Interoperable Map Data Media for Navigation Systems

Rethinking the problem, and exploring possible solutions

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Panel Discussion Members

- Philippe Challe - Renault
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- Philippe St. Martin – Navigation Technologies
- ~~Uwe Koch~~ - BMW
- Michael L. Sena - Moderator

The Current Navigation Systems Developers Model

Navigation System Map Data Suppliers

Data suppliers combine themes from sub-suppliers and deliver data to software developers in a transfer format

Navigation System Software Developers

Each system manufacturer has its own team of software developers

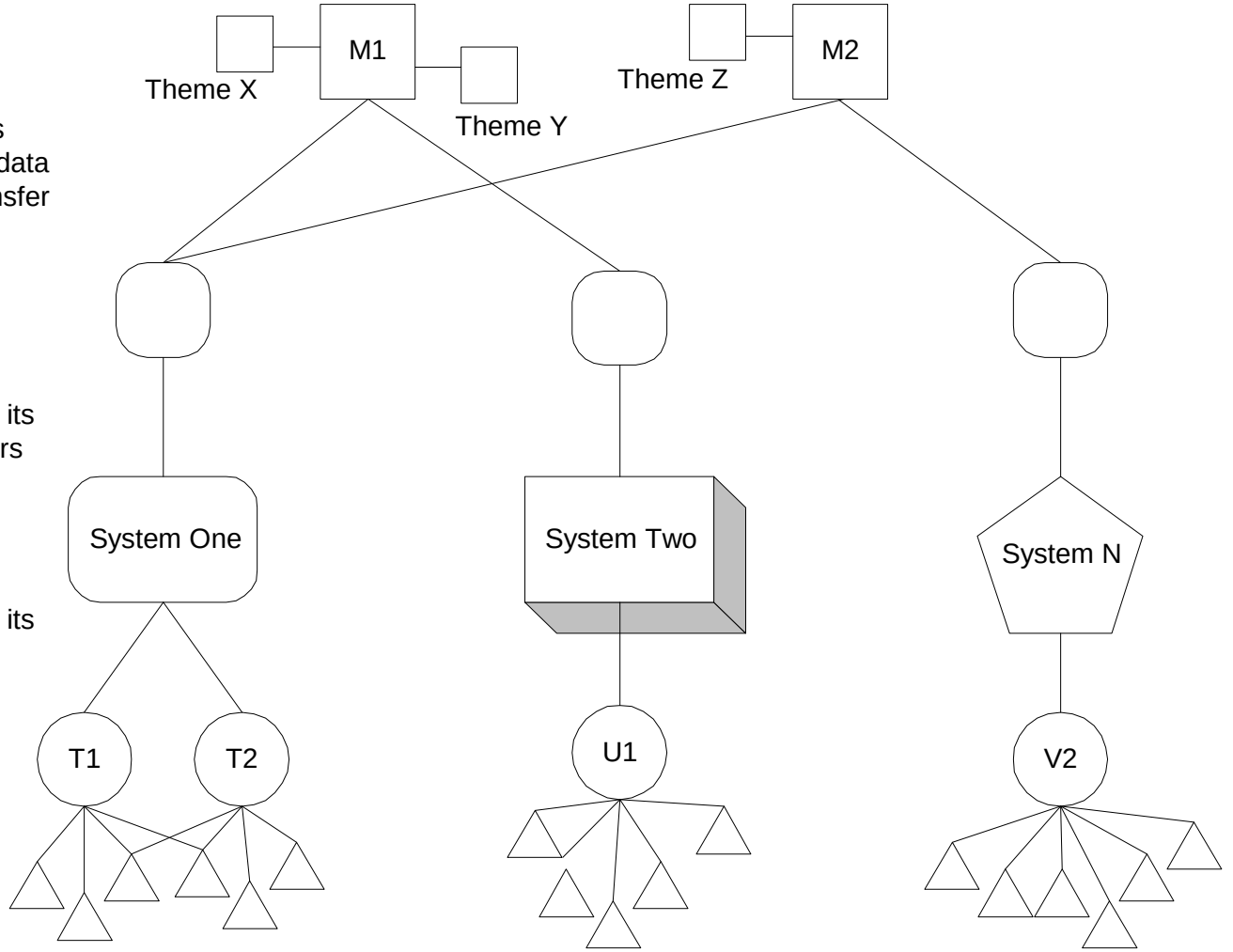
Navigation System Manufacturers

Each system manufacturer has its own proprietary data format

Navigation System Map Data Media Titles

Navigation System and Map Data Title Customers

Customers purchase one or more titles for their specific system



Nav System One Format with M1 on one title and M2 Data on another title

Nav System Two Format with M1 Data

Nav System N Format with M2 Data

Statement of the Problem

- Map data media can only be used on systems developed by a single manufacturer--with the exception of NavTech's SDAL format and possibly the KIWI format.
- Each system manufacturer must therefore convert data delivered by data suppliers to its own proprietary format--or multiple formats for different generations of its system.

Statement of the Problem

- The results are:
  - ✓ High conversion costs that must be spread out among the systems delivered by each manufacturer, rather than over the entire navigation system market--and these conversion costs recur with each update cycle
  - ✓ Long conversion times--from source data delivery to customer media--which means more out-of-date information
  - ✓ Higher distribution costs to be borne by each OEM
  - ✓ Difficulty to change system suppliers
  - ✓ Difficulty to add new areas of coverage

Basic Principles

- On the issue of map data interoperability the vehicle OEMs and map data suppliers are not competing; it is in their best interests to co-operate.
- We cannot change what has gone before--proprietary navigation systems and data formats--it was a necessary step in the development process. However we can alter the course for the future to deliver on the promise of in-vehicle navigation systems.

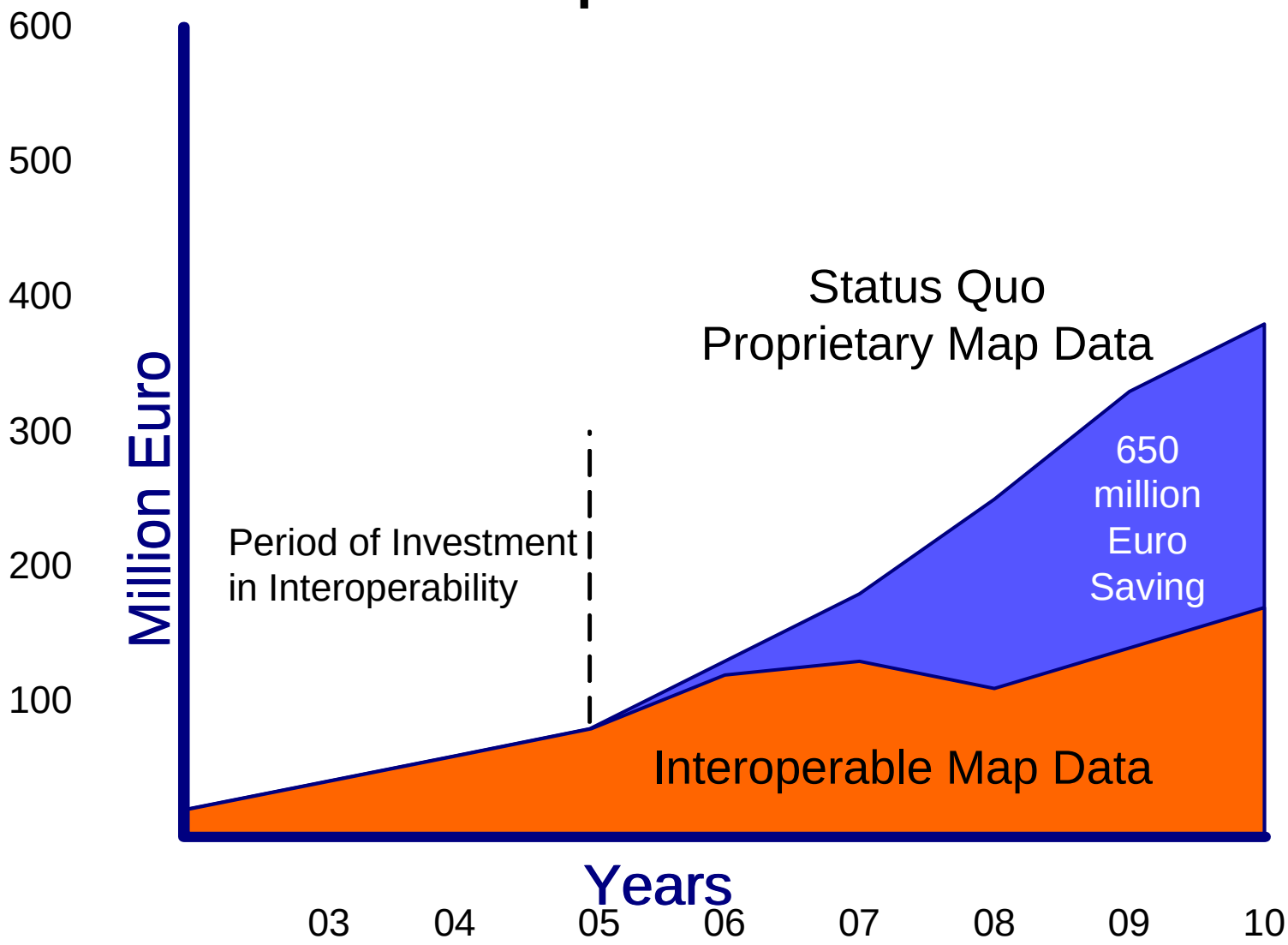
Basic Principles

- The tight coupling between map media format and system performance is the source of the problem.
- Achieving interoperable map data media requires a fundamental change in the system developers' business model, as well as a new technical solution.
- Other industries, namely video games and music, faced similar problems, and have resolved them to the benefit of system developers, content suppliers and consumers.

Goal of Interoperability

- Achieve a technical and commercial solution for interoperable map data used by applications in the vehicle environment, including cars, trucks and buses.
- Rewards
  - ✓ Lower compilation costs
  - ✓ Faster and more accurate updates
  - ✓ Faster and less costly distribution of map data
  - ✓ Ability to use a single map data source for all in-vehicle applications
  - ✓ Ability to introduce new areas of coverage faster and more economically

Compilation Costs



Objectives

- Develop a long-term, sustainable approach to providing map data for the in-vehicle applications that use this data
- Develop a solution that can be adopted by all map vendors, system vendors and vehicle OEMs for future generations of navigation systems
- Develop a solution that can serve as a standard for in-vehicle applications
- Develop a solution that can be used for on-board, off-board and a combination of both on-board and off-board storage of data
- Develop a solution that can be used with different types of on-board media and storage mechanisms

List of Issues

- International standardisation efforts have thus far produced no visible results
- An earlier attempt by the auto OEMs to gain consensus did not succeed
- Navigation system vendors are reluctant to relinquish control of their data media formats
- The original preconditions for navigation are disappearing, and new requirements are emerging (e.g. ADAS and off-board data servers)
- The longer we wait to achieve consensus this time, the larger the problem grows as more and more systems are sold that will require proprietary data format support.

Questions for the Panel

- The exchange format (GDF) was defined over 10 years ago and is now a standard used world-wide. Why is it only now that the industry is initiating a standard approach for PSF?
- Isn't it too late to work on such a project now that the market is well established?
- Are all the players in the industry in favour of developing a standard? What are, if any, the arguments against this initiative?

Questions for the Panel

- What do the Japanese and North Americans think about this issue? Are they supportive?
- Considering that some companies have worked on the economics and that some others (German companies) have worked on technical issues, when are you going to meet with the system vendors and get them to join this initiative?
- Don't you think that your proposed standard is going to hinder the competition between the map vendors, and also between the various system suppliers?

Auto Industry Survey

- Survey prepared and conducted by M.L. Sena following first meeting in Munich, September 3, 2002.
- Fifteen (15) auto companies and three (3) map data vendors included in the survey.
- Sixteen (16) responses received (13+3)
- Responses compiled and results distributed to all eighteen companies.
- Agreement to meet in January in Hamburg to discuss next steps.

Scoring of Responses

4 to 5 Strongly Agree

1 to 4 Agree

1 to -1 Uncertain

-1 to -4 Disagree

-4 to -5 Strongly Disagree

Audi	
BMW	
DaimlerChrysler	
Fiat	
Ford	
General Motors	
Jaguar	
Land Rover	
Porsche	
PSA	
Renault	
Saab	
Skoda	
Volkswagen	
Volvo	
NavTech	
Tele Atlas	
Zenrin	
Average	

1. Map data media for in-vehicle navigation systems (e.g. CD's, DVD's, Flash) can only be used on systems developed by a single manufacturer, with the exception of systems using NavTech's SDAL or some versions of KIWI.

Scoring of Responses

4 to 5	Strongly Agree
1 to 4	Agree
1 to -1	Uncertain
-1 to -4	Disagree
-4 to -5	Strongly Disagree

Audi	Agree
BMW	Stongly Agree
DaimlerChrysler	Agree
Fiat	Agree
Ford	Uncertain
General Motors	Uncertain
Jaguar	Strongly Agree
Land Rover	
Porsche	
PSA	Agree
Renault	Strongly Agree
Saab	Strongly Agree
Skoda	Strongly Agree
Volkswagen	Agree
Volvo	Strongly Agree
NavTech	Strongly Agree
Tele Atlas	Uncertain
Zenrin	Agree
Average	3.13

2. Each navigation system manufacturer must convert source data delivered by data suppliers (e.g. Tele Atlas, NavTech, Zenrin) to its own proprietary format, or multiple formats for different generations of its systems.

Scoring of Responses

4 to 5	Strongly Agree
1 to 4	Agree
1 to -1	Uncertain
-1 to -4	Disagree
-4 to -5	Strongly Disagree

Audi	Strongly Agree
BMW	Strongly Agree
DaimlerChrysler	Strongly Agree
Fiat	Strongly Agree
Ford	Agree
General Motors	Agree
Jaguar	Strongly Agree
Land Rover	
Porsche	
PSA	Strongly Agree
Renault	Agree
Saab	Strongly Agree
Skoda	Agree
Volkswagen	Strongly Agree
Volvo	Strongly Agree
NavTech	Strongly Agree
Tele Atlas	Strongly Agree
Zenrin	Strongly Agree
Average	4.19

3. The high costs of converting the source data to their own proprietary formats can only be spread out among their own proprietary systems, rather than over the entire navigation system market.

Scoring of Responses

4 to 5	Strongly Agree
1 to 4	Agree
1 to -1	Uncertain
-1 to -4	Disagree
-4 to -5	Strongly Disagree

Audi	Srtongly Agree
BMW	Strongly Agree
DaimlerChrysler	Agree
Fiat	Strongly Agree
Ford	Agree
General Motors	Agree
Jaguar	Strongly Agree
Land Rover	
Porsche	
PSA	Strongly Agree
Renault	Strongly Agree
Saab	Strongly Agree
Skoda	Agree
Volkswagen	Strongly Agree
Volvo	Strongly Agree
NavTech	Strongly Agree
Tele Atlas	Strongly Agree
Zenrin	Strongly Agree
Average	4.19

4. Long conversion times from the source delivery to when a customer can use the data results in information being out-of-date when the customer receives the map data.

Scoring of Responses

4 to 5	Strongly Agree
1 to 4	Agree
1 to -1	Uncertain
-1 to -4	Disagree
-4 to -5	Strongly Disagree

Audi	Agree
BMW	Agree
DaimlerChrysler	Strongly Agree
Fiat	Agree
Ford	Agree
General Motors	Strongly Agree
Jaguar	Agree
Land Rover	
Porsche	
PSA	Agree
Renault	Strongly Agree
Saab	Strongly Agree
Skoda	Strongly Agree
Volkswagen	Uncertain
Volvo	Strongly Agree
NavTech	Agree
Tele Atlas	Agree
Zenrin	Strongly Agree
Average	3.50

5. The OEM has higher distribution costs as a result of proprietary formats than would be the case with a single, interoperable media format.

Audi	Uncertain
BMW	Strongly Agree
DaimlerChrysler	Uncertain
Fiat	Agree
Ford	Agree
General Motors	Agree
Jaguar	Strongly Agree
Land Rover	
Porsche	
PSA	Agree
Renault	Agree
Saab	Strongly Agree
Skoda	Uncertain
Volkswagen	Strongly Agree
Volvo	Strongly Agree
NavTech	Strongly Agree
Tele Atlas	Strongly Agree
Zenrin	Strongly Agree
Average	3.31

Scoring of Responses

4 to 5	Strongly Agree
1 to 4	Agree
1 to -1	Uncertain
-1 to -4	Disagree
-4 to -5	Strongly Disagree

6. Proprietary formats make it more difficult for the OEM to change navigation system suppliers.

Audi	Uncertain
BMW	Agree
DaimlerChrysler	Uncertain
Fiat	Agree
Ford	Uncertain
General Motors	Uncertain
Jaguar	Strongly Agree
Land Rover	
Porsche	
PSA	Disagree
Renault	Uncertain
Saab	Agree
Skoda	Strongly Agree
Volkswagen	Strongly Agree
Volvo	Strongly Agree
NavTech	Strongly Agree
Tele Atlas	Agree
Zenrin	Strongly Agree
Average	2.44

Scoring of Responses

4 to 5	Strongly Agree
1 to 4	Agree
1 to -1	Uncertain
-1 to -4	Disagree
-4 to -5	Strongly Disagree

7. Proprietary formats make it more difficult for the OEM to add new areas of coverage.

Audi	Disagree
BMW	Agree
DaimlerChrysler	Agree
Fiat	Agree
Ford	Disagree
General Motors	Uncertain
Jaguar	Strongly Agree
Land Rover	
Porsche	
PSA	Agree
Renault	Disagree
Saab	Strongly Agree
Skoda	Uncertain
Volkswagen	Strongly Agree
Volvo	Strongly Agree
NavTech	Uncertain
Tele Atlas	Disagree
Zenrin	Strongly Agree
Average	1.75

Scoring of Responses

4 to 5	Strongly Agree
1 to 4	Agree
1 to -1	Uncertain
-1 to -4	Disagree
-4 to -5	Strongly Disagree

8. Off-board solutions, in which there is no data stored on media inside the vehicle, will solve the problems related to proprietary map data media formats.

Audi	Disagree
BMW	Strongly Disagree
DaimlerChrysler	Disagree
Fiat	Agree
Ford	Uncertain
General Motors	Disagree
Jaguar	Agree
Land Rover	
Porsche	
PSA	Disagree
Renault	Uncertain
Saab	Uncertain
Skoda	Disagree
Volkswagen	Strongly Disagree
Volvo	Uncertain
NavTech	Uncertain
Tele Atlas	Strongly Disagree
Zenrin	Disagree
Average	-1.50

Scoring of Responses

4 to 5	Strongly Agree
1 to 4	Agree
1 to -1	Uncertain
-1 to -4	Disagree
-4 to -5	Strongly Disagree

9. It is possible to achieve a technical and commercial solution for interoperable map data media used by applications in the in-vehicle environment.

Audi	Agree
BMW	Agree
DaimlerChrysler	Agree
Fiat	Agree
Ford	Strongly Agree
General Motors	Strongly Disagree
Jaguar	Strongly Agree
Land Rover	
Porsche	
PSA	Agree
Renault	Agree
Saab	Agree
Skoda	Strongly Agree
Volkswagen	Uncertain
Volvo	Strongly Agree
NavTech	Agree
Tele Atlas	Agree
Zenrin	Agree
Average	2.63

Scoring of Responses

4 to 5	Strongly Agree
1 to 4	Agree
1 to -1	Uncertain
-1 to -4	Disagree
-4 to -5	Strongly Disagree

10. Vehicle OEMs can co-operate in an effort to achieve an interoperable map data media solution.

Audi	Agree
BMW	Strongly Agree
DaimlerChrysler	Agree
Fiat	Agree
Ford	Uncertain
General Motors	Uncertain
Jaguar	Strongly Agree
Land Rover	
Porsche	
PSA	Agree
Renault	Strongly Agree
Saab	Strongly Agree
Skoda	Strongly Agree
Volkswagen	Agree
Volvo	Strongly Agree
NavTech	Strongly Agree
Tele Atlas	Strongly Agree
Zenrin	Agree
Average	3.44

Scoring of Responses

4 to 5	Strongly Agree
1 to 4	Agree
1 to -1	Uncertain
-1 to -4	Disagree
-4 to -5	Strongly Disagree

11. Vehicle manufacturers and their customers have the most to gain from an interoperable map data media solution.

Audi	Agree
BMW	Agree
DaimlerChrysler	Uncertain
Fiat	Uncertain
Ford	Strongly Agree
General Motors	Agree
Jaguar	Strongly Agree
Land Rover	
Porsche	
PSA	Strongly Agree
Renault	Strongly Agree
Saab	Strongly Agree
Skoda	Agree
Volkswagen	Agree
Volvo	Strongly Agree
NavTech	Strongly Agree
Tele Atlas	Agree
Zenrin	Strongly Agree
Average	3.13

Scoring of Responses

4 to 5	Strongly Agree
1 to 4	Agree
1 to -1	Uncertain
-1 to -4	Disagree
-4 to -5	Strongly Disagree

12. Navigation system vendors will comply with a single, interoperable map data media format if the vehicle OEMs made it a condition of system purchase.

Scoring of Responses

4 to 5	Strongly Agree
1 to 4	Agree
1 to -1	Uncertain
-1 to -4	Disagree
-4 to -5	Strongly Disagree

Audi	Uncertain
BMW	Uncertain
DaimlerChrysler	Agree
Fiat	Agree
Ford	Strongly Agree
General Motors	Disagree
Jaguar	Uncertain
Land Rover	
Porsche	
PSA	Agree
Renault	Uncertain
Saab	Agree
Skoda	Agree
Volkswagen	Uncertain
Volvo	Strongly Agree
NavTech	Agree
Tele Atlas	Agree
Zenrin	Strongly Agree
Average	1.75

13. Map data suppliers have a strong interest in a single, interoperable map data media format.

Audi	Uncertain
BMW	Agree
DaimlerChrysler	Agree
Fiat	Uncertain
Ford	Uncertain
General Motors	Strongly Agree
Jaguar	Agree
Land Rover	
Porsche	
PSA	Disagree
Renault	Strongly Agree
Saab	Uncertain
Skoda	Strongly Agree
Volkswagen	Disagree
Volvo	Uncertain
NavTech	Agree
Tele Atlas	Strongly Agree
Zenrin	Agree
Average	1.63

Scoring of Responses

4 to 5	Strongly Agree
1 to 4	Agree
1 to -1	Uncertain
-1 to -4	Disagree
-4 to -5	Strongly Disagree

14. My company would support an effort to achieve an interoperable map data media format.

Audi	Agree
BMW	Strongly Agree
DaimlerChrysler	Agree
Fiat	Agree
Ford	Strongly Agree
General Motors	Uncertain
Jaguar	Strongly Agree
Land Rover	
Porsche	
PSA	Strongly Agree
Renault	Strongly Agree
Saab	Strongly Agree
Skoda	Uncertain
Volkswagen	Agree
Volvo	Strongly Agree
NavTech	Strongly Agree
Tele Atlas	Agree
Zenrin	Strongly Agree
Average	3.25

Scoring of Responses

4 to 5	Strongly Agree
1 to 4	Agree
1 to -1	Uncertain
-1 to -4	Disagree
-4 to -5	Strongly Disagree

Ideas on Possible Solutions

- Identify the real problem we are trying to solve--interoperability is the solution
- Identify an appropriate business and technical model that can be adopted by all industry players
- De-couple the map data format from system performance to the maximum possible degree

The Current Navigation Systems Developers Model

Navigation System Map Data Suppliers

Data suppliers combine themes from sub-suppliers and deliver data to software developers in a transfer format

Navigation System Software Developers

Each system manufacturer has its own team of software developers

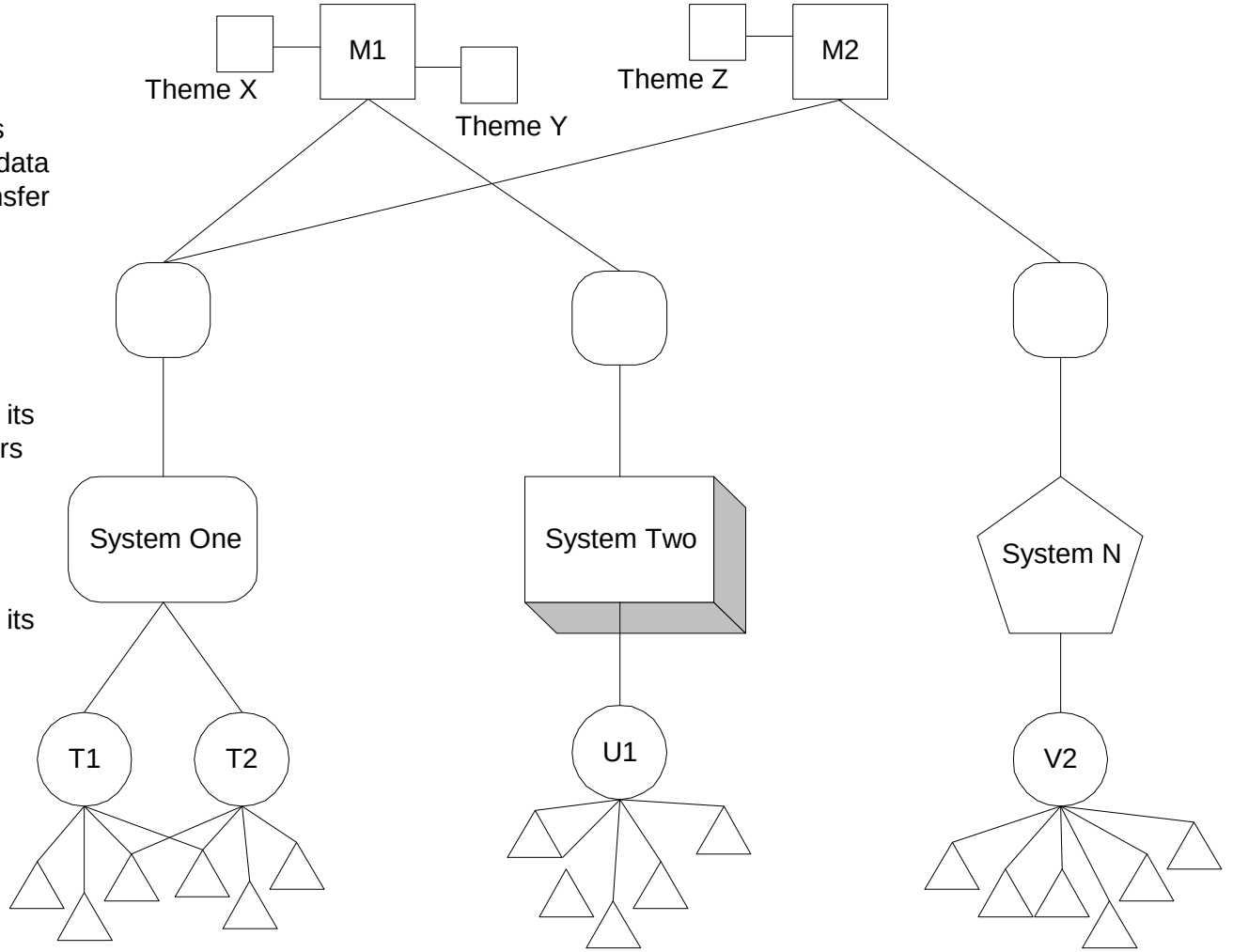
Navigation System Manufacturers

Each system manufacturer has its own proprietary data format

Navigation System Map Data Media Titles

Navigation System and Map Data Title Customers

Customers purchase one or more titles for their specific system



Nav System One Format with M1 on one title and M2 Data on another title

Nav System Two Format with M1 Data

Nav System N Format with M2 Data

The Video Games Model

Games Developers

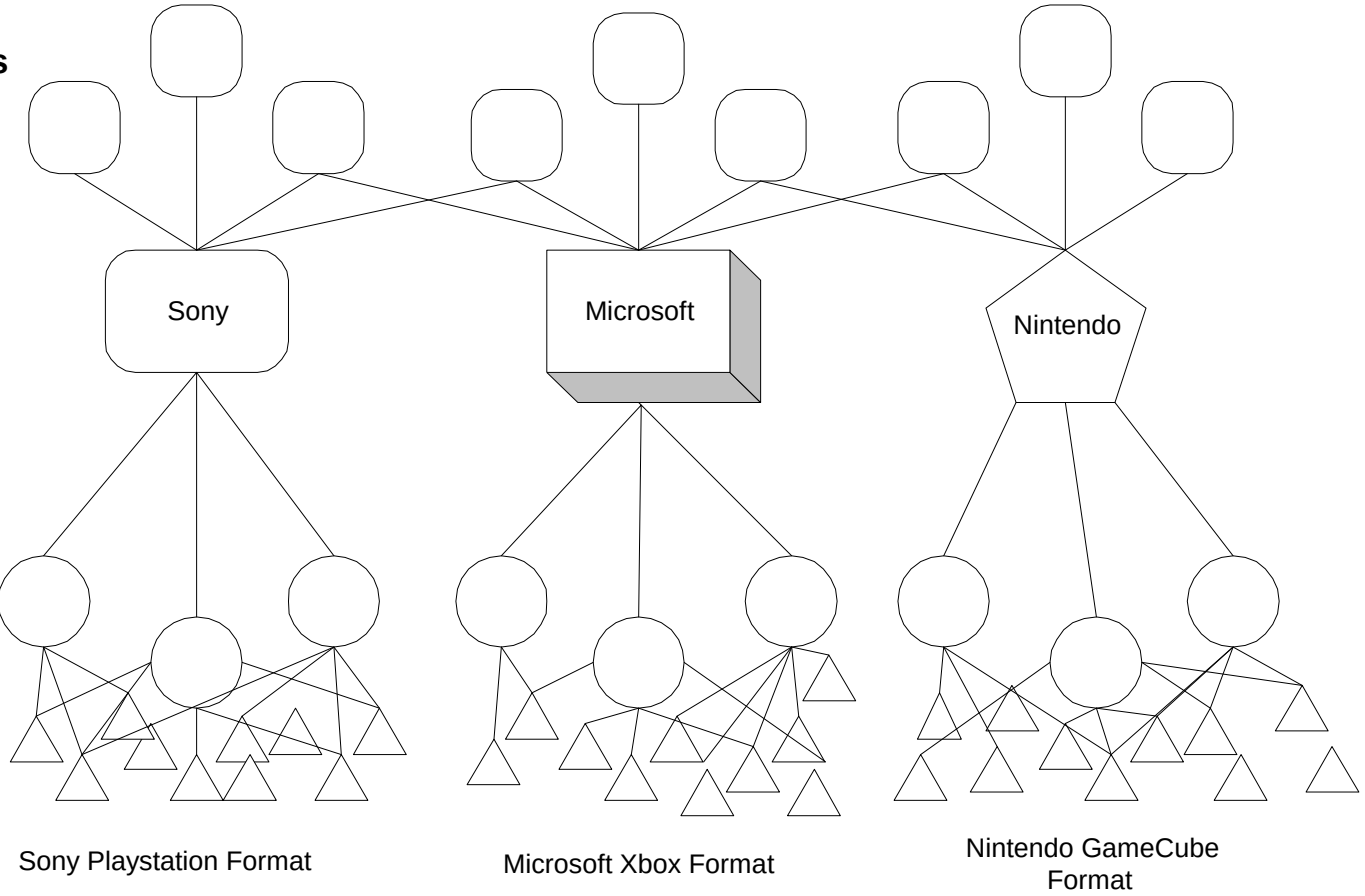
Games developers work for one or more system manufacturers

Games System Manufacturers

Games Titles

Games System and Games Titles Customers

Customers purchase one or more titles for each games system they buy
A customer can own one or more games systems



The Music CD Model

Music Artists

Music artists produce their own titles, or work for one publisher.

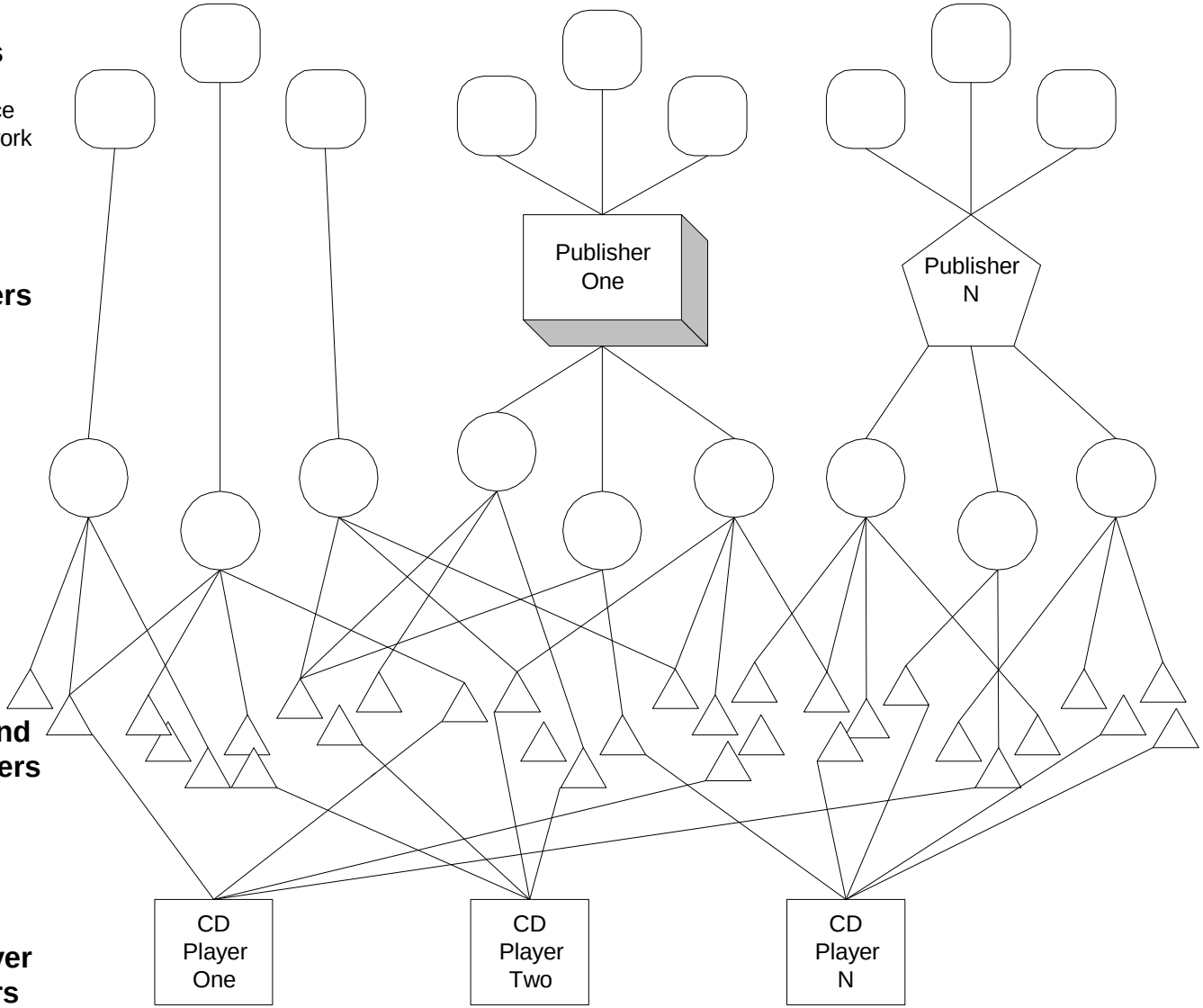
Music Publishers

Music Titles

Music Titles and Music CD Players Customers

Music CD Player Manufacturers

Customers purchase any music title for any player



A Model for Interoperable Navigation System Map Media

Navigation System Map Data Suppliers

Map data supplliers or other data suppliers provide customer-ready data in one standard format

Navigation System Software Developers

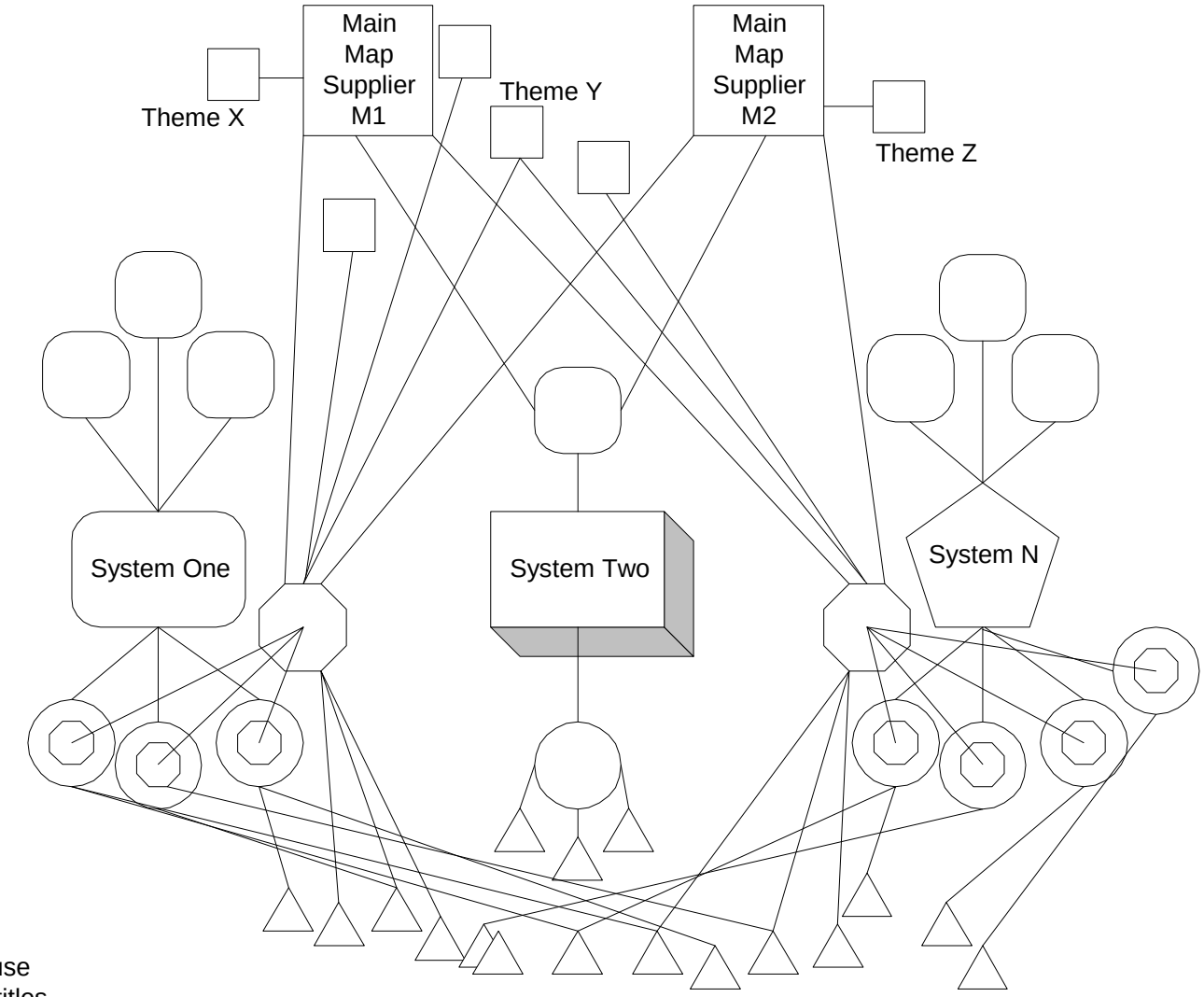
Navigation System Manufacturers

System vendors can either work with the standard format, or use their proprietary format

Navigation System Map Data Media Titles

Navigation System and Map Data Title Customers

Customers who buy systems that use the standard format can purchase titles from the system manufacturers or other data publishers, including the map suppliers.



Implementation Options

- Hold a competition
  - Invite parties to submit proposals according to a set of pre-defined requirements
  - Benchmark the solutions and select a winner
- Select a small group of system manufacturers to develop a common solution that would be adopted as a de facto industry standard
- Give the task to the map data suppliers
- Appoint a group made up of system suppliers, map data suppliers, automotive OEM representatives

Next Steps

- Establish a working group to lead the effort, and select a working group leader who can devote the time and effort to achieve a positive result
- Develop a reference design and functional specification for a solution
- Identify a technical solution that can be applied to the problem
- Review the technical solution with map data vendors and system developers
- Decide on the best method to implement the solution
- Perform a proof of concept
- Implement the solution