

1394.1 for Phase 1/2/(3)

Takashi Sato
Philips Research

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Outline

- **Background**
- **Proposed Wireless 1394 Architecture**
 - 1394/1394.1 Architecture
 - Wireless 1394 Architecture
 - Phase 1 & Phase 2 Topology
- **1394.1 for Phase 1/2/(3)**
 - Phase 1: Leaf Bridge
 - Phase 2: Subnet Bridge
 - Phase 3: Mininet Bridge
- **Conclusion**

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Background

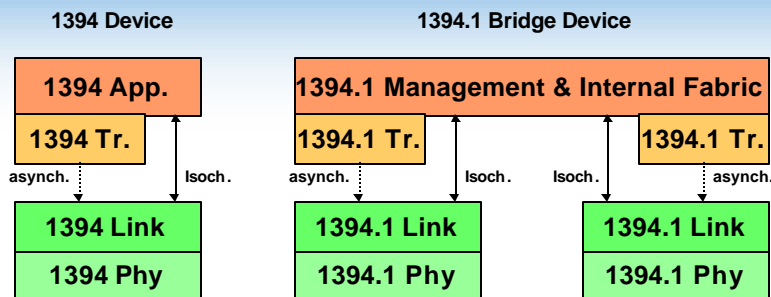
- **In Europe: ETSI BRAN group needs a bridge spec ASAP so they can complete the wireless 1394 spec by End/99**
 - ETSI (European Telecommunications Standards Institute)
 - BRAN (Broadband Radio Access Networks)
- **09/01/99: Wireless 1394 architecture proposed and accepted with a 2-Phase approach**
- **10/06/99: 1394.1 solution for Phase 1 and Phase 2 proposed and partially accepted**
- **In Japan: MMAC group is now considering adopting the same solution**
 - MMAC (Multimedia Mobile Access Communication)

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1394/1394.1 Architecture



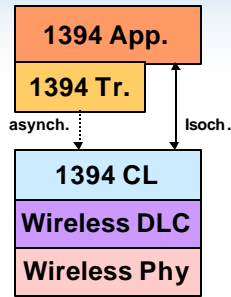
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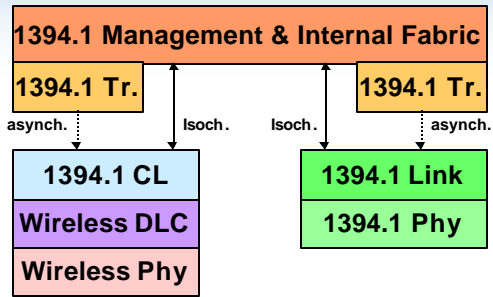
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Wireless1394 Architecture

Wireless1394 Device



Wireless 1394.1 Bridge Device



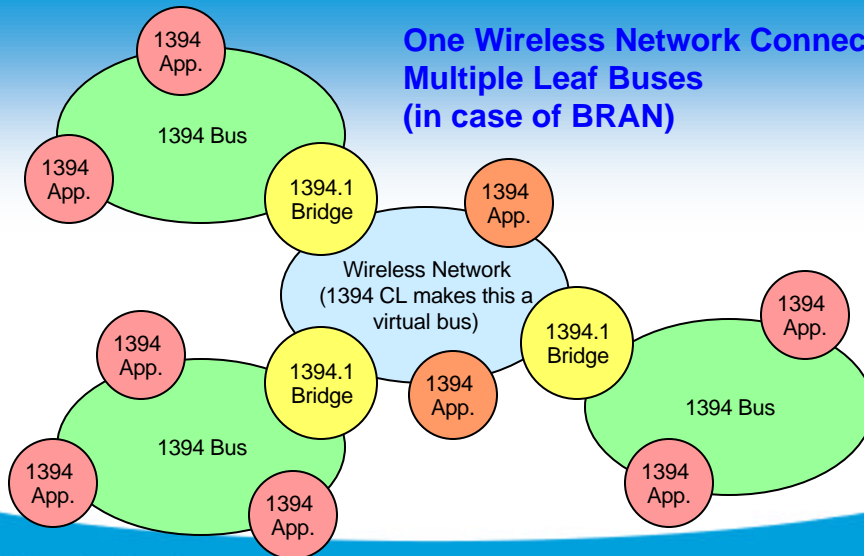
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Network Topology (Phase 1)

One Wireless Network Connects Multiple Leaf Buses (in case of BRAN)



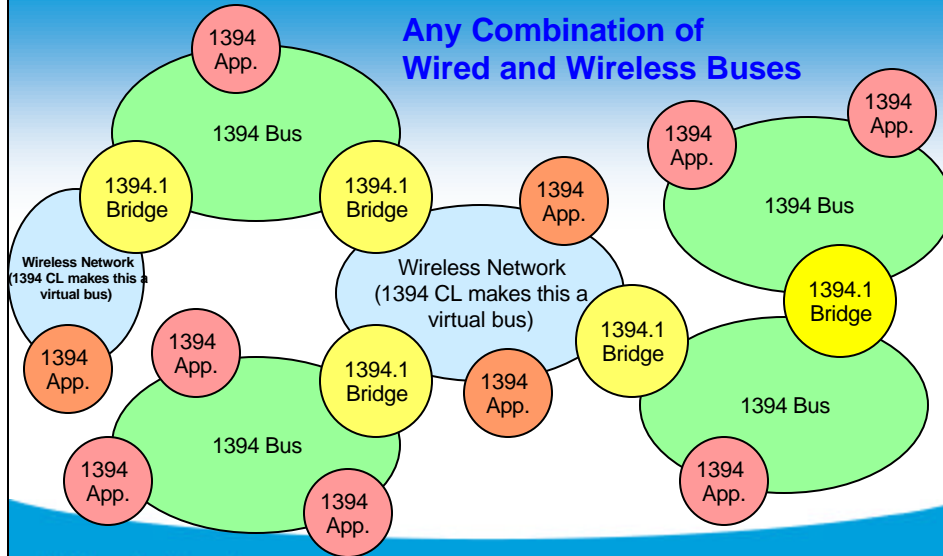
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Network Topology (Phase 2)

Any Combination of
Wired and Wireless Buses



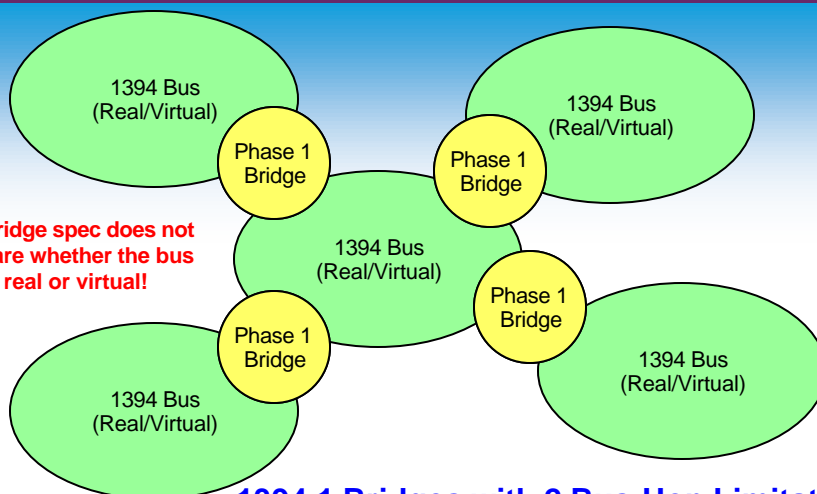
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What to be defined for Phase 1

Bridge spec does not
care whether the bus
is real or virtual!



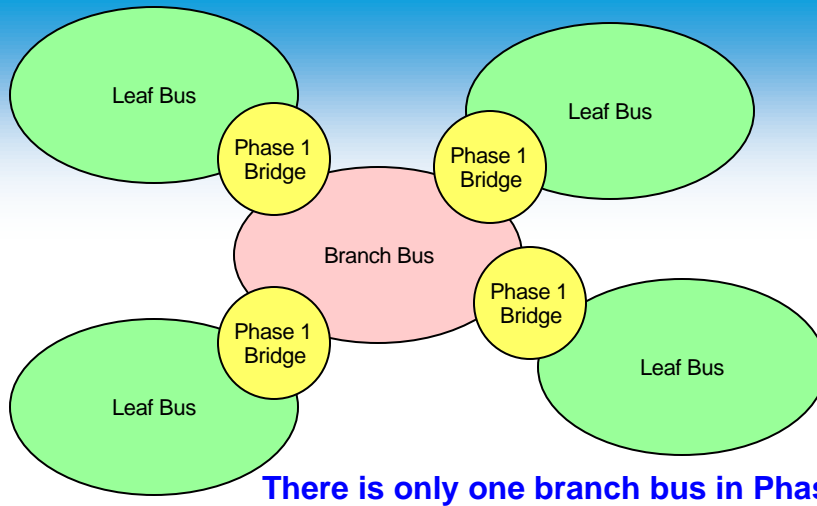
1394.1 Bridges with 2 Bus-Hop Limitation!

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Branch Bus & Leaf Bus



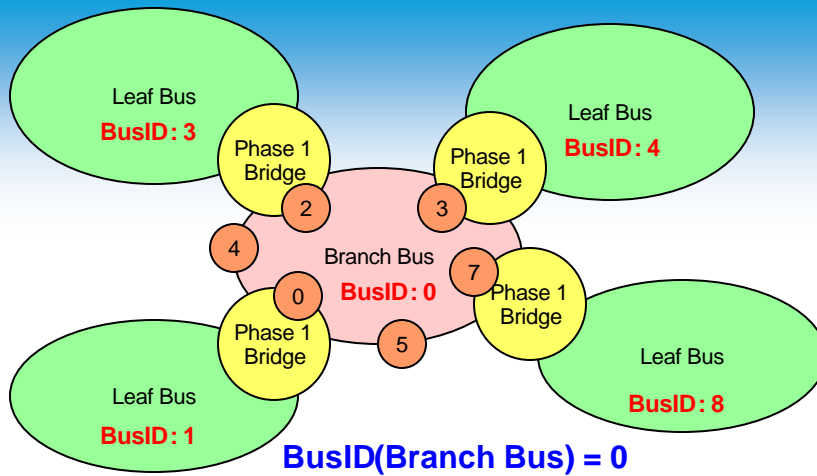
There is only one branch bus in Phase 1

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BusID Assignment



BusID(Branch Bus) = 0

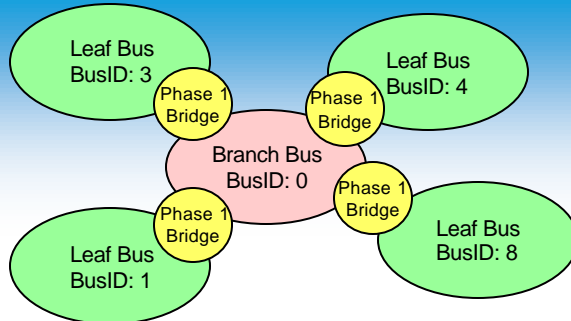
BusID(Leaf Bus) = (Stable PhyID on Branch Bus) + 1

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Packet Routing



Portal on Branch Bus forwards a packet if its destination BusID (10 bits) matches the BusID on the other side of the bridge

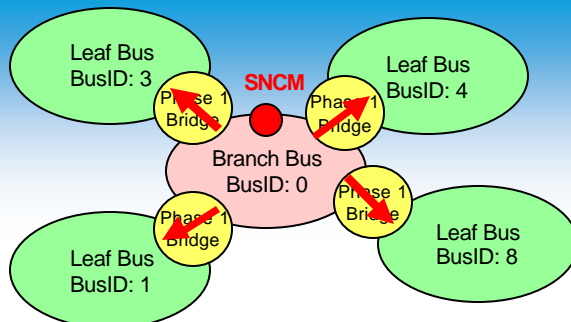
Portal on Leaf Bus forwards a packet if its destination does not match its local BusID

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Clock Synchronization (1)



Cycle Master on Branch Bus becomes Subnet Master as default

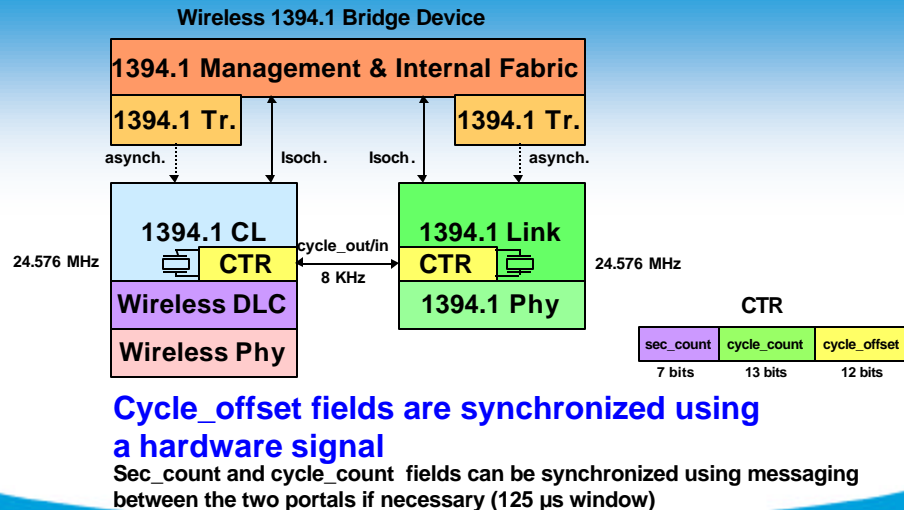
Directions of clock propagation are determined accordingly

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Clock Synchronization (2)



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Open Issues - Phase 1

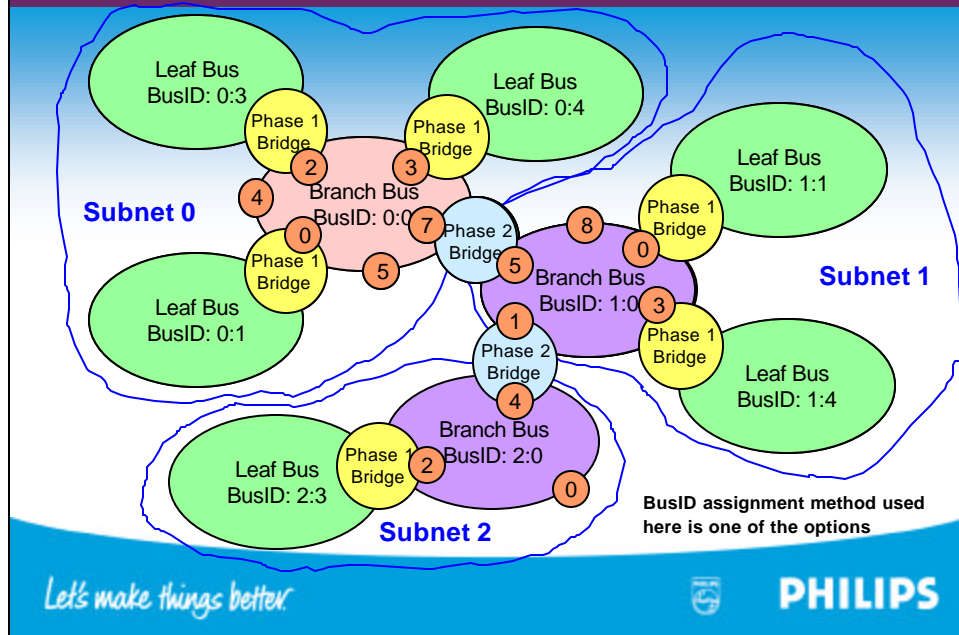
- **Clock synch: absolute value or phase lock?**
 - Philips prefers phase lock (synchronize cycle_offset field only) since synchronizing absolute value (all 32 bits) network-wide can be disruptive (especially when net cycle master changes)
 - No known application requires absolute value
- **Isochronous setup/teardown**
- **Quarantines**
- **Event notification mechanism**
- **Device discovery**
 - GASP based solution?

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Extension to Phase 2



Phase 1: Leaf Bridge

NodeID

SubnetID	BusID	PhyID
4 bits	6 bits	6 bits

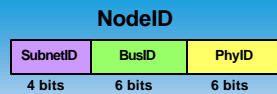
- **Phase 1 (Leaf) Bridge**
 - At least one portal connects to a leaf bus
 - Automatic BusID assignment (in absence of Phase 2 bridges)
 - Very simple routing -> **No routing table needed!**
 - Interoperable with Phase 2 bridges

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Phase 2: Subnet Bridge



- **Phase 2 (Subnet) Bridge**
 - Connects up to 16 subnets
 - Routing table based on SubnetID -> **Only 16 entries instead of 1023!**
 - Max. 15 subnet-hops or 17 bus-hops (excludes ridiculous cases such as 1022 bus-hops)
 - Backward compatible with Phase 1 bridges
 - Options: (subnets x buses) = (16 x 64), (32 x 32), (64 x 16), etc.

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Open Issues - Phase 2

- Open issues for Phase 1
- +
- SubnetID assignment
- Clock synch among subnet cycle masters
- Net refresh/reset

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BusID Assignment for Phase 2

■ Option 1:

- BusIDs within a subnet (default: 6 bits) get assigned automatically based on stable PhyIDs as in the case for Phase 1
 - not suitable if less than 6 bits are used for BusID

■ Option 2:

- BusIDs within a subnet get assigned by Alpha portal (Phase 2 bridge) on the branch bus in the subnet

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BusID Assignment for Phase 2

■ Option 3:

- All the BusIDs in the network (10 bits) get assigned by Prime portal (Phase 2 bridge)
 - It is doubtful Option 3 can be any better or even different from Option 2 under the constraint of the backward compatibility with Phase 1
 - Is there any other way to solve the backward compatibility issue without using a subnet concept???

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SubnetID Assignment for Phase 2

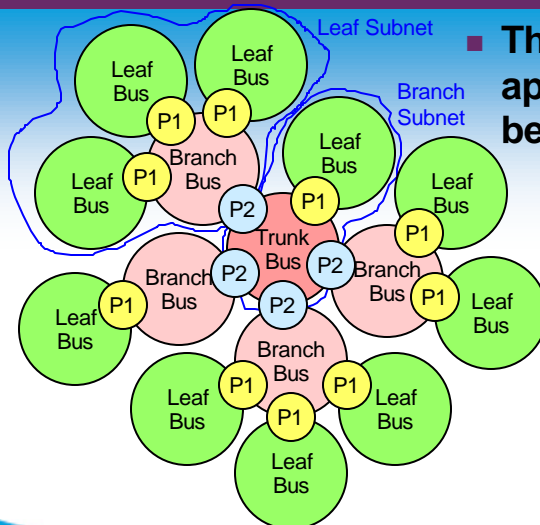
- **Option A:**
 - SubnetIDs get assigned by Prime portal (Phase 2 bridge)
- **Option B:**
 - It may be automated or simplified as shown in the following slide
- **Option C:**
 - Any other ideas?

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Food for Thought (1)

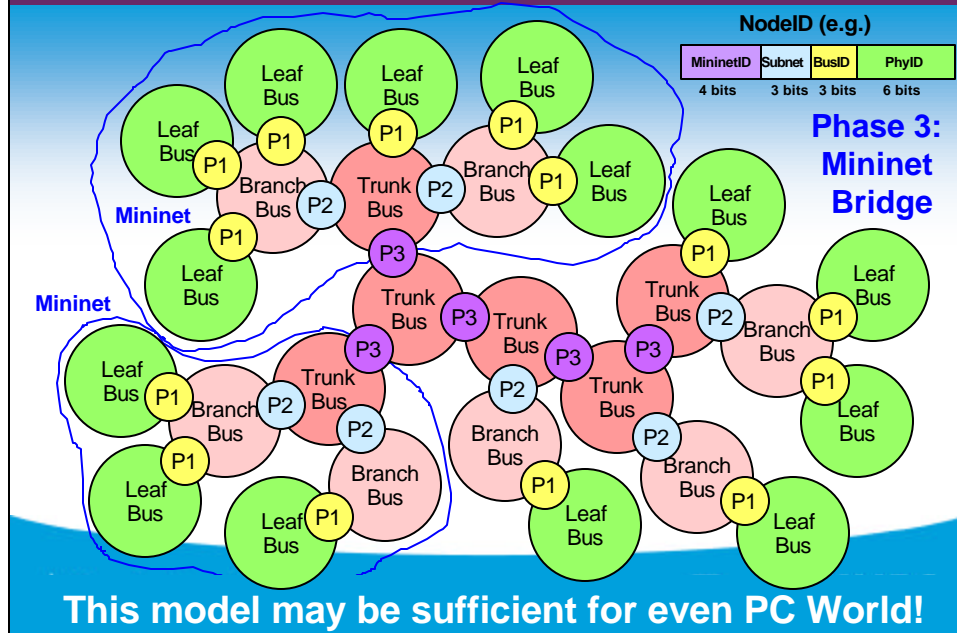


- **The same principle applied to Phase 1 can be applied to Phase 2**

- Prime portal/Net cycle master selection can be automated
 - Prime portal = Alpha portal on Trunk Bus
 - Net cycle master = Cycle master on Trunk Bus
- SubnetID assignment can be automated/simplified
- **No routing table needed!**
- etc...

This model should be sufficient for CE World!

Food for Thought (2)



Summary (1)

- **There is an urgent and pressing need for a Multi-Phase bridge approach in the industry**
 - ETSI BRAN group needs a solution ASAP
 - At least CE manufacturers do not want to waste resources by coping with routing possibility of 1023 buses
 - If 1394.1 group could not provide a solution in time, there would be a danger of non-1394.1 bridges becoming the de-facto standard

Summary (2)

- **Phase 1 (Leaf), Phase 2 (Subnet), and Phase 3 (Mininet) bridge models were proposed**
 - Phase 1 bridges can be defined and introduced to the market quickly
 - Phase 2/(3) bridges can be introduced later while maintaining the backward compatibility with Phase 1/(2) bridges
 - BRAN accepted the Leaf Bridge model for Phase 1
 - BRAN did not commit to the Subnet Bridge model, and decided to let 1394.1 group to come up with a solution for Phase 2
 - In the presence of Phase 2 bridge(s), the automatic BusID assignment by Phase 1 bridges will be disabled

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Conclusion

- **The multi-phase (scalable & hierarchical) approach should be adopted by the 1394.1 group**
 - Satisfies the immediate need of BRAN and manufacturers who are going to make products
 - Simplifies bridge functions (BusID assignment, routing, etc.) for each phase

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