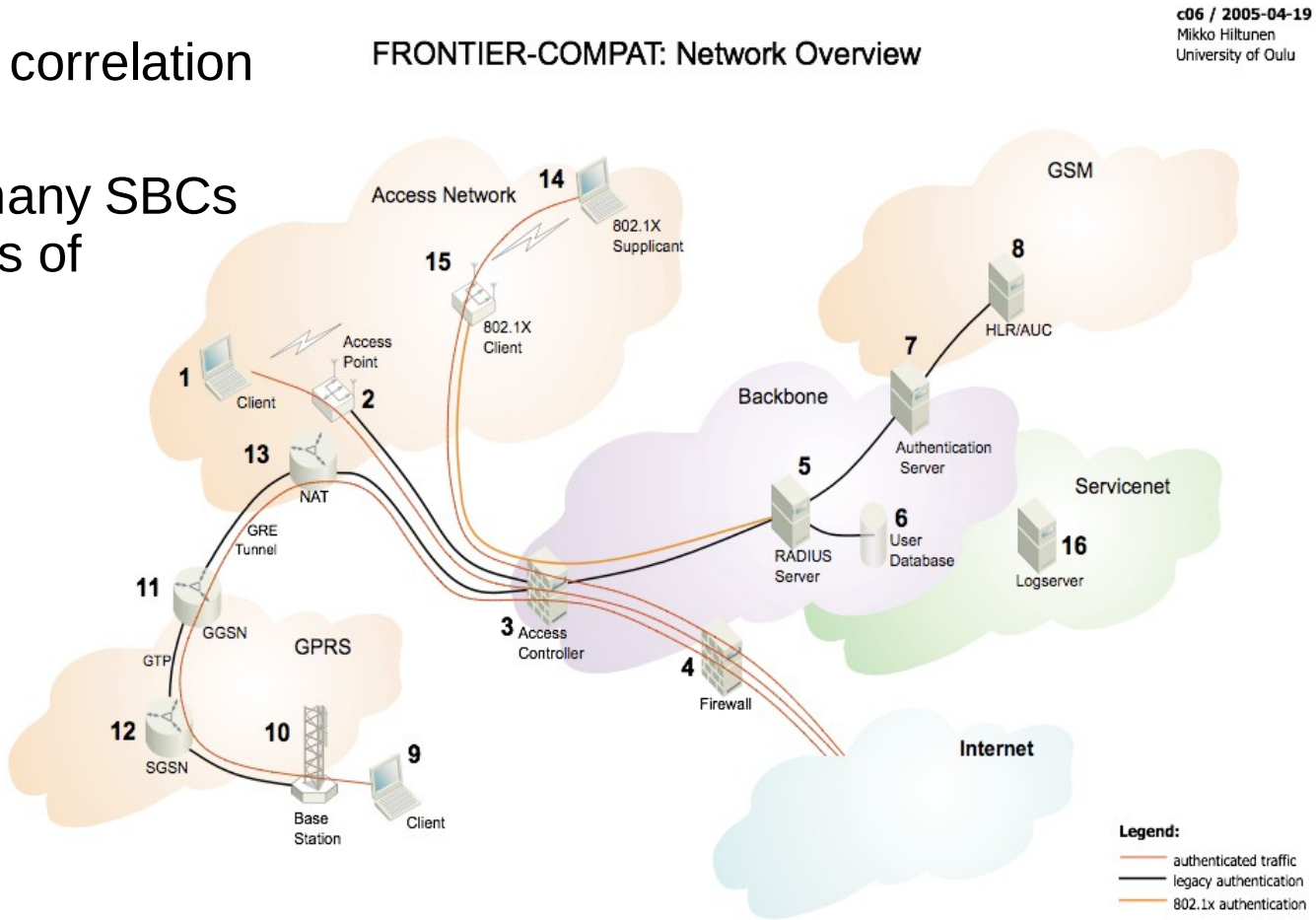
Passive multipoint measurement

- Progress of the traffic can be analysed in detail
  - Is the packet flow (route) as expected
  - Are there replications
  - Are there changes
    - Expected
      - SBCs
    - Unexpected
      - Misbehaving device



Passive multipoint measurement

- General problems with correlation of packets
  - Usually there are many SBCs which alter identities of packets
    - IP addresses
    - Ports
    - Tunneling
    - Crypting
    - ALGs



Problems

- There are
  - Tens of protocols to decode
  - Gigabytes data
    - Noise
  - Often hard to combine packets on different points of network

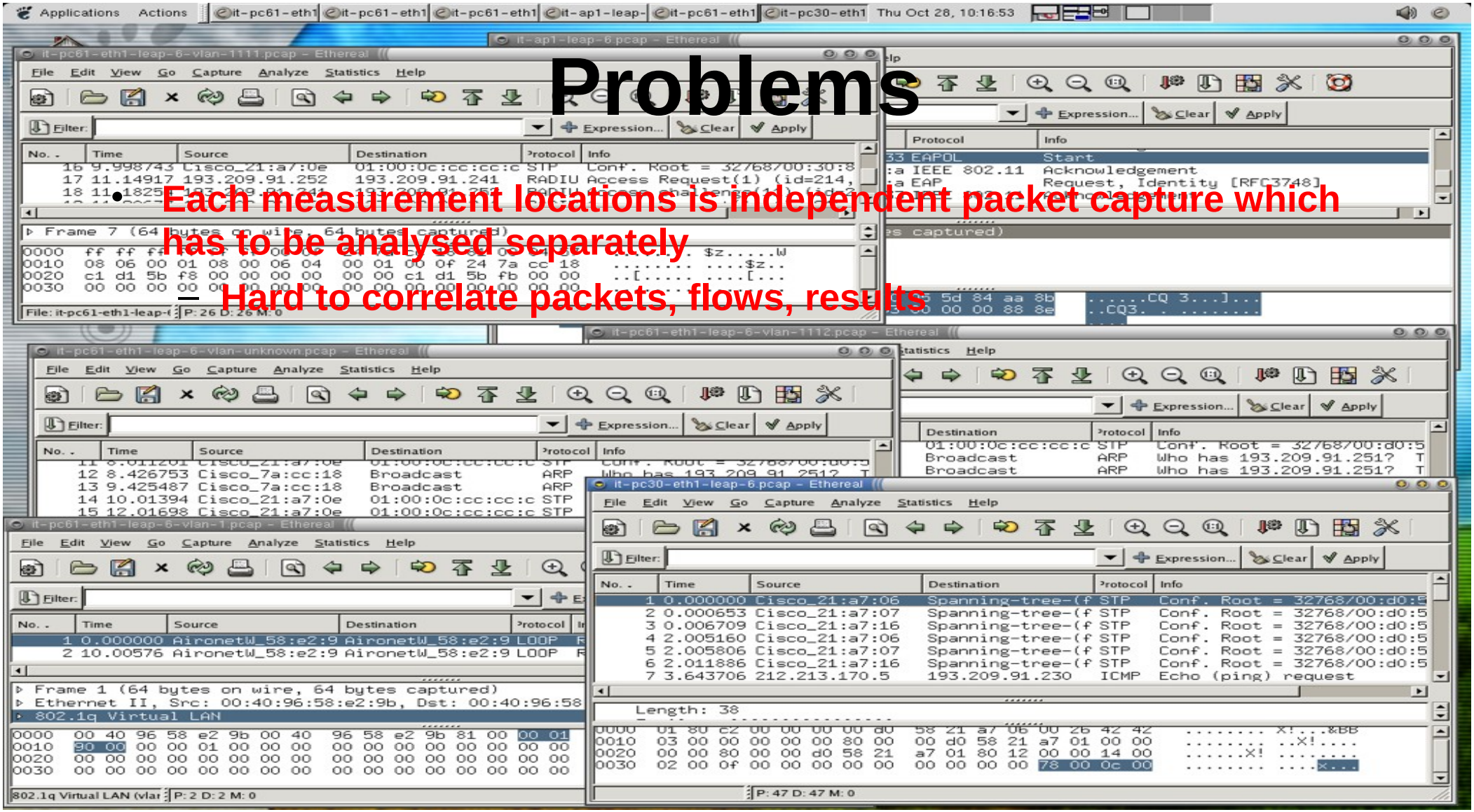
PPP RFC1661, RFC1662; Frame relay FRF.1, RFC1490 HDLC Cisco ; IP RFC791 ; Ipv6 over Ipv4 supported, RFC2529 ; Ipv6 over Ipv4 tunneling supported, RFC2185 ; Network time protocol RFC1305 ; Network address translation (NAT) ; DHCP RFC2131 ; CIDR RFC1519 ; ICMP Router Discovery (server portion) RFC1256 ; ICMP RFC792 ; ARP RFC826 Route aggregation ; Requirements for IPv4 routers RFC1812 ; Route redistribution ; DVMRP RFC1075 ; IGMPv2 RFC2236 ; PIM-SM ; Multicast tunnels ; PIM-DM (multicast) ; RIPv1 RFC1058 ; VRRP RFC2338 ; OSPFv2 RFC2328 ; RIPv2 (with authentication) ; RFC1723 ; IGRP (optional) Cisco ; Static routing BGP4 (optional, available ; only for IP330) RFC1771 ; Supports IEEE802.1x authentication framework GRE tunneling ; SSL versions 2 and 3, TLS ; version 1 supported ; Native IPSec (IKE, AH, ESP) ; SSH server, versions 1 and 2 ; supported ; MD5 Routing Authentication ; (RIPv2) RFC1723 ; SNMPv3 with User-Based Security Model ; Radius client RFC2865 Radius accounting client ; RFC2866 ; Proxy Radius RFC2865 ; Virtual Router Redundancy ; Protocol RFC2338 ; Traffic management ; SSL/TLS RFC2246 ; SSL/TLS RFC2216 ; SSH server, versions 1 and 2 supported ; SNMP, SNMPv2 and SNMPv3 CLI via Telnet RFC854 ; RFC959 ; SMTP mail (send) RFC821 ; RFC1760 ; SNMP and SNMP MIB II RFC1213 ; RADIUS auth.client MIB RFC2618 ; RADIUS acc.client MIB RFC2620 ; P022 MIB ; DiffServ, EF) RFC2598 ; 1350 The TFTP Protocol

3 authentication server

Kitchen sink?

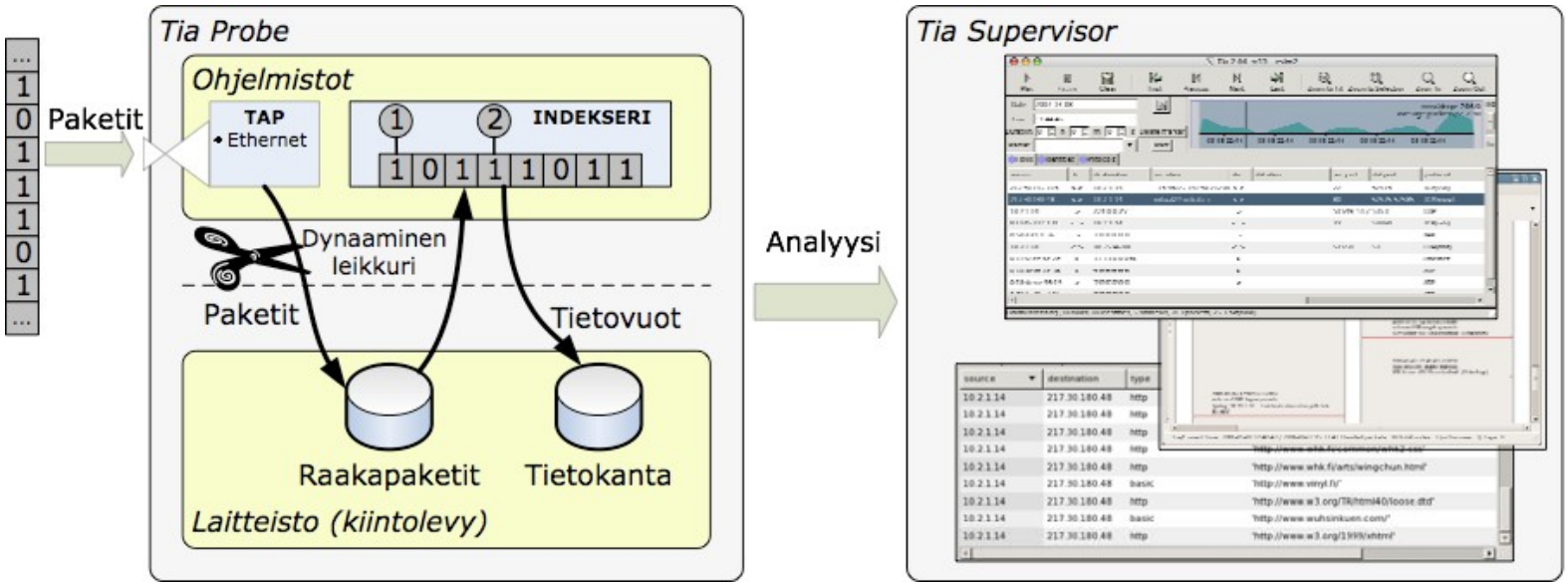
Problems

- Each measurement locations is independent packet capture which has to be analysed separately
- Hard to correlate packets, flows, results

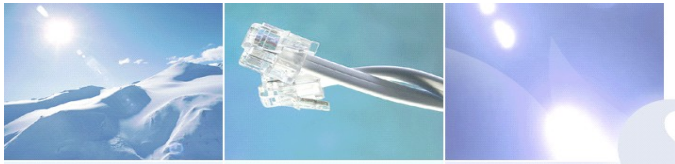


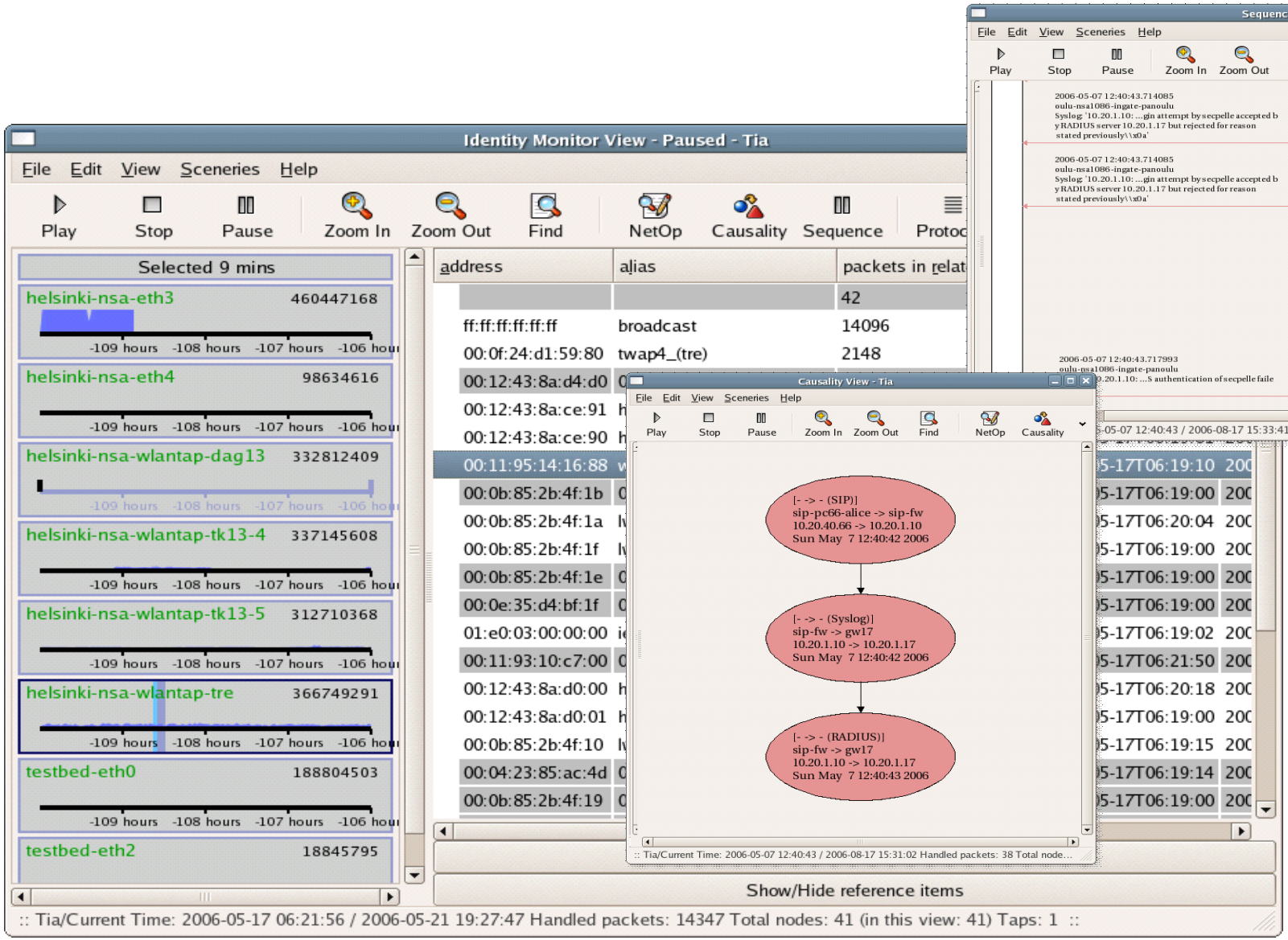
Solution

- Clarified Networks – HowNetWorks
  - Finnish SME developing tools to bring order into chaos
    - Causality analysis -> causalities are easier to understand for humans than individual bits and packets



Clarified NETWORKS





Active Multipoint Measurements

- Availability analysis between PE's
  - Potential outages of the network
- Delays between PE's
  - Load level vs SPF optimization
- KPI analysis for core network
  - Delay, jitter, loss

Active Multipoint Measurements

- Spatial composition
  - Each stage of the network is measured as a separate entity
    - Same level of aggregation in measurement traffic as there is aggregation in users
      - Each customer has not separate core network measurement stream rather one measurement which results are shared
      - Each customer has individual access loop measurement whose results are composited to core measures
  - Lower accuracity with better scaling

Active Multipoint Measurements

- Consolidation measurements
  - Testing from several locations to single point in the network
    - User sites to consolidated service center
    - Users to NPs Internet gw
    - Between service demarcation points
      - Hub and spoke VPN

Multipoint Measurements

- Challenges
  - Time synchronization
    - System time differences limit the accuracy of measurements
      - Local oscillators with initial synchronization
      - NTP
      - GPS
  - Processing time constraints
    - Injection of time information into packets
      - HW/SW
      - Packet rings
      - IRQ mitigation