Putting Intelligence in Internetworking: an Architecture of Two Level Overlay

EE228 Project

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End-to-End

- The traditional networking research is based on the end-to-end principle:

--*The function in question can completely and correctly be implemented only with the knowledge and help of the application standing at the endpoints of the communications system. Therefore, providing that questioned function as a feature of the communications systems itself is not possible*

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--From the application point of view: *more demanding applications, ISP service differentiation, more security issues and less sophisticated users.*

--From the hardware point of view: *more powerful computer boxes and more sophisticated routers/switches.*

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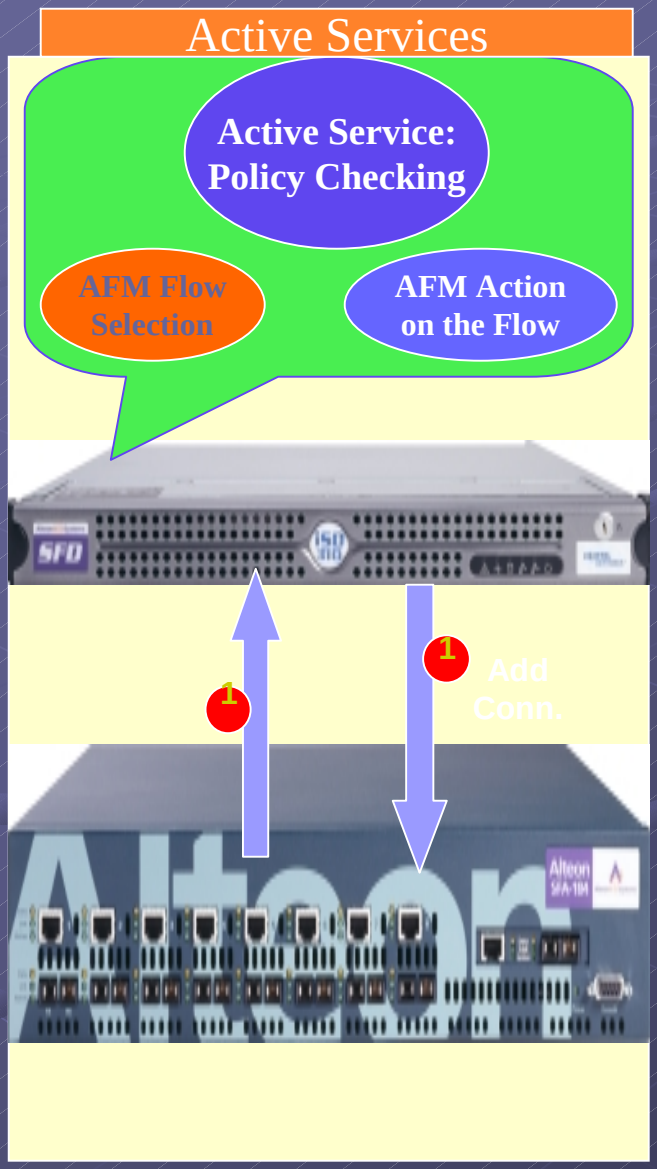
--Alteon: *a powerful switch with L2-L7 switching ability*

--ISD: *the computational plane for Alteon, equipped with CPU and FPGA/ASIC hardware assist for specific applications*

--Alteon+ISD: *an intelligent switch with strong computational ability. Or a computer with strong switching ability. We call it Programmable Gateway.*

Alteon+ISD



Up to 256 Linux based engines

Active Services Platform

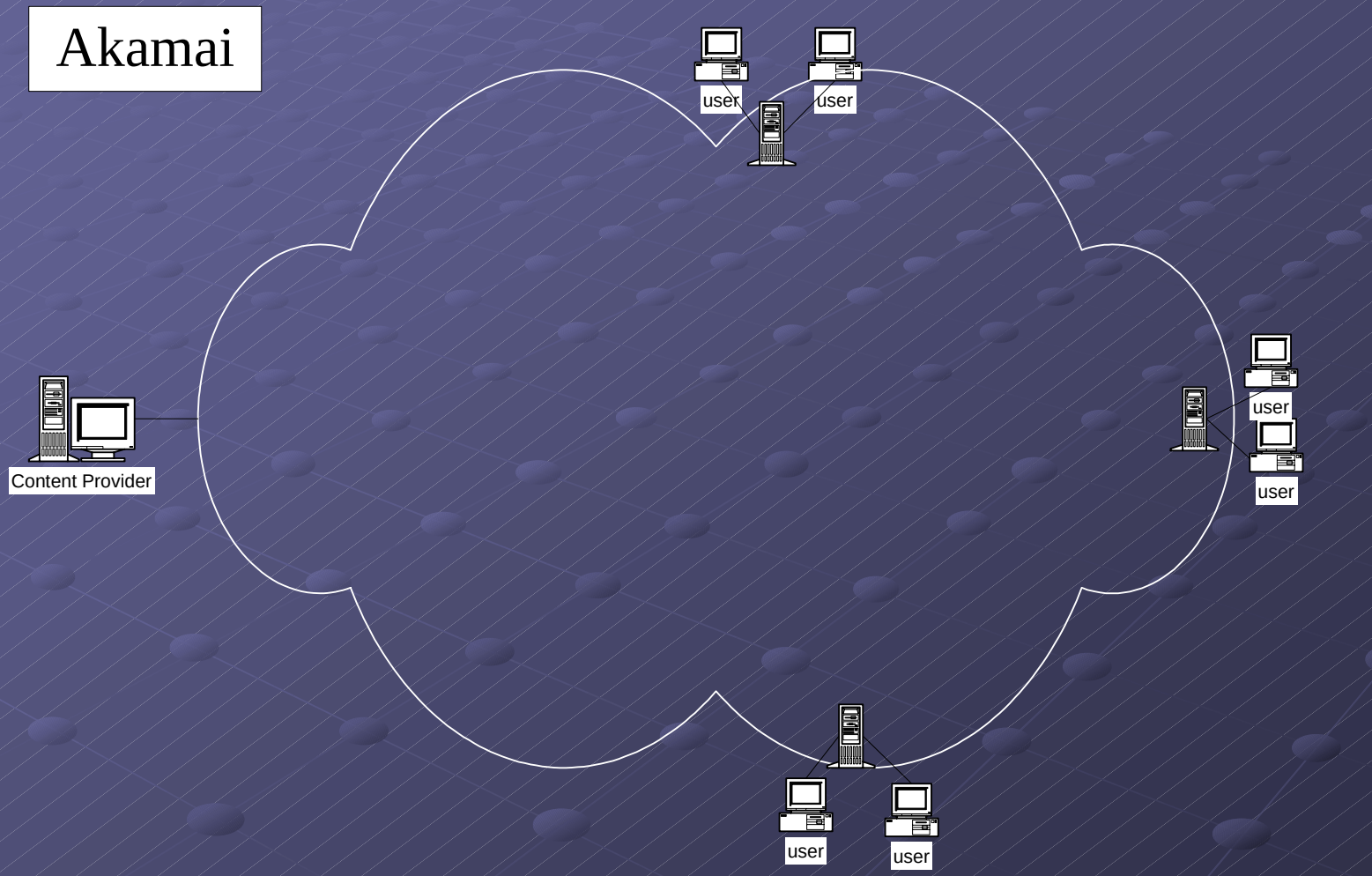
Intercepts selected flows and performs intelligent processing based on L2-L7 filtering

Users

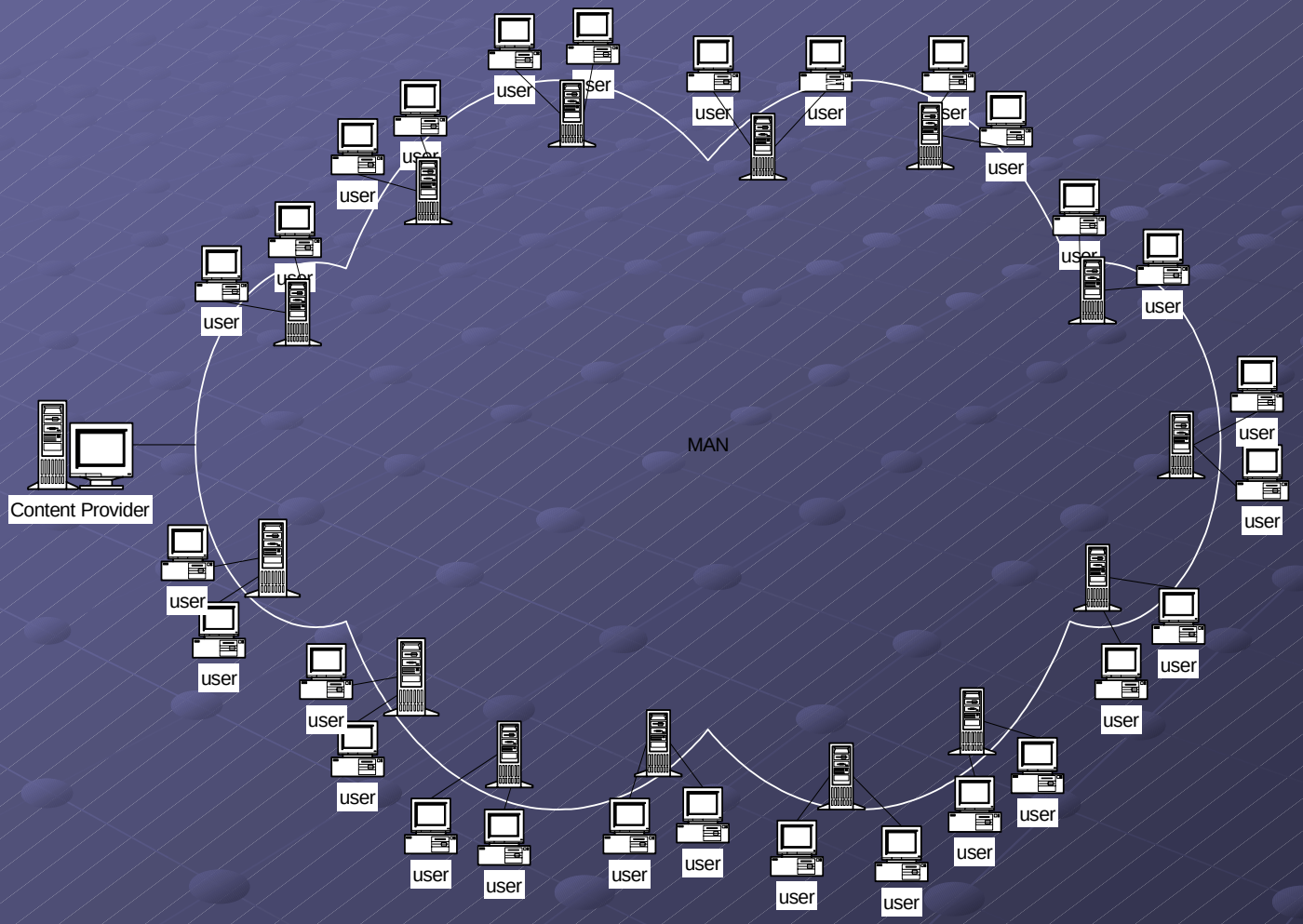
Servers

The emphasis is on interception and processing transparently. Entities at both ends may not be aware of the existence of the Alteon in the path

Content Delivery: Overlay Network



Akamai



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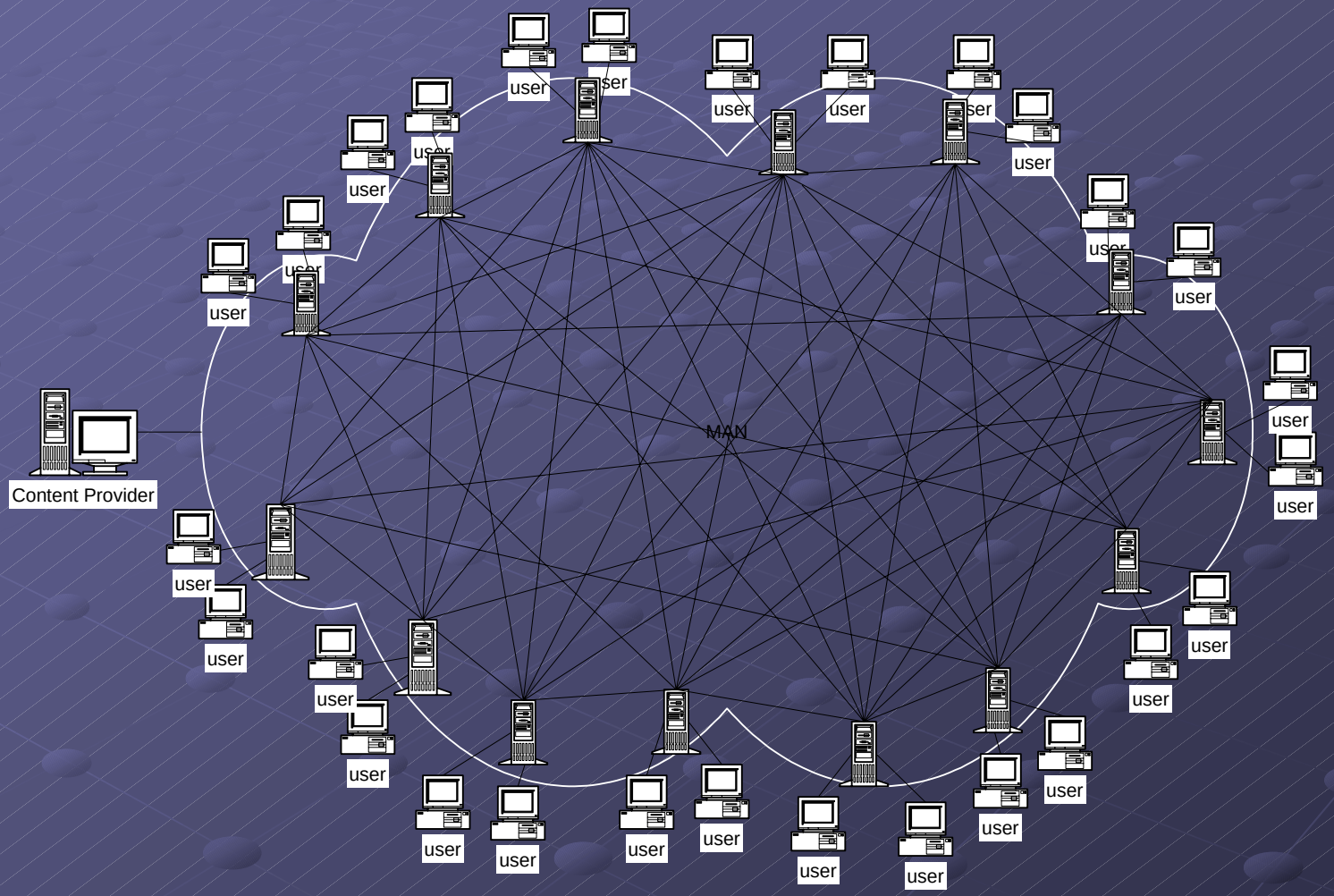
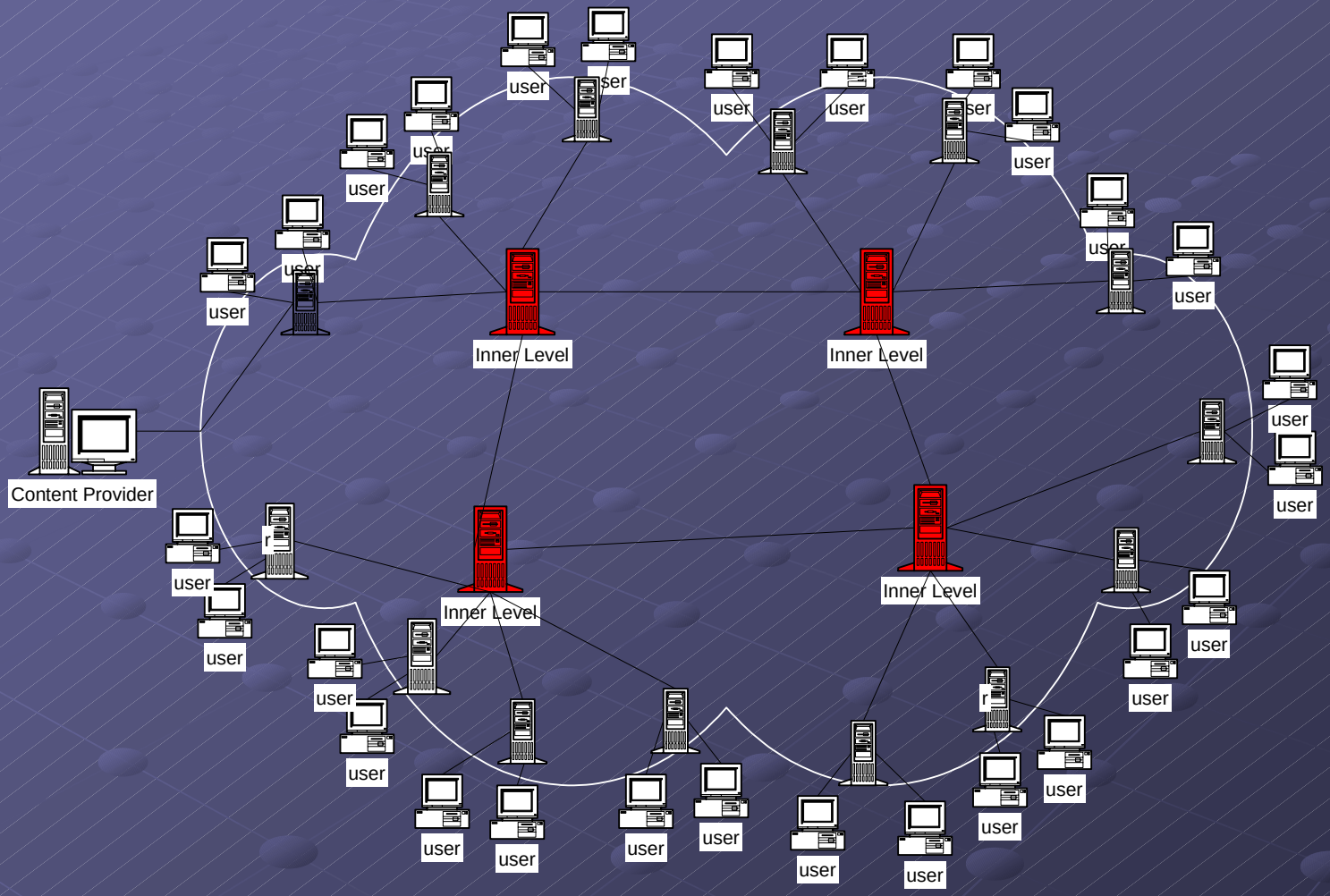


Two Level Overlay



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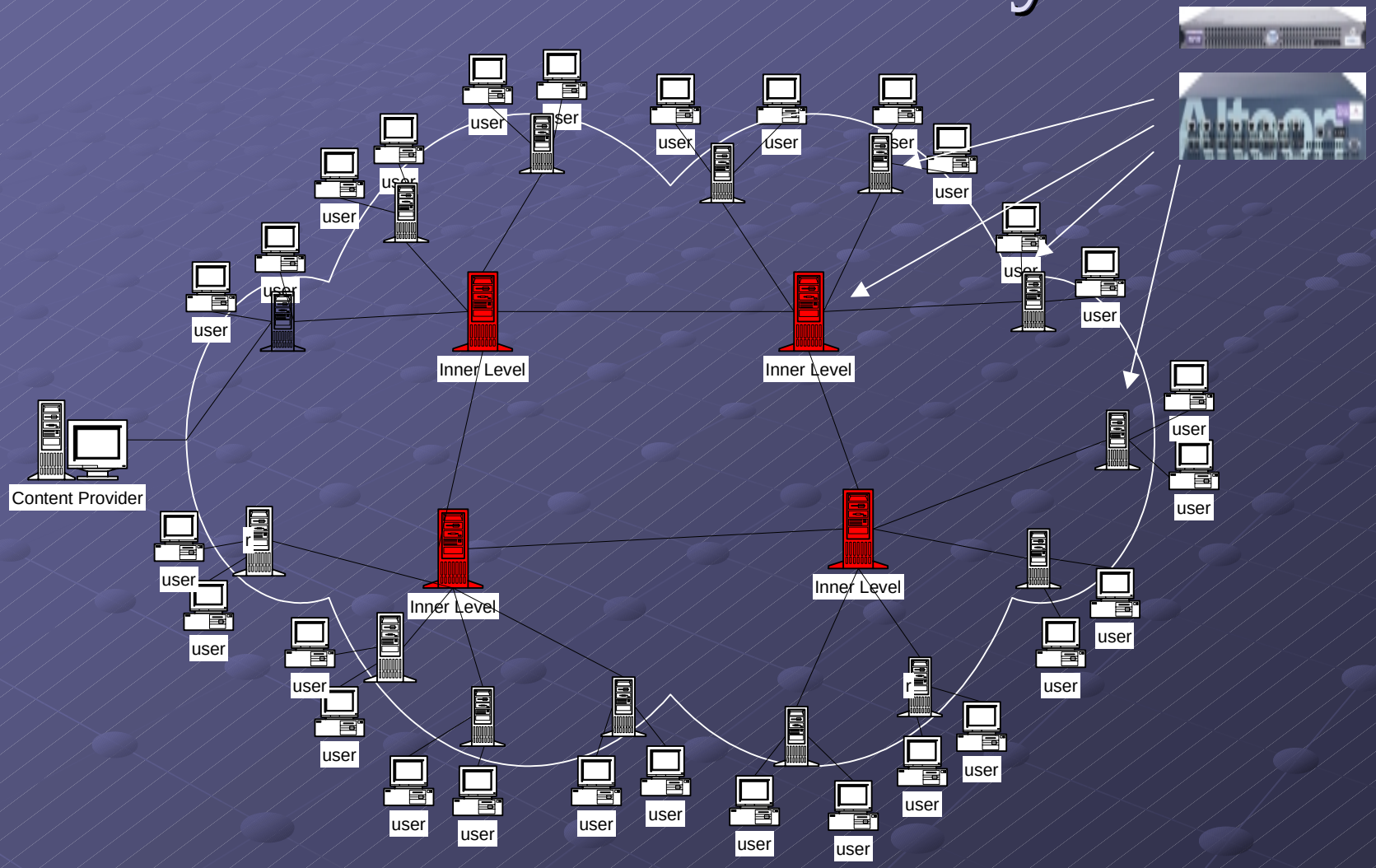

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- Putting these Programable Gateway on the MAN (storage network management, QoS channel and service negotiation)

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- Fewer route setup $O(n^2)+m$, n/m is the number of nodes of inner/outer overlay, respectively.
- The two level overlay architecture with programmable gateway can solve the inter-AS bottleneck problem.

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- Suggested Business Model:

  end customers

  → content provider (web site, TV station…)

  → ISP (constructor of outer level)

  → Network Operator (constructor of inner level)

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- Implementation:

  Avoid congestion for these paid service: over reserve bandwidth, limit best-effort traffic if needed.

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- Content provider: better performance for content delivery, need to pay for service but should get be able to get more from customers (QoS video streaming).
- ISP: reduce congestion for paid service
- Network Operator: get pay from ISP

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--*The outer level nodes can provide functionalities like geographic load balancing, disaster recovery (re-route setup), mirroring, etc.*

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- Example: Storage Network

--The outer level nodes can provide functionalities like geographic load balancing, disaster recovery (re-route setup), mirroring, etc.

--The inner level nodes (with hardware assist) can provide functionalities like storage management, firewall, etc.

Other Applications—Wireless Network

- Rough ideas:

--*Dynamic bandwidth capacity allocation according to change of subscribers at a location*

--*Adaptive content delivery according to end user link speeds*

--*Congestion control*

Conclusion

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--*Two-level overlay network structure*

--*Intelligence in the network: Programmable Gateway*

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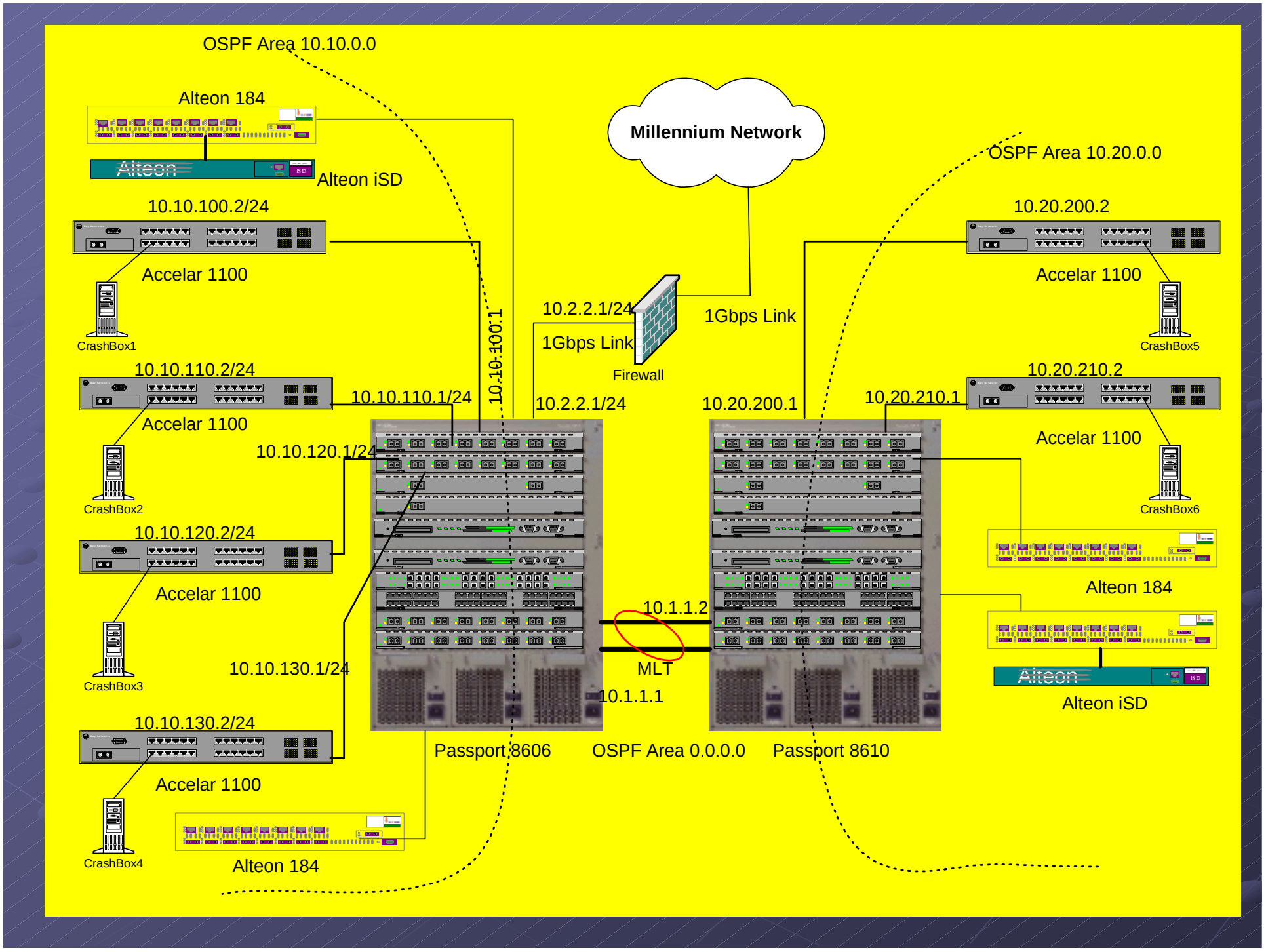
OSPF Area 10.10.0.0
Alteon 184
Alteon iSD
10.10.100.2/24
Accelar 1100
CrashBox1
10.10.110.2/24
Accelar 1100
CrashBox2
10.10.120.2/24
Accelar 1100
CrashBox3
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Accelar 1100
CrashBox4
Alteon 184
10.10.110.1/24
10.10.100.1
10.10.120.1/24
10.10.130.1/24
Millennium Network
10.2.2.1/24
1Gbps Link
Firewall
10.2.2.1/24
Passport 8606
10.1.1.2
MLT
10.1.1.1
OSPF Area 0.0.0.0
1Gbps Link
OSPF Area 10.20.0.0
10.20.200.2
Accelar 1100
CrashBox5
10.20.210.2
Accelar 1100
CrashBox6
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- A testbed is constructed.
- An ongoing experiment with iSCSI packet interception, recognition and redirection (for storage network geographic load balancing).

Future Direction

- This two-level overlay architecture will be further discussed/modified/implemented within a Nortel-Berkeley networking research group
- Functionalities for MAN will be experimented on our testbed
- A larger scale experiment will be constructed for full functionalities